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FREEZING FRUITS AND VEGETABLES

UNIVERSITY OF MINNESOTA

DOCUMENTS

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SUCCESS with frozen foods depends largely on selecting a product of good quality, preparing it properly, providing adequate protection by proper packaging, and freezing and storing it at proper temperature.

Freezing, unlike canning, does not sterilize the product, but the low temperature prevents harmful yeasts, molds, and bacteria from growing and developing. Many of these microorganisms are killed by freezing storage, but some survive. Consequently, cleanliness and sanitary methods in handling foods for freezing are very important. Make sure that the water supply is clean and pure. See that all utensils are scrupulously clean and do not allow anyone to handle and pack the product until the hands are thoroughly washed.

Use containers made especially for storing frozen fruits and vegetables. Glass jars with tight covers preserve these products well, but the jars are bulky and add to storage cost.

The recommendations made here apply to storage of fruits and vegetables in frozen food lockers or in home freezing cabinets.

THE average frozen food locker will hold 175 to 200 pounds, net drained weight, of a vegetable such as cut corn when packed in rectangular cartons; or 200 to 250 pounds of fruit packed in sugar or sirup. If packed in round glass jars or in waxed containers with sloping sides, the amount will be reduced nearly one half; if round waxed containers with straight sides are used the reduction will be about one third.

A quart container usually is the most satisfactory size. It will hold about 24 ounces drained weight of most vegetables and will provide six to eight servings. A quart container of frozen cut corn will hold the equivalent of eight medium to large ears of corn.

A quart container of frozen berries, cantaloup, or rhubarb packed in sugar-sirup will hold about 20 ounces drained weight of fruit in addition to about 12 ounces of sirup. When packed in dry sugar, a quart container will hold 20 to 25 ounces drained weight of berries together with 5 to 7 ounces of sugar. This provides from 8 to 10 servings.

Freezing and Storage Temperatures

Any room kept at -5° F. or lower and arranged so that packages may be spread out to facilitate the transfer of heat is satisfactory for initial freezing. A fan may reduce the freezing time one half. However, too much emphasis has been placed on the need for very rapid freezing while other factors largely determine the quality of the pack.

For best results with most fruits and vegetables a storage temperature not higher than 5° F. should be maintained. Temperatures between 5° and 10° F. may be satisfactory for many products for a few months.

FREEZING FRUITS

IF POSSIBLE, pick fruit when fully ripe and freeze the same day. If this is not practicable, the fruit may be held in a cool place or under refrigeration until the next day. With perishable fruits a few hours' delay will lower quality. Choose varieties known to be suitable for freezing.

Sugar Pack—Coat the fruit with dissolved sugar and fruit juice before freezing by stirring sugar and washed fruit together in a pan or large bowl. The normal amount of sugar used may be reduced, but the fruit's color and quality may not be protected if less than 1 pound of sugar to 5 pounds of fruit is used. This is referred to as a $5 + 1$ pack. A $4 + 1$ pack would mean 4 pounds of fruit to 1 pound of sugar.

Sirup Pack—Prepare by dissolving the right amount of sugar in clean, cold water. The sirup must be cold when poured over the fruit. Leave a space one tenth the height of the container for expansion. Sirups made by dissolving less than 12 cups

of sugar in a gallon of water may not properly preserve color and quality. Sirups must be freshly mixed and should not be allowed to stand for more than a few hours unless under refrigeration.

Unsugared Pack—With few exceptions, fruit should not be frozen without adding some sugar or other sweetening material. Blueberries and raspberries may be frozen without sugar for cooking but a 4 + 1 sugar pack will retain quality better. If it is necessary to freeze strawberries without sugar, the fruit may be crushed so that the juices will retard excessive drying of the tissues during storage. When frozen without sugar, berries for dessert use are best thawed in sugar sirup.

PREPARATION FOR FREEZING

Apples—Apples may be sliced into cold water or light sugar sirup to avoid discoloring. Remove and scald soft-fleshed varieties in steam for 3 to 4 minutes, firmer varieties 6 to 8 minutes. A 4 + 1 sugar pack is preferred. For ordinary use, cellar or cold storage is preferable to freezing.

Apricots—Halve and then handle same as peaches.

Blueberries—Sort, remove immature fruit, wash, and pack in sirup for dessert use.

Cherries (sour)—Cherries are usually pitted and packed in a 3 + 1 sugar pack.

Peaches—Freestone varieties are preferred, Elberta and J. H. Hale being the most suitable among those commonly found on local markets. Special care is necessary to avoid browning of the cut slices. Plunge the whole fruit into boiling water for one-half minute or until the skin loosens, then cool quickly in cold water in readiness for peeling. Peel, remove pit, and slice directly into cold sugar sirup, or drop into water to which has been added about 1 teaspoonful of lemon juice per pint of water. A weak citric acid solution (1 per cent by weight) may be used in place of the lemon juice and water.

Plums and Cherry Plums—Most local varieties are unsatisfactory for dessert use after freezing, but suitable varieties are very satisfactory for cooking. Plums may be frozen in sirup at the concentration recommended for peaches. According to tests at the Division of Home Economics and elsewhere the following varieties of plums and cherry plums are satisfactory for jam and preserves: La Crescent, Ember, Fiebing, Hennepin, Red Wing, Sapa, Superior, Underwood, and Pipestone. Satisfactory varieties for plum jelly are: Elliot, Fiebing, Hennepin, Monitor, Superior, and Pipestone.

Raspberries (black)—Excellent for jam and preserves. May be handled like red raspberries.

Raspberries (red and purple)—A sirup pack is preferred for dessert use. Use sugar pack for cooking.

Strawberries—After the berries are hulled and washed they may be packed whole or chopped. The

chopped fruit usually retains a little better flavor. An ordinary kitchen food chopper with stainless steel blades may be used to chop the berries before sugar is added. A 4 + 1 sugar pack is preferred. Unsweetened strawberries are much less desirable except for persons who cannot eat sugared products.

Varieties Recommended for Freezing

Heavy type indicates preferred varieties. Undoubtedly there are other good freezing varieties not yet tested.

Blueberries—Any well-graded berries

Purple Raspberries—Sodus

Red Raspberries—Chief, King, Latham, and Taylor

Strawberries—Beaver, Dorsett, Dunlap, Premier, Tonka, Burgundy (Minn. No. 1192), Gem (everbearing), and Wayzata (everbearing)

Table 1. Sugar and Sirup Packs for Freezing

Product	Sugar	Extra-Sweet Corn Sirup	Honey
SIRUP PACKS			
(Measurements for sirup packs are for one gallon of water)			
	Cups	Cups	Cups
APRICOTS (halved), PLUMS			
Standard pack	15	none	none
BLACKBERRIES			
Standard pack	15	none	none
BLUEBERRIES			
Standard pack	12	none	none
Medium sugar-saving pack	6	5½	none
Maximum sugar-saving pack	3	8	none
PEACHES			
Standard pack	17	none	none
Medium sugar-saving pack	8	8	none
Medium sugar-saving pack	8	none	5½
Maximum sugar-saving pack	5	11	none
RASPBERRIES AND RHUBARB			
Standard pack	15	none	none
Medium sugar-saving pack	6	6½	none
Maximum sugar-saving pack	none	15	none

DRY SUGAR PACKS

(No added water)

CANTALOUP (10 lbs.)			
Standard pack	4	none	none
Medium sugar-saving pack	2	1½	none
Medium sugar-saving pack	1¾	none	1¼
Maximum sugar-saving pack	1	2½	none
SOUR CHERRIES (pitted—3 lbs.)			
Standard pack	2	none	none
STRAWBERRIES (4 lbs.)			
Standard pack	2	none	none
Medium sugar-saving pack	1	1	none
Medium sugar-saving pack	1	none	⅔
Maximum sugar-saving pack	½	1½	none

Note: When using dry sugar pack, sprinkle sugar on fruit and allow to stand for 3 to 4 minutes or until sugar is dissolved in fruit juice, add extra-sweet corn sirup or honey, and stir carefully until well mixed. Pack into containers for freezing.

SWEETENING MATERIALS

Equal parts by measure of sugar and extra-sweet corn sirup may be used for most fruits (except plums) with little if any noticeable difference in quality as compared to a straight sugar or sugar-sirup pack. In fact, many persons will find extra-sweet corn sirup only (without sugar) to be acceptable for red and purple raspberries, and rhubarb.

Extra-sweet corn sirup is a new product manufactured by a special process making it much sweeter than ordinary corn sirup. The light-colored sirup should be used.

Some persons will like equal parts by weight of sugar and honey as a pack for strawberries, peaches, and cantaloup.

Table 1 gives the amount of sugar or other sweetening materials needed in freezing. **Standard** pack refers to the regular sugar or sirup pack. The **maximum sugar-saving** packs contain a minimum amount of sugar. Some adjustment can be made to meet individual preferences.

FREEZING VEGETABLES

FIVE DISTINCT operations are required: (1) wash and prepare the product for scalding; (2) sort according to size and maturity; (3) scald according to directions; (4) cool immediately and drain; (5) pack into containers (add no liquid). Certain types of containers require heat sealing.

It is most important to select vegetables at the proper stage of maturity, and, if possible, they should be picked and frozen on the same day. If it is necessary to hold the product until the following day, most vegetables must be placed in a cool place and covered with cracked or crushed ice to prevent serious loss in quality. Some vegetables, such as sweet corn and peas, lose quality much more quickly than others. Delay of more than a few hours at summer temperatures often lowers quality of the frozen product.

Proper scalding in boiling water is necessary for vegetables being prepared for freezing storage, except those to be packed in sugar or sugar sirup. The purpose of scalding vegetables is to inactivate certain substances in the plant (known as enzymes) that hasten deterioration during storage. The product should be carefully sorted so that vegetables of the same size and maturity may be scalded at one time. The water must return to a boil within 60 to 75 seconds, otherwise it indicates that too little water is being used. Very hard water has a tendency to toughen vegetables.

Usually, on the average kitchen stove, not more than 1 pound of the product can be scalded at one

time for each 8 to 10 quarts of boiling water used. A clean, well-tinned wash boiler (not used for washing) or a 12-quart enamelware pail is useful for this purpose. If large quantities are being packed, frequently change water used for scalding. As soon as scalding is finished, quickly cool the vegetables in clean water, drain a few minutes, and then pack into suitable containers.

The following scalding periods are recommended; the time begins when the vegetable is first immersed in boiling water.

	Minutes
Asparagus, medium stalks	3
Asparagus, large stalks	4
Broccoli	4
Brussels sprouts	4
Bush beans, very tender	$2\frac{1}{2}$
Bush beans, slightly mature	$3\frac{1}{2}$
Lima beans, small	$3\frac{1}{2}$
Lima beans, large	$4\frac{1}{2}$
Carrots (diced)	3
Cauliflower	4
Corn (to be packed on cob), small ears	6
medium ears	8
Corn (to be cut)	4
Peas	$2\frac{1}{2}$
Spinach	3

PREPARATION FOR FREEZING

Asparagus, Bush Beans—Prepare as for cooking. Cut bush beans into 1-inch lengths. Sort asparagus into medium and large sizes. Avoid iron utensils because they may discolor these vegetables.

Cantaloup—Cut flesh into $\frac{1}{2}$ - to $\frac{3}{4}$ -inch cubes. Pack with sugar like strawberries using a 5 + 1 pack. Do not scald. Product must be firm but well ripened. If slightly immature, quality is very inferior.

Carrots, Cauliflower, Spinach—Prepare as for cooking. Dice carrots. Cut cauliflower into medium-sized pieces weighing about 14 to the half pound.

Lima Beans, Peas—Discard all hard, overmature specimens when shelling. Small, poorly formed peas will not freeze well. Overmature peas may be separated before scalding by floating in brine (about one-half cup of salt per gallon of water).

Rhubarb—Cut into one-inch lengths. For sauce, pack dry without sweetening or in sirup. Sirup pack gives better texture. For pies, pack dry without sugar or sirup. Do not scald.

Sweet Corn—Pick when slightly more mature than for immediate table use. Remove the husks and silk, and trim the ends.

In most instances, it will be best to cut the corn from the cob because it is difficult to scald the center of the cob properly without overscalding the corn itself. The corn should not be cut from the cob until after scalding. Cut corn requires one third the space occupied by the same quantity of corn on the

cob. When packing corn on the cob, use only small and medium sized ears weighing less than 7 ounces to facilitate proper scalding.

Varieties Recommended for Freezing

Heavy type indicates preferred varieties. Undoubtedly there are other good varieties not yet tested.

Asparagus—Washington

Cantaloup—Beauty Osage, Bender's Surprise, Golden Gopher, Sugar Rock, Sunrise

Cauliflower—Snowdrift, White Mountain

Lima Beans—Baby Fordhook, Burpee's Improved Bush, Fordhook Bush

Peas—**Alderman**, **Dark Podded Thomas Laxton**, Little Marvel, Glacier, Laxton's Progress, Teton, **Thomas Laxton**, World's Record

Rhubarb—McDonald Crimson and most varieties

Bush Beans (green podded)—Stringless Green Pod, Giant Stringless Green Pod, Tendergreen Stringless

Bush Beans (yellow podded)—Brittle Wax

Soybeans—Bansei, Emperor, Giant Green, Kobbot, Sousei

Spinach—Bloomsdale

Sweet Corn—Earliest Golden Sweet, Early Aristogold Bantam, Golden Bantam, Golden Cross Bantam, Kingscroft Hybrid, Minhybrid 202

Other Vegetables—Although not commonly frozen in Minnesota, Brussels sprouts, beets, beet greens, cabbage, kale, mushrooms, squash, Swiss chard, and turnips may be frozen satisfactorily.

Whole tomatoes and vegetables used uncooked in salads such as celery, cucumbers, endive, and lettuce are not suitable for freezing.

Packaging and Wrapping

Frozen foods must be protected from drying during storage, as the cold air is relatively dry and will take away moisture which may pass through a package or wrapping in the form of moisture-vapor. A material may be waterproof but not moisture-vapor proof. Manufacturers recognize the importance of reducing moisture losses, and most containers **made for frozen foods** are satisfactory in this respect.

Wax-coated locker papers afford relatively good protection against moisture losses, and excellent protection is given by a moisture-vapor proof transparent film such as cellophane. Ordinary meat wrapping papers are not treated to make them moisture-vapor proof and are not suitable for wrapping frozen foods.

It is obvious that moisture can escape through open folds, therefore ends should be creased and folded over to make a package as airtight as possible. Avoid unnecessary creasing, as badly creased paper may triple the rate of moisture-vapor loss.

FRUIT AND VEGETABLE JUICES

Most fruit juices, and tomato and rhubarb juice, are well adapted for freezing. Wash, slightly crush soft fruit or add $\frac{1}{2}$ cup water per pound of firm fruit. Simmer at 170°-180° F. until juice separates from pulp, but do not boil. Strain through cloth bag, add about one cup sugar per gallon juice. Cool and pour into containers for freezing. Rhubarb may be handled like fruit or frozen as cooked sauce. Prepare tomato juice as for canning.

Juices for freezing should not be placed in containers larger than one gallon, or in glass containers that taper sharply at the top.

THAWING THE PRODUCT

COMMENCE cooking frozen vegetables, if practicable, before the product is completely thawed. Do not cook corn on the cob until the cob is thawed. Most frozen fruits are at their best if served about the time that thawing is completed. Thaw fruit in the original container which should be placed bottom side up if leakproof. Do not remove cover during thawing or until ready to serve. Rapid thawing in lukewarm water is preferred for peaches and apricots to avoid discoloration. When frozen foods have been thawed they should not be refrozen.

The approximate time required to thaw frozen fruits and vegetables in pint or quart containers is given in table 2 together with the approximate time the product may be expected to keep without significant loss of quality due to bacterial action.

Table 2. Time Required for Thawing Frozen Products

Where Held When Removed from Freezing Storage	Approximate Temperature	Time Required for Thawing*	Time Product May Be Kept Without Significant Loss of Quality
Room temperature	68°-75° F.	3- 4 hours	6- 8 hours
Ice box	45°-50° F.	8-10 hours	24-36 hours
Mechanical refrigerator	40°-45° F.	10-15 hours	36-48 hours
Ice cube compartment	20°-25° F.		
Fruits in sugar or sirup			10-15 days
Vegetables (dry pack)			5- 7 days

* Rapid thawing in lukewarm water is preferred for peaches and apricots.

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