Preservation of Fruits and Vegetables in Refrigerated Food Lockers
Michigan State University Extension Service
H.L. Seaton, Ruth M. Griswold
Issued June 1940
4 pages

Extension Bulletin 208 June 1940

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By H. L. Seaton and Ruth M. Griswold

MICHIGAN STATE COLLEGE :: EXTENSION DIVISION

EAST LANSING

General Directions

Since 1938, there has been a rapid increase in number of the so-called freezer locker plants in Michigan where farmers and townspeople may take their fresh meats, poultry, fruits and vegetables to be frozen and stored for use months later. Quick freezing is essentially a method of fresh food preservation whereby the color, flavor, texture and nutritional values of many fresh products are more nearly retained than by other methods. Many Michigan-grown fruits and vegetables, comparable to commercially frozen products, may be prepared at home, frozen and stored in the refrigerated food lockers, if certain precautions are observed. The suggestions for preparation of fruits and vegetables for freezing given herewith are based on recent experimental work conducted at the Michigan and other state and federal experiment stations.

SELECTION OF PRODUCTS

Practically all Michigan fruits and many vegetables may be frozen successfully. Strawberries, red raspberries, blueberries, blackberries, sour red cherries and rhubarb are all easily prepared and are especially adapted to preservation by freezing. Peaches and the light-colored sweet cherries make excellent frozen products, but discolor (turn brown) badly if not properly prepared. It is doubtful economy to freeze apples and pears because they may be easily stored at home.

Peas, lima beans, corn cut from the cob, asparagus, broccoli, green beans, peppers, spinach and other greens are suitable for freezing, but are more exacting in their preparation than are the small fruits. Those vegetables with a high-water content—tomatoes, lettuce, celery, cucumbers, cabbage and similar crops—as well as those with a high-starch content—potatoes, certain varieties of peas and lima beans—are not adapted to freezing. Corn may be frozen on the cob, but the product requires a special blanching treatment and takes up much valuable locker space.

Quality of the frozen product depends on color, flavor and texture. All three must be good or excellent if the product is to be satisfactory. Varieties of fruits and vegetables vary widely in those respects, and many excellent canning and market sorts are unsuited for freezing. In the tables given for fruits and vegetables, desirable varieties are suggested. Different lots of the same variety may give variable results owing to variations in the quality of the fresh products.

PROPER HARVESTING AND HANDLING IMPORTANT

Freezing retains rather than improves the quality of any product. All fruits and vegetables used should be of the best quality obtainable. Fruits should be harvested at the proper stage of maturity for immediate table use. Green or immature fruits lack flavor and lose their color when frozen. Over-ripe, badly bruised or moldy fruits develop off-flavors. Only highest quality fresh vegetables should be used and all tough or overmature parts should be discarded. The products should be processed within a few hours after harvest. Purchase of products, for freezing, on open markets where the variety and length of time elapsing after harvest are unknown, cannot be recommended. The directions for harvesting, handling and preparations as given in the tables should be followed closely.

CLEANLINESS ESSENTIAL

Freezing differs from ordinary canning in that it kills only a portion of the bacteria, yeasts, and molds usually present on the products. Freezing does not sterilize the products and cleanliness throughout all preparation operations is important. There is no known danger of food poisoning developing while the products remain in the frozen state and no danger of illness caused by use of properly handled frozen foods. Prolonged exposure of products to warm temperatures before freezing and after thawing is risky. All water used in washing, cooling, and preparing syrups and brines should be free from contamination. This applies to all utensils, containers and sugars used.

PREPARING FRUITS

With the exception of those fruits peeled by submerging in boiling water, fruits are not heated before packing. Most fruits are washed and prepared as for canning. They are then packed in the containers and covered with sugar syrups or packed with dry sugar, depending on the use for which they are intended. When packed without sugar or syrup most fruits lose their shape and some of their color and flavor upon thawing.

The syrups may be made with either hot or cold water but should be chilled before using. The following table gives the amounts of sugar to use for one gallon of water in preparing syrups of different concentrations.

PREPARATION OF FRUITS FOR STORAGE IN REFRIGERATED LOCKERS

Fruit	Desirable Varieties	Harvesting and Handling Instructions	Preparation	Sugar Syrup Pack	Dry Sugar and Dry Pack	Containers
Rhubarb	MacDonald Ruby Victoria	Pack early in season when color is best and stalks are not stringy. Harvest early in morning. Trim off leaves and bases of stalks.	Wash and cut in 1" sections. Do not peel.	Cover with 50-per cent syrup.	Dry sugar not recommended. May be packed dry without sugar.	Air-tight. Air-tight or non-air-tight.
Strawberries	Premier Dunlap Gem (everbearing)	Use only bright red firm ripe berries. Avoid green or over-ripe fruit. Hull, sort, wash and drain thoroughly. Handle quickly.	May be packed whole, cut in slices ½" thick, or crushed.	Cover with 40- or 45-per cent cold syrup.	Mix 1 part sugar with 3 or 4 parts berries. If whole fruits are used, set in refrigerator over night before freezing.	Air-tight preferred.
Red Raspberries	Latham Viking Taylor Cuthbert	Select firm ripe berries. Avoid over-ripe berries, and those harvested after rains or during hot weather as they turn dark. Rapid handling essential and reduce to minimum to avoid bruising.	Sort, wash and drain thoroughly. Do not crush berries in filling containers.	Cover with 40-per cent cold syrup. Rush to freezer as soon as packed.	Not recommended for berries for dessert purposes.	Air-tight preferred.
Black Raspberries	Cumberland Naples	Slightly seedy for dessert purposes. Handle same as red raspberries.	Same as red raspberries.		For use in pies and cobblers, mix 1 part sugar to 3 or 4 of berries.	Air-tight or non-air-tight containers may be used.
Dewberries Blackberries Boysenberries	Lucretia Eldorado	Avoid immature and over-mature berries. Careful and rapid handling essential. Exercise care to prevent bruising.	Sort, wash and drain. Pack loosely in containers.	Cover with 45- or 50-per cent cold syrup.	For pastry mix 1 part sugar to 3 or 4 parts of berries.	Non-air-tight containers may be used on syrup packs. Dry packs air-tight preferred.
Blueberries	Jersey Pioneer Rubel, Adams Rancocas Wild Low Bush type	Harvest as for fresh use. May be held for several days at cool temperatures. Remove undersized, immature berries and pieces of leaves and stem.	Wash, drain and pack loosely in containers.	Cover with 40- or 50-per cent cold syrup.	Dry sugar not recommended. May be frozen without sugar for use in pies.	Non-air-tight may be used.
Sour Red Cherries	Montmorency	Harvest when fully tree ripe. Immature fruits turn pale and over-ripe fruits dark after freezing. Handle quickly after picking. Avoid soaking in water after washing.	Wash, remove pits and pack in containers rapidly.	Cover with 60-per cent cold syrup.	For pies mix 1 part sugar with 3 or 4 parts pitted cherries. Mix well.	Air-tight preferred.
Sweet Cherries	Schmidt, Windsor, Bing (Napoleon and other light color varieties are likely to turn brown)	Harvest when firm ripe; immature fruits shrivel, fade and are tough after freezing. Handle carefully to prevent bruising.	Stem, sort, wash and drain. Usually not pitted. Pack loosely in containers	Cover with 50-per cent cold syrup.	Not recommended.	Air-tight.
Peaches	J. H. Hale Kalhaven Halehaven Fertile Hale South Haven Elberta	Excellent frozen product but difficult to prepare. Harvest at firm-ripe stage, usually a few days later than the stage when harvested for market but before fruit reaches soft-ripe stage. Avoid bruising by excessive handling.	Rapid preparation essential to prevent browning. Peel by submerging in boiling water or lye solution (1 part lye—10 parts water) at 140° F. Plunge in cold water and rub off peelings. If lye is used, pass peeled peaches through 2-per cent citric acid solution, or lemon juice solution. Remove pits and cut each half in 4 or 6 pieces. Pack quickly into containers. Leave as little head space as possible.	Cover with 40- or 50-per cent cold syrup, depending on variety and individual taste. Syrup must cover fruit. Seal quickly and rush containers to freezer as quickly as possible.	Not recommended.	Air-tight essential.
Cantaloupes and Watermelons	Honey Rock Hearts of Gold Pride of Wisconsin Kleckley's Sweet Northern Sweet	Select high quality melons with firm-ripe flesh. Cut flesh in balls or squares for cocktails and salads. Entire product must be defrosted before serving to retain shape of balls.	Pack loosely in containers with waxed paper between each layer of pieces.	Cover with 40- to 45-per cent cold syrup.	Not recommended.	Air-tight or non-air-tight may be used.

Michigan State College of Agriculture and Applied Science and U. S. Dept. of Agriculture co-operating,
R. J. Baldwin, Director Extension Division. Printed and distributed under act of Congress, May 8, 1914

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Per Cent Sugar or Degree Balling	By Measure		By Weight
	Standard ½ pint cups	Standard quarts	
30°	8	2	3 lb.—10 oz.
35°	10	2½	4 lb.— 8 oz.
40°	13	3¼	5 lb.— 9 oz.
45°	15½	3⅞	6 lb.—13 oz.
50°	19	4¾	8 lb.— 6 oz.
55°	23¼	5⅞	10 lb.— 3 oz.
60°	28	7	12 lb.— 8 oz.

PREPARING VEGETABLES

All vegetables intended for frozen pack should be blanched (scalded), before packing, as suggested in the table. Blanching inactivates the enzymes (ferments) responsible for deterioration of flavor and quality, which occur even at low temperatures. It also "sets" the characteristic color of the vegetable and in some products makes packing easier. Sufficiently large quantities of boiling water (3 gallons per pint of product) should be used so that the addition of the vegetables will not lower the temperature of the water. Large wire baskets or muslin bags may be used. After blanching, the products should be plunged immediately in running cold water to cool them quickly before packing.

Many vegetables are packed dry but others retain their quality better if packed in a weak salt brine solution. The brine solution used is a 2-per cent solution and may be prepared by dissolving 1 teaspoon salt in 1 quart of water, or 4 teaspoons in 1 gallon of water; cool before using.

CONTAINERS

In the selection of containers it is necessary to consider the dehydrating effect of the exceedingly dry air in the locker storage rooms maintained at 0° F. This dry air will extract moisture through paper and other materials which are ordinarily water-proof. Beside drying, certain fruits oxidize (turn brown) if exposed to the air of the locker and vegetables lose their fresh color and flavor. The more effectively the product is protected from air, the better the quality will be. The containers should be straight-sided and if possible larger at the top to permit easy removal of the frozen products. They should be of such a shape so as to prevent a loss of valuable locker storage space. In the directions given in the tables, "air-tight" designates containers which do not permit the exchange of gases between the contents and air; non-air-tight indicates that the containers are moisture-proof or do not permit the exchange of water-vapor.

Glass jars with well-fitting lids and rubbers are air-tight and may be used if handled carefully to prevent breakage. Tin cans may be used if sealed with a hand sealer, or if provided with suitable friction-top covers. Lacquered tins are necessary for most fruits and vegetables, particularly those fruits with high acid-content, those which discolor badly, and vegetables packed in weak brine solutions.

Containers of paper board, provided with moisture-vapor proof linings of parchment or cellophane, are satisfactory if properly sealed. Much progress has been made in developing bags and wrappers of paper, parchment, cellophane and rubber film which are air-tight and moisture-proof, and in some instances water-proof as well. Such materials are especially useful for dry-packed products or those frozen before packing. Most locker plants keep a supply of containers for sale to patrons.

To provide for expansion of the product during freezing, it is necessary to leave from ¾ to 1½ inch head space in quart glass jars and about ½ inch in tin cans and paper board containers. That is much more head space than is allowed in canning and varies somewhat with the strength of the syrup used in packing fruits.

FREEZING AND STORAGE

After packing, the prepared products should be taken immediately to the locker plant for quick freezing and storage. There they are placed in the "sharp freezer" at —15° to —25° F. for 8 to 12 hours, frozen solid and moved to the individual's locker in a room maintained near 0° F. Most fruits may be frozen at 0° F. but slightly lower temperatures are desirable with many vegetables. Storage temperatures should be maintained uniformly near 0° F.

LABELS AND RECORDS

All containers should be properly labelled with name, product and date of packing. Gummed labels do not stick well at low temperatures and ink is likely to run. These materials should not be used. A small piece of adhesive tape may be used on glass and tin containers or they may be marked with a china-marking pencil. A record of the procedures followed with all of the products stored in the locker should be kept in a note-book for future reference.

CARE OF FROZEN FOOD IN THE HOME

Unless frozen food can be kept frozen, it should be used promptly. Once thawed, the food should not be re-frozen. Vegetables should be partially cooked if they cannot be used soon after thawing. Twenty-four hours may be allowed after thawing, if the vegetables are kept in the food compartment of an efficient refrigerator.

COOKING AND SERVING

Fruits are considered best when served just before they are completely thawed. Dry pack or sugar pack fruits may be put in pies or into the preserve kettle without thawing. If dry pack fruits are used for dessert purposes they should be thawed in syrup. During thawing, the products should be left in the unopened original containers and if the containers used for fruits packed in syrup are leak-proof it is advisable to invert them when thawing. Small packages of fruit in syrup may be thawed in 60 to 90 minutes in cold or luke-warm water.

All frozen vegetables should be cooked before they are eaten: Dry-pack vegetables are considered best when plunged into boiling salted water, but may be allowed to thaw first. Corn on the cob and asparagus should be thawed slightly before cooking. Brine packs may be started cooking slowly while still frozen and the frozen masses broken apart with a fork. A small amount of water may be added to prevent burning.

Cooking periods are shorter than for fresh vegetables by approximately one-half, starting from the time the thawed mass begins to boil. Frozen vegetables, if overcooked, will lose their fresh flavor and color.

SUGGESTED VARIETIES, HARVESTING, HANDLING, PREPARING, BLANCHING AND PACKING PROCEDURES FOR QUICK FROZEN VEGETABLES

Vegetable	Suggested Varieties	Harvesting and Handling Instructions	Preparation	Blanching Time—Boiling Water 212° F.	Packing	Containers
Asparagus	Mary Washington	Avoid small and woody stalks. Handle quickly.	For "tips" cut in 4½" lengths. For cut use 1" lengths. Wash thoroughly. Don't use iron utensils.	2 to 3 min. Plunge in cold water. Drain.	2-per cent brine or dry pack (1 teaspoon salt to 1 qt. water, or ¼ lb. salt to 6 qts. water).	Air-tight preferred.
Beans: Green Wax	Refugee, Tendergreen, Stringless Green Pod, Kentucky Wonder (pole), Round Pod Kidney Wax, Pencil Pod Black Wax	Avoid over-mature and small pods. Handle quickly after harvest.	Prepare as for canning.	2 to 3 min. Plunge in cold water. Drain.	2-per cent brine or dry pack.	Non-air-tight containers may be used for brine pack. Air-tight preferred for dry pack.
Beans: Lima	Fordhook, King of the Garden (pole), Burpee Bush, Early Baby Potato, Henderson	Harvest when beans have reached full size but before they have started to turn white and harden.	Shell by hand. Process as soon as possible after shelling. Pick out white beans.	1½ to 2 min. Plunge in cold water. Drain.	Dry pack or 2-per cent brine.	May be frozen on trays and packed after freezing in air-tight or non-air-tight containers.
Broccoli and Brussels Sprouts	Italian Green Sprouting or Christmas Calabrese. Long Island Improved	Harvest as for fresh use. Avoid yellow or tough flower heads. Use only medium sized firm sprouts.	Examine carefully. Cut in small pieces. Use only tender portions of flower stems. Remove outer yellow leaves.	3 to 4 min., depending on size of pieces. Plunge in cold water. Drain.	2-per cent brine or dry pack.	Either air-tight or non-air-tight containers may be used.
Carrots	Red Cored Chantenay Nantes or Coreless	As for table use.	Top, scrub under running water, trim, and dice. Young carrots may be left whole.	2 to 3 min. for diced, 3 to 4 min. for whole carrots. Plunge in cold water. Drain.	2-per cent brine or dry pack.	Air-tight or non-air-tight containers.
Cauliflower	Snowball, Snowdrift, or White Mountain	As for table use. Avoid discolored or spreading heads.	Examine carefully. Trim and break into small pieces.	2 to 3 min., depending on size of pieces.	2-per cent brine desirable.	Air-tight containers preferred.
Corn: Yellow (Sweet) White	Golden Cross Bantam Golden Bantam Stowell's Evergreen	Harvest early in morning. Select ears with rounded kernels, milky juice and sweet flavor. Avoid hard and immature kernels. Handle quickly to preserve quality and flavor.	Husk, silk and trim ears. Avoid submerging corn in water as much as is possible. Scald on cob for cut corn.	**Cut corn**–scald on cob for 2 to 3½ min. Cool in ice water. Cut from cob and pack. **Corn on cob**–scald for 8 to 9 min. for medium ears, large–8 to 10 min.	Usually packed dry. Individual ears wrapped in moisture-proof paper and placed in container.	Air-tight or non-air-tight containers may be used.
Peas	Thomas Laxton World Record Asgrow 40 Alderman (Alaska not suited)	Use only adapted varieties. Avoid over-ripe pods. Handle quickly from time of harvest to freezing to preserve quality and flavor.	Shell by hand. Sort out small immature and large hard peas, split peas and foreign material.	60 to 90 seconds. Cool promptly in cold water.	2-per cent brine preferred for home use. May be packed dry. May be frozen on trays then put in containers.	Air-tight or non-air-tight containers may be used.
Peppers (sweet)	California Wonder or similar varieties	Select thick walled green or red fruits.	Wash, halve, remove seeds. Slice or dice, as preferred.	May be packed without scalding or may be scalded for 2 minutes. Cool promptly.	May be packed dry or in 2-per cent brine. Latter preferred.	Air-tight or non-air-tight containers may be used. Small size desirable.
Spinach and other greens	Giant Nobel King of Denmark Long Standing Bloomsdale Viking	Harvest as for table use. Do not hold long before packing.	Wash thoroughly. Remove all discolored leaves and large stems.	Scald for 2 to 2½ min. Keep leaves moving during scalding and subsequent cooling.	Usually packed dry.	Air-tight or non-air-tight containers may be used.