

RECEIVED

APR 26 1944

EXPERIMENT STATION

STORING FOODS

in

FREEZER

LOCKERS

Suggestions for

**Preparation • Packing • Freezing
Thawing • Cooking**

Circular 398

UNIVERSITY OF KENTUCKY
College of Agriculture and Home Economics
Extension Division

Thomas P. Cooper, Dean and Director

This circular is based entirely upon information gained in investigations made by other colleges of agriculture and home economics, by the U. S. Department of Agriculture, and by locker companies and manufacturers of equipment for them. No investigational work of this sort has been done at the University of Kentucky, and the authors hereby acknowledge their indebtedness to these other workers, institutions, and companies. Kentucky readers whose questions on storage of food in freezer lockers may not be fully answered in this publication are requested to write to the authors for a list of other sources of information.

CONTENTS

	Page
MEATS	3
POULTRY	5
VEGETABLES	6
FRUITS	11
THAWING AND COOKING	
FROZEN FOODS	14

St

Co
is dres
should
temper
Small
chilled

Am
Moist
air less
weight

Ag
ton. F
for sev
stored

Pre
lamb a
if the f

Por
as soon

Bev
in the

Cut
cut int
and pla

Wr
must p
it must
to the
tures.

Cell
the mo
still ma
one sid
carefull
Stea

Storing Foods in Freezer Lockers

By J. B. KELLEY and PEARL J. HAAK

Meats

Cooling and aging.—Rapid cooling of meat immediately after it is dressed is most important to prevent spoilage. The dressed carcass should be chilled and aged in a refrigerated room maintained at a temperature of 32° to 36° F and at a humidity of 80 to 85 percent. Small carcasses, such as veal, lamb, and pork, are usually thoroughly chilled in 24 to 36 hours, but larger carcasses may take 72 hours.

Amount of moisture in the air (humidity) is of great importance. Moist air favors the growth of bacteria and molds on the meat. Dry air lessens their growth, but if too dry it causes excessive shrinkage in weight of the carcass.

Aging improves the quality and tenderness of beef, veal and mutton. However, do not over age meat that is to be frozen and stored for several months, since it will reduce the length of time it may be stored without becoming rancid.

Present practices are to age beef 5 to 10 days, veal 3 to 5 days, and lamb and mutton 5 to 7 days. Extremely fat beef may be aged longer if the fat is trimmed before freezing the meat.

Pork, fish and poultry are not aged but are packaged and frozen as soon as thoroughly chilled.

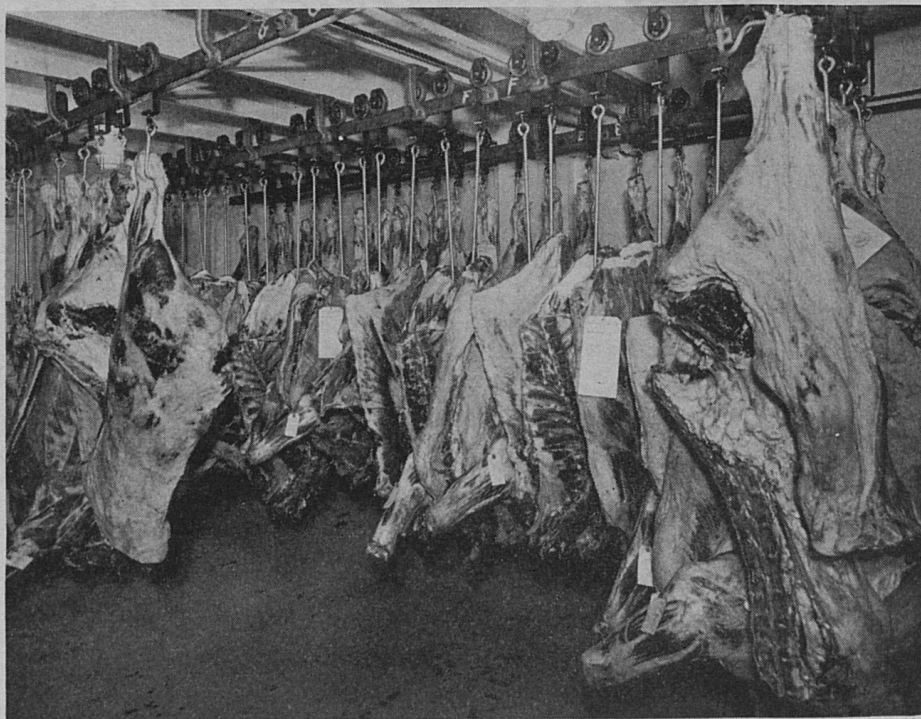
Beware of bruised, spoiled or soiled parts. Cleanliness is essential in the handling of meats.

Cutting.—When the meat has been cooled and aged, it should be cut into the so-called "retail cuts," or otherwise processed as desired, and placed in packages of the sizes needed to suit the family.

Wrapping.—In selecting a wrapping material, keep in mind it must prevent the food from drying out and from absorbing flavors; it must not absorb grease, oil, water, blood; it must not give a flavor to the product; it must not crack or become brittle at low temperatures.

Cellophane and cellophane combined with stockinette have been the most successful wrappings for meat. A limited amount of these still may be obtainable. Parchment papers or papers paraffined on one side are the available wrappings now. Packages must be wrapped carefully and tightly. Two thicknesses of some papers may be needed.

Steaks should be separated by parchment paper if they are to be



Chilling and aging room for meats in freezer-locker plant in Shelbyville, Kentucky.

cooked unthawed. Ground meat should be firmly packed in cartons to keep out air. Sausage should not be salted or seasoned, because it may develop rancid flavor sooner than unseasoned sausage.

Marking.—Label each package with the kind of meat, the cut, the weight, the date, and locker number. This will aid later in selecting the cuts wanted and the meat that has been stored for the longest time.

Quick freezing.—When packages are marked, the meat should be placed in the quick freezer compartment and held at a temperature of 10 to 15° below zero Fahrenheit. There is considerable difference in present practices regarding the length of freezing time. For meat, present practices range from 2 to 24 hours.

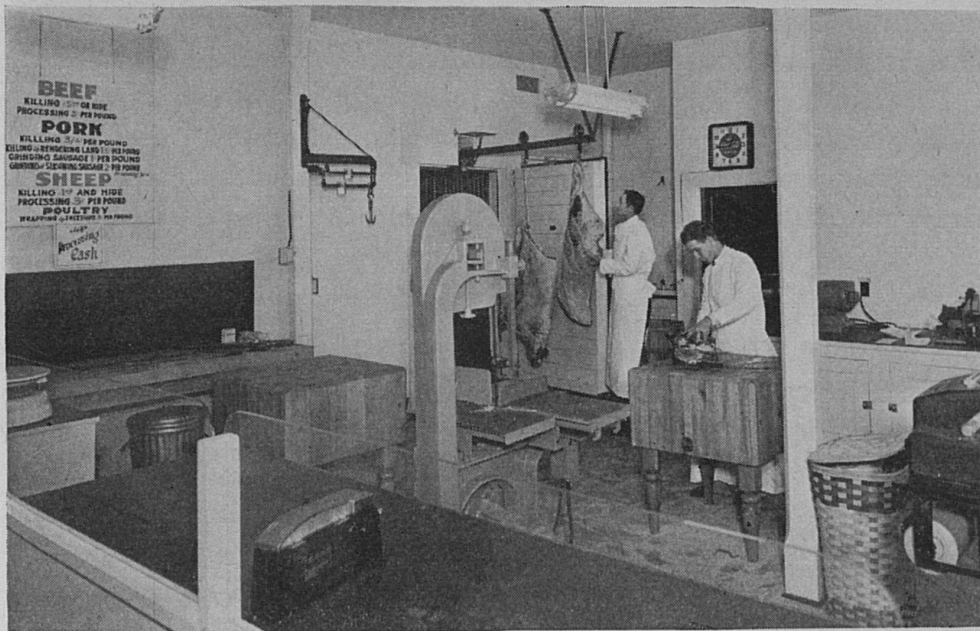
Storage.—After freezing, place the packages in storage lockers. Be careful not to injure the wrappers. For meats, a storage temperature of 0° Fah. or lower is recommended. Fresh pork should not be left in storage more than 4 to 6 months, cured pork for more than 10 to 12 months, and ground pork or sausage that is seasoned or salted for more than 2 months. Ground pork unseasoned and unsalted, can be left in storage about 4 months.



Room a
packagi

Be
Veal, m
fish fro
It
differ
riety a

Se
birds u
Dr
in rem
for ov
scuffe
remov
over a
It
bird h
Th
up or
Pa
effort



Room and equipment in Shelbyville freezer-locker plant used in cutting and packaging meats.

Beef and lamb can be kept for 10 to 12 months in freezer storage. Veal, mutton, and poultry are commonly stored 4 to 6 months and fish from 1 to 3 months.

It is a good practice to store and use different kinds of meats at different times during the year, so as to have a constant supply, a variety and so that none will remain in storage after it starts to spoil.

Poultry

Selecting.—Select for freezing birds that are fat, for fattened birds usually have best flavor and juiciness.

Dressing.—Remove the feathers and draw the entrails. As an aid in removing the feathers, use water at temperature of 128° to 130° F, for overscalding at a higher temperature will often leave the skin scuffed and scalded. Also over-scalded birds will not keep well. Then remove pin feathers with a dull knife and remove the hair by singeing over an open flame.

It is easier to remove the entrails without breaking them if the bird has first been thoroughly cooled in cold water.

Thoroughly wash the carcass, dry it, and cool it before cutting it up or putting it in the package or storage container.

Packing.—Poultry may be packed whole or taken apart. Every effort should be made to store poultry in moisture-proof containers to

prevent drying and "freezer burns" which not only make the product unsightly, but often cause very pronounced off-flavors in the meat.

Poultry for locker storage may be placed in tin cans, sirup pails, glass jars, with tight lids, and moisture proofed paper cartons or wrappings such as cellophane, parchment, and waxed paper. Take care when handling the package not to injure the wrappings.

Vegetables

Vegetables selected for freezing should be at right maturity for cooking. They should not be woody, but should be sound, and have a good flavor and color. Remember the product you take out of storage will be no better than the one you put in.

Vegetables keep best if processed and placed in the freezing compartment within 6 hours after they are gathered. If it is not possible to freeze them the same day they are gathered, keep them in a cool place over night.

A list of the vegetables which have been found satisfactory for freezing, and directions for preparing and packing them, is given in Table 1.



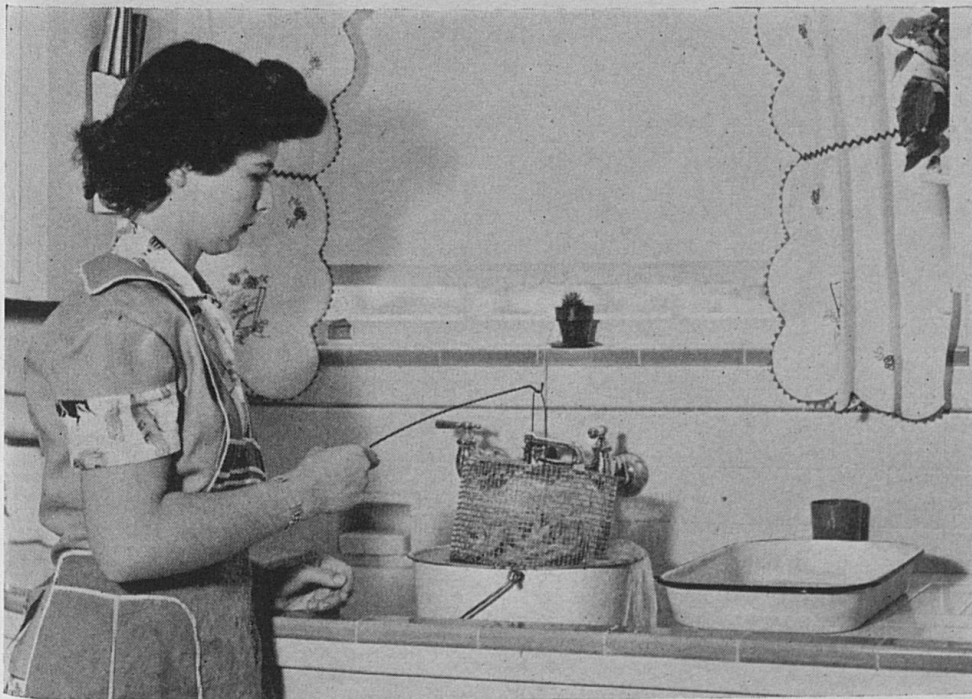
Scalding vegetables in boiling water before freezing causes them to keep better during freezing storage. Unless the vegetables are properly scalded, undesirable flavors develop and food value is lowered.

Carefully sort, grade, wash, and prepare the vegetables as for cooking, then scald and package them before putting them into the freezer.

Scalding aids in cleaning the vegetables, and helps them to keep well. It partly sterilizes them and slows down their loss of vitamins C and A. Scalding also greatly helps to keep color, flavor, texture, and food nutrients. Scalding may be done by putting the vegetables, after they have been sliced, cubed or otherwise prepared, in boiling water, or by exposing them to steam in a pressure cooker or other suitable container. Vegetables should be scalded at a temperature of 212° F. The time required depends upon the kind of vegetables and size of parts and whether scalded in water or steam.

Table I gives time recommended for scalding in water. If steam is used, increase the scalding period to 2½ times that of boiling water.

When scalding with hot water, use 4 or 5 gallons of hot water to 1 pint of the vegetable, or 6 to 8 gallons of water for each pound of vegetable. For leafy vegetables and corn, about twice as much water will be needed for rapid handling.



After scalding the vegetables are immediately cooled. Here they are being cooled in running tap water.

Table 1.— Directions for Preparing, Scalding, and Packing Vegetables for Quick Freezing

Vegetable	Preparation	Scalding* time in boiling water	Packing
Asparagus	Cut tips in 4½-inch lengths, cut other shoots in 1-inch lengths. Wash thoroughly. Don't use iron utensils.	2 to 3 minutes*. Cool in cold water. Drain.	2-percent brine (4 teaspoons salt to 1 qt water, or ¼ lb salt to 6 qts water), or dry pack.
Green beans	Prepare as for canning.	2 to 3 minutes*. Cool in cold water. Drain.	2-percent brine or dry pack.
Lima beans	Shell by hand. Process as soon as possible after shelling. Pack white beans separately.	1½ to 2 minutes*. Cool in cold water. Drain.	Dry pack.
Broccoli } Brussels } sprouts }	Examine carefully. Cut in small pieces. Use only tender portions of flower stems. Remove outer yellow leaves.	3 to 4 minutes*, depending on size of pieces. Cool in cold water. Drain.	2-percent brine or dry pack.
Carrots	Top, scrub under running water, trim, and dice. Young carrots may be left whole.	2 to 3 minutes* for diced, 3 to 4 minutes for whole carrots. Cool in cold water. Drain.	2-percent brine or dry pack.
Cauliflower	Examine carefully. Trim and break into small pieces.	2 to 3 minutes, depending on size of pieces.	2-percent brine desirable.
Sweet corn (yellow or white)	Husk, silk, and trim ears. Scald on cob for cut corn.	Cut corn —scald on cob for 4 minutes. Cool in cold water. Cut from cob and pack. Corn on cob —Scald medium ears for 8 to 9 minutes; large ears 8 to 10 minutes.	Usually packed dry. Individual ears wrapped in moisture-proof paper and placed in container.
Peas	Sort out small immature pods, large hard pods, and foreign material. Shell by hand or with hand-sheller.	1 minute. Cool promptly in cold water.	May be packed dry. Brine preferred.
Peppers (sweet)	Wash, halve, remove seeds. Slice or dice as preferred.	May be packed without scalding or may be scalded 2 minutes. Cool promptly.	May be packed dry or in 2-percent brine (brine preferred).

(See footnote at end of table on following page.)

Table 1.—(continued)

Vegetable	Preparation	Scalding* time in boiling water	Packing
Spinach and other greens	Wash thoroughly; remove all discolored leaves and large stems.	Scald for 2 to 2½ minutes.* Keep leaves moving during scalding and cooling.	Usually packed without added liquid.
Summer squash	Cook as for the table. Do not add seasoning. Avoid using excess water.	3½ minutes.	Cool before packing in paper containers.
Winter squash	Cook until soft.		Cool before packing in paper containers.

* If steam is used, increase scalding time 2½ times longer than given for boiling water.



After cooling, the scalded vegetables are put in paperboard cartons fitted with moisture-resistant bag. The heat-sealable moisture-resistant bag is essential to prevent "freezer burn" during storage.

The bag liner is sealed with a heated flatiron. Use moderate heat so as not to destroy the sealing surfaces. In an air-tight and moisture-tight package the frozen foods will keep longer.

Directions for scalding with hot water

1. Place the prepared vegetable in a wire basket and dip it under rapidly boiling water.
2. Lift the basket of vegetables up and down once or twice so that the hot water will go among all the vegetables.
3. Scald for the right time in water that is kept boiling.
4. Remove the basket of vegetables and chill in cold running water or iced water at 50° or 60° F, cooling, if possible, to 60° F.
5. Remove and drain in a colander.
6. Do not leave the vegetables in the water longer than needed to cool them.

Directions for scalding in steam

1. Scalding may be done in a pressure cooker.
2. Place the vegetables in a basket on a rack.
3. Use enough water to keep from going dry.
4. Be sure the pet-cock is open; no steam pressure is needed.
5. Have water boiling before the vegetables are put in.
6. Count the scalding time from the moment there is a flow of steam from the pet-cock.
7. Never use steam for leafy vegetables such as spinach, because of their tendency to mat.

Packing vegetables for freezing

Vegetables may be packed in a weak salt solution (a 1½-percent or 2-percent brine) or "straight" without liquid.

A 2-percent brine solution is made by dissolving 4 level teaspoonfuls ($\frac{3}{4}$ ounce) of pure table salt in 1 quart of water, or 3 ounces to 1 gallon of water. A 2-percent brine is not considered too salty for the average taste. However, some prefer a 1½ percent brine pack.

The "brine pack" is helpful in preserving quality and color of product, in keeping the product cool before freezing. There is less drying during storage and a longer storage period is possible. Its chief disadvantages are the extra weight of the package and that the container must be water-tight.

Whether packed straight or in weak brine, the vegetables are best packed in an air-tight and moisture-vapor-proof container. Strong glass jars or tin cans, may be used, and paper cartons made especially for this purpose are satisfactory. Plain tin cans are satisfactory for most vegetables. Lacquered cans should be used for fruits and asparagus.

The expansion of liquids in freezing must be considered. This is done by leaving about 10-percent of the space for expansion.

Regardless of the method of packing, prompt delivery of the product to the freezing room is important. There should be not more than 6 hours between gathering and freezing the vegetables.

Fruits

Kinds of fruits.—Fruits best adapted for quick freezing which are commercially important are strawberry, raspberry, dewberry, blackberry, cherry, peach, blueberry, apricot, and rhubarb.

Other fruits which can be frozen include apple, grape, pineapple, sweet cherry, cranberry, currant, gooseberry, and certain plums. The juices of apple, cherry, rhubarb, pineapple, currant, and raspberry are also said to be well adapted for freezing.

Selecting fruits, grading for maturity and quality.—Fruits for freezing should be of the best quality. They should be ripe enough for eating but not over-ripe. They should be sound and should have a good flavor and color. The product you take out of storage will be no better than the one you put in.

Berry fruits keep best if processed and frozen in the shortest length of time after they are harvested. If it is not possible to freeze berries the same day as gathered, they should be stored over night in a refrigerator at a temperature of 32° to 34° F. It is recommended that berry fruits be placed in the freezer compartment within 6 hours after they are gathered.

Some fruits such as apples, peaches, plums and apricots may require a ripening period before they are ready to freeze. Don't freeze them until they are ripe enough to eat.

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

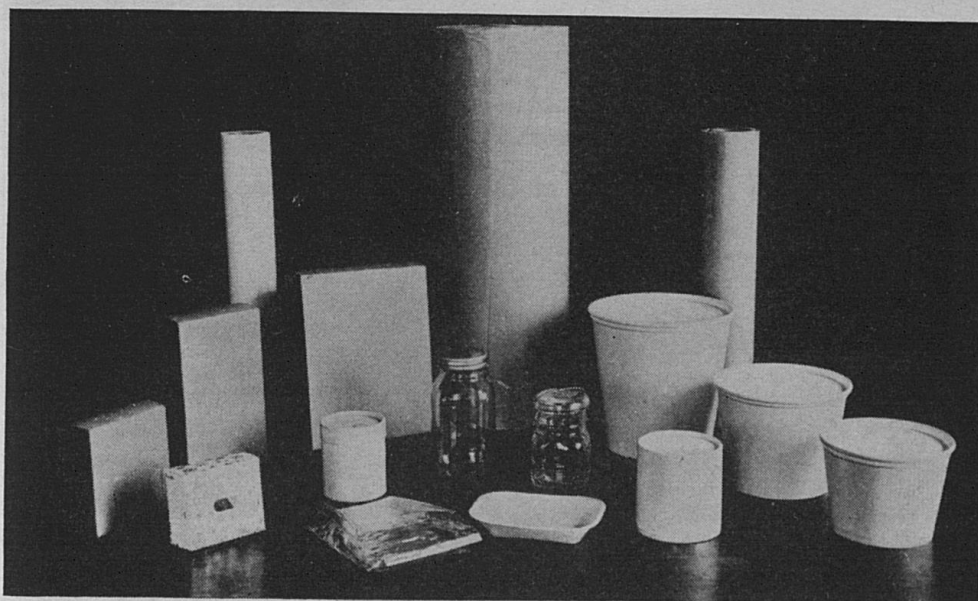
Table 2 gives a list of fruits commonly frozen and suggestions regarding their preparation for freezing. They are best packed in airtight containers.

Containers.—Tin cans, glass jars or special cartons may be used. The cartons should be used only once, because they cannot be heated for sterilization.

The most popular commercial container is a rectangular waxed paper-board carton lined with cellophane, parchment or other moisture-vapor-proof material. This lining may be a bag which can be heat-sealed with a flat-iron or soldering iron, or with paraffin, after filling. The cartons are light and convenient. They permit storing about one-third more food in a given space than round containers.

Table 2.— Directions for Preparing and Packing Fruits for Quick Freezing

Fruit	Preparation	Sugar sirup pack	Dry sugar and dry pack			
Rhubarb	Wash and cut 1 inch sections. Do not peel.	Cover with 50 percent sirup.	Dry sugar not recommended. May be packed dry without sugar.			
Strawberries	May be packed whole, cut in slices 1/8-inch thick, or crushed.	Cover with 50-percent cold sirup. Sugar pack preferred.	Mix 1 part with 4 parts berries. If whole berries are used, use 1 part sugar to 3 parts berries.			
Red raspberries	Sort, wash, and drain thoroughly. Do not crush berries in filling containers.	Cover with 50-percent cold sirup. Rush to freezer as soon as packed.	Sirup pack preferred.			
Black raspberries	Same as red raspberries.	Same	For use in pies and cobblers, mix 1 part sugar to 3 parts berries.			
Dewberries Blackberries Boysenberries	Sort, wash, drain, and pack loosely in containers.	Cover with 45 or 50-percent cold sirup.	For pastry, mix 1 part sugar to 3 parts berries.			
Blueberries				Sort, wash, drain, and pack loosely in containers.	Cover with 40 or 50 percent cold sirup.	Dry sugar not recommended. May be frozen without sugar for use in pies.
Red cherries				Wash, remove pits, and pack in containers rapidly.	Cover with 60-percent cold sirup. Dry sugar packs preferred.	For pies, mix 1 part sugar with 4 parts pitted cherries. Mix well.
Sweet cherries	Stem, sort, wash, drain and pack loosely in containers. May be pitted.	Cover with 50-percent cold sirup.	Dry sugar or dry pack not recommended.			
Peaches	Rapid preparation essential to prevent browning. Peel by submerging in boiling water. Remove pits and cut each half in 4 to 6 pieces. Pack quickly into containers. Leave as little head space as possible.	Cover with 50 or 60-percent cold sirup. Sirup must cover fruit. Seal quickly and rush containers to freezer as quickly as possible. Slice peaches into containers having sirup.	Dry sugar or dry pack not recommended.			
Cantaloupes	Pack loosely in containers with waxed paper between each layer of pieces.	Cover with 40 or 45 percent cold sirup.	Dry sugar or dry pack not recommended.			



Various kinds of containers are used for packaging frozen foods for lockers.

Choose containers of a size to meet the family's needs for one meal.

The ordinary 1-quart carton requires a head space of $\frac{3}{4}$ of an inch to allow for expansion when product is frozen; when unsweetened juices are frozen, the container should be filled only four-fifths full. A quart glass jar should not be filled higher than an inch below top of rim.

Packing in sugar.— The amount of sugar to use may be varied to suit the individual taste. A sirup concentration of 60 percent is very sweet and more difficult to handle than lighter sirups. Sirups of 40- to 55-percent are usually preferred.

Proportions of sugar and water to use for different concentrations are given in Table 3.

After putting the fruit in the container, cover it with the sirup. The sirup should be cold when poured over the fruit. Leave room for expansion in freezing (see paragraph on containers, above). Fruit usually stays in better condition in sirup than in dry sugar, but has less liquid after thawing when packed dry.

When using the "dry sugar pack," the sugar should be thoroughly mixed with the fruit before putting in container.

The following method of applying the sugar to berries has proven successful. Place the berries, that have been washed in cold water and drained, in a cold crock, in 2-inch layers, sprinkling dry sugar over each layer as the container is filled. Allow the berries to remain in the

Table 3.—How Much Sugar and Water to Use in Making Sirups

Concentration	Amount of sugar per quart of water		Resulting volume of sirup (quarts) at 72° F
	By volume, in standard cups	By weight	
30 percent	2 $\frac{1}{8}$	14 oz	1.25
40 percent	3 $\frac{1}{4}$	1 lb, 6.3 oz	1.38
45 percent	4	1 lb, 11.3 oz	1.47
50 percent	5	2 lb, 1.4 oz	1.56
55 percent	6	2 lb, 8.8 oz	1.72
60 percent	7 $\frac{2}{5}$	3 lb, 2 oz	1.84

crock until sugar dissolves (usually within an hour) and then place them in the containers. Seal and freeze them at once. Some prefer to mix sugar and berries in a large pan, turning them with a pancake turner and putting them in the containers at once.

Label the container with the date packed, kind of fruit it contains and locker number.

Thawing and Cooking Frozen Foods

The food value of frozen foods depends upon the quality of the foods and how they are treated before they are frozen, how long they are kept after thawing before being cooked; and how they are prepared for the table. Some food value is lost in preparing frozen foods just as in preparing fresh products. Frozen foods can be kept frozen for several days in the freezing compartment of a refrigerator if they are quickly transferred from the locker or freezing cabinet to the refrigerator.

Meats.—In tests made by the Bureau of Animal Nutrition and Home Economics of the U. S. Department of Agriculture, frozen meats

Table 4.—Time Table for Cooking Roasts (300° to 350° F) and Steaks

Kind of meat	Unfrozen	Frozen
Beef roast		
Rare	28 min per lb	53 min per lb
Medium	32 min per lb	57 min per lb
Well done	40 min per lb	65 min per lb
Pork roast (should always be cooked until well done)		
Center cuts	30 to 35 min per lb	50 to 55 min per lb
Rib or shoulder ends	50 to 55 min per lb	70 to 75 min per lb
Steaks, broiled		
1 inch thick	8 to 10 minutes	21 to 33 minutes
1 $\frac{1}{2}$ inch thick	10 to 15 minutes	23 to 38 minutes
2 inches thick	20 to 30 minutes	33 to 43 minutes

taken from the storage lockers and put in the home refrigerator could be kept only 2 to 3 days in an ice refrigerator and 3 to 4 days in an electric refrigerator, depending on the thickness of meat, before a tainted odor appeared.

It is not necessary to thaw meat entirely before cooking but it is advisable to have it at least two-thirds thawed to assure uniform cooking. There are several ways of thawing meat: (1) It may be left in the refrigerator to defrost slowly. There will be less loss of juice when meat is thawed slowly, allowing 24 to 36 hours for thawing a 4-pound roast. (2) It may be thawed at room temperature (70° F) which requires about 2 hours per pound of meat. (3) It may be put under an electric fan at room temperature and thawed in about 45 minutes per pound of meat.

Time needed for cooking frozen and unfrozen roasts and steaks is given in Table 4.

Poultry.—Most people recommend complete thawing of poultry and cooking it the same as a fresh bird. It takes about 8 hours per pound to thaw a chicken in an electric refrigerator, but less time in an ice box. Thawing may be hastened by using the methods suggested for other meats.

Vegetables.—Vegetables will keep as long as they remain solidly frozen, but once they are thawed they become like fresh food and should be used at once. The flavor, color, and texture of vegetables are best if the cooking is done by dropping the frozen food into boiling water and continuing the cooking at boiling temperature until

Table 5.—Directions for Cooking Frozen Vegetables

Product (1-pound package)	Amount of water	Time of cooking
Asparagus	1 cup	Boil 8 to 10 minutes
Broccoli	1 cup	Boil or steam 5 to 8 minutes
Brussels sprouts	1 cup	Boil 5 to 7 minutes
Cauliflower	1½ cup	Steam 4 to 6 minutes
Corn on the cob	1½ cup	Steam 4 to 6 minutes
Corn (cut)	¾ cup	Steam 4 to 5 minutes
Carrots	¾ cup	Boil or steam 5 to 10 minutes
Green beans	1 cup	Boil or steam 8 to 15 minutes
Green peas	¾ cup	Boil or steam 5 to 7 minutes
Green lima beans		
Small green	2 cups	Boil or steam 8 to 12 minutes
Large	2 cups	Boil or steam 15 to 20 minutes
Soybeans (green edible)	¾ cup	Boil or steam 10 to 15 minutes
Spinach (partially thawed)	½ cup	Boil 4 to 6 minutes
Kale	1 cup	Boil 14 to 20 minutes

tender, from 10 to 20 minutes. Frozen vegetables will cook in about half the time needed for fresh vegetables.

The amount of water and time needed for cooking frozen vegetables is given in Table 5. The amount of water given in the table is based on the average size and kind of containers used and degree of heat at which cooking was done. By experimenting in your own kitchen you will learn the right amount of water to use to last through the cooking period and prevent scorching. Any liquid left should be served with the vegetable or in soups, sauces, and so on.

Fruits.— Thawing fruits is all that is necessary but timing is most important. Berries, especially, are a delicate fruit and should be handled carefully. Slow thawing in the refrigerator is recommended for all fruits. It will take about 6 to 8 hours to thaw the fruit in an unopened carton in the food compartment of a refrigerator; at room temperature it will take about 3½ hours. If it is necessary to thaw fruit in less time it may be removed from the package, but the fruit will be less firm after thawing if the thawing is hastened. Thaw just long enough before using so that it can be served cold.

Table 6.— Time Table for Thawing Fruits (1-pound packages)

Product	In the refrigerator	In carton at room temperature	Out of the carton at room temperature
Berries	6 to 8 hours	3 to 3½ hours	1½ to 2½ hours
Cherries (in sugar)	1¼ hours	¾ hour	½ hour
Mixed fruit	5 to 6 hours	3½ hours	2 hours
Peaches (in sirup)	6 to 8 hours	3½ hours	2½ hours
Rhubarb	Cook without thawing beforehand		

Lexington, Kentucky

April, 1944

Cooperative Extension Work in Agriculture and Home Economics: College of Agriculture and Home Economics, University of Kentucky, and the United States Department of Agriculture, cooperating. Thomas P. Cooper, *Director*. Issued in furtherance of the Acts of May 8 and June 30, 1914.

15M-4-44