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Home Freezing of Foods

University of Tennessee Agricultural Experiment Station

G.A. Shuey

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HOME FREEZING OF FOODS

By

G. A. SHUEY

THE UNIVERSITY OF TENNESSEE
AGRICULTURAL EXPERIMENT STATION
Knoxville
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FOREWORD

In the interest of a varied and well-balanced diet, all families that can are urged to produce and preserve foods in season for future use. The purpose of this bulletin is to aid those who wish to preserve foods by freezing.

Freezing is one of the most practical methods yet devised for supplying the table, the year round, with processed fruits, vegetables, and meats, with much of their freshness and original quality retained. Families that produce, or purchase, a considerable portion of their food supply—fresh fruits, vegetables, and meats—for winter storage and home processing, should include freezing as a part of the over-all food-preservation program.

Because of the convenience and improvement in quality of commercially prepared frozen foods, there is an ever-increasing number of families that depend entirely on retail service for these products. Many purchase frozen foods from day to day as needed; others get a week's supply, and utilize the frozen-food compartment of the household refrigerator.

Families that are in position to grow or buy fresh materials for freezing at reasonable prices, or to buy frozen foods in quantity, should provide themselves with equipment for freezing and storing the food. Household and farm-size units, with separate freezing and storage compartments, are available in a variety of shapes and sizes. "Walk-in" types designed to provide both ordinary refrigeration (34° to 38° F) and zero temperature are available.\(^1\) The cold room is used for chilling and aging of meats, chilling of poultry, and storing of fresh fruits and root vegetables; the zero room is used for freezing and storage.

While a discussion of the frozen-food locker-plant industry is not within the scope of this publication, it should be emphasized that experienced locker-plant personnel can be of service in meat and poultry processing, packaging, and quick freezing, for which many families are not equipped.

A rented locker of average size (7 cubic feet) in a modern, well-operated frozen-food locker plant, supplemented by a small (3 or 4 cubic feet) household storage unit in the home, will hold a total of approximately 325 pounds of miscellaneous frozen foods. The small home unit will hold several weeks' supply of frozen foods, and will also serve to freeze and accumulate surpluses from the family garden which may later be taken to the locker plant, when the home supply of meats and other foods is replenished.

Families residing in rural communities, that produce a considerable part of their food supply, and have adequate freezing and storage facilities in the home, should make a list of the kinds and amounts of foods—fruits, vegetables, meats, fish, and poultry—to be

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\(^1\) Drawings and plans for farm freezers may be obtained from the Agricultural Engineering Department, Agricultural Extension Service, University of Tennessee, Knoxville, Tennessee.
frozen during the year. With proper planning, such families are assured of a supply of miscellaneous frozen foods throughout the year; they avoid overloading the zero storage unit early in the season, and thus leave space for products that come later in the year.

Certainly, if mechanical refrigeration facilities are available, they provide a good method of conserving such produce as root vegetables, potatoes, cabbage, and apples, in a cool, humid atmosphere (34° to 38° F.) for use during the winter months. A properly constructed cool room in the basement is a suitable storage place for both fresh produce and canned goods.

Some fruits and vegetables—pears and tomatoes, for example—are not so well suited to freezing. These and numerous other home-grown products that give variety in the meals, should be preserved in liberal amounts by canning.

It is assumed that the homemaker is skilled in the use of kitchen equipment. To conserve space, therefore, the author has omitted illustrations of the techniques of scalding (blanching) and cooling vegetables, filling containers, mixing sugar with fruit, wrapping meats and poultry, and other well-known operations. The county home demonstration agent can supply detailed information concerning the steps involved in preserving food by freezing.

Research on the freezing of foods was conducted by the University of Tennessee Agricultural Experiment Station, Department of General Agricultural Chemistry. In the course of the work, excellent cooperation was received from the Station Department of Horticulture which provided varieties of the several kinds of fruits and vegetables used in many of the experiments. We wish to express thanks to the Winter Garden Company of Knoxville, which provided generous quantities of fruits, vegetables and packaging materials.

The author also wishes to express appreciation to the following persons, who rendered invaluable service in the course of the experimental laboratory work: Addie R. Wise, Geraldine C. Coleman, Kathleen M. McCook, Ramelle Paige, and Lois M. Beach. The author is especially indebted to Richard G. Garner, Assistant General Agricultural Chemist for his very efficient services.

Principles governing the process are discussed in this bulletin, and specific directions for freezing different kinds of foods are given. While not exhaustive, the bulletin contains data of practical value obtained through research and experience over a period of years.
HOME FREEZING OF FOODS

By

G. A. SHUEY

INTRODUCTION

An ample supply of wholesome and nutritious food is a matter of first concern to every home. Many foods, both raw and cooked, can be preserved for future use by freezing if correct procedures are followed. Frozen products of high nutritive value, pleasing appearance, and good taste should be the ultimate aim of the home and commercial processor. Every step, from harvest to container, as well as storage conditions, will have some effect on the frozen material. Fruits, vegetables, and meats should be of good quality to begin with. It is impossible to convert material of poor quality into a high-grade product, however much care is taken in the processing operations. Our experiments have shown that the quality of frozen fruits and vegetables is influenced by a number of factors, the most important of which are (1) variety; (2) stage of maturity, or ripeness; (3) promptness and care in processing; (4) use of moisture-proof packaging materials; (5) rapid freezing, and storage of the product in a constant temperature, at or near zero; and (6) method of cooking.

The practice of preserving foods by freezing, both commercially and in the home, is growing rapidly. Frozen foods of good quality, raw and cooked, are in considerable demand in the metropolitan areas. Freezer and storage cabinets of many designs and sizes are available for home use and for the display of such merchandise. It is generally agreed that the quality—flavor, nutritive value, and appearance—of frozen foods will ultimately determine the success or failure of freezing as a method of preserving foods.

VARIETY IS IMPORTANT

It cannot be assumed that all varieties of any kind of fruit or vegetable will make products of the same quality under the same conditions of preparation, freezing, and storage; hence, choice of variety is important. While a particular variety of strawberry, for example, may have a high nutritive value with respect to vitamin-C content, it may lack color or flavor, or may become very soft upon
thawing, and therefore, would not be satisfactory as a frozen product. Celery, cucumbers, green onions, lettuce, parsley, radishes, grapes, pears, cantaloup and watermelon—whole, halved, or quartered—have not proved satisfactory as frozen products. Full-ripe, good-flavored cantaloup and watermelon may be cut into balls or cubes of from 1- to 1 1/2-inch size and frozen; but in texture and flavor after thawing they are inferior to the fresh product. Varieties of many Tennessee-grown fruits and vegetables that have been found by experiment to be suitable for home use as fresh, canned, and frozen products have been listed in Circular No. 84 of this Station. Other varieties of vegetables undoubtedly are grown in many home gardens and will make good frozen products. If you have a variety preference, do not hesitate to try it.

**Maturity and Quality**

Fruits and vegetables should be harvested and processed when they have reached the proper stage of maturity. Fruits should be just ripe enough for good eating. Unripe fruits lack flavor and have not fully developed their characteristic colors. Overripe fruits, whole or cut, do not retain their crispness or shape upon thawing and are less attractive. This is especially true of berries. Then, too, overripe fruits, particularly blackberries, are easily damaged in handling, and hence are more likely to become infested with eggs and larvae of the fruit gnat. Overripe, soft blackberries and dewberries, and to some extent soft peaches, develop an off-flavor after freezing that may be described as slightly bitter or earthy. The characteristic fruity flavor is due to the presence in the fruit of small amounts of acids, aldehydes, esters, ether-like substances or a mixture of them. The water content of fruits is high, averaging about 86 percent of the edible portion, and serves to dissolve the sugars, acids, and esters, which, together with the water, impart juiciness, texture, and flavor to properly ripened fruit.

As the fruit is formed on the bush, vine, or tree, some flavorless starch-like compounds are present, and the acid content usually is high. As the fruit approaches maturity, the starch is changed into sugars, and there is a decrease in the amount of acid, all of which improves the flavor. The nature and amount of acids in unripe fruits, especially apples, is often the cause of stomach irritations when such fruits are eaten too freely. On the other hand, fruits that are overripe to the point of extreme softness if eaten freely may set up abnormal fermentation. From the standpoint
of wholesomeness and best flavor, berries, peaches, plums, summer apples, and cherries should be harvested when fully ripe but still firm.

Generally the common fruits, such as apples, blackberries, cherries, currants, gooseberries, grapes, peaches, pears, plums, red raspberries, and strawberries, contain ascorbic acid (vitamin C) in variable quantities, ranging from 50 milligrams of vitamin C per 100 grams (3.5 ounces) in strawberries to as low as 3 milligrams in the edible portion of pears. The citrus fruits are excellent sources of vitamin C.

If ripened fruit, particularly berries and peaches, are allowed to remain in a warm place, there is gradual impairment of their vitamin-C content. Moderate to warm temperatures are favorable for the activity of enzymes. This is notably true of the oxidases—in particular the ascorbic oxidase—which destroys vitamin C as well as other nutritive constituents of fruits that collectively give them the factors of quality that are essential to the growth and health of the human body. Chemical changes that impair quality can be retarded somewhat by the storing of fruit in the kitchen refrigerator, or in contact with finely cracked ice. This also delays attack by organisms of decay.

Vegetables should be of deep color and possess good flavor. If immature, like unripe fruit, they lack full flavor; if overmature, they are often tough and fibrous. While there are commonly accepted stages of maturity at which vegetables should be harvested for freezing-preservation, some people prefer the flavor of green pole beans, for example, when they are slightly overmature, with seeds well formed in the pod. The stage of maturity at which green pole beans should be harvested and processed is best decided, therefore, by the people who grow them and consume the frozen product. Such vegetables as asparagus, broccoli, green lima beans, green snap beans, green peas, green edible soybeans, rhubarb, spinach, okra, sweet corn, sweet pepper, and vegetable greens should be harvested at the best stage of maturity for eating, and prepared and frozen without delay. Both fruits and vegetables are living materials for a time after being harvested, and to a certain extent are capable of carrying on respiratory changes, in which they consume oxygen, evolve heat, and expire carbon dioxide gas. The heat liberated during respiratory activity accounts for the higher temperature often occurring in the center of hampers and other containers of beans and leafy vegetables. Changes of this nature are rapid in such vege-
tables when freshly harvested, and in certain fruits, such as peaches, cherries, and berries of all kinds. Changes occur also in beets, carrots, turnips, pumpkin, squash, sweetpotato, rutabaga, apples, and pears; but the changes are at a slower rate, and these products, therefore, may be held in cool storage for a longer period of time.

**PROMPT HANDLING**

Perishable fruits and vegetables should be washed, sorted, and processed promptly after harvesting, to preserve their quality. Even though they are selected and harvested with care, sorting is necessary to eliminate immature, overmature, and defective specimens. Grading according to size adds to the attractiveness of a pack. Washing must be done to remove soil particles, spray residues, and insects. Crops that grow close to the ground and are not protected by pod or peel, such as asparagus, green snap beans, greens of various kinds, and strawberries, should be especially well cleaned because they are more apt to be contaminated with the undesirable organisms that grow abundantly in the soil. Reasonable care, of course, must be exercised in handling delicate fruits, as raspberries, blackberries, and strawberries, since they soften easily, and lose flavor and color if allowed to remain in contact with water for too long a time. Overripe, very soft fruits should be processed separately from the firm-ripe. Fruits such as peaches and berries that are soft but otherwise in good condition may be pulped and sweetened before freezing, and later used for flavoring ice cream, or made into preserves, jams, or jellies.

Some of the good qualities possessed by choice varieties of properly ripened, freshly harvested, green-colored vegetables, sweet corn, and the more perishable kinds of fruit, such as berries, cherries, and peaches, are lost if the products are allowed to remain too long in ordinary room temperature. Respiratory activity, which is destructive of quality, can be slowed down somewhat if the material is kept cool, as previously indicated. This should be done if there is delay in preparing and freezing the materials after they are harvested. It must be remembered that the sooner fresh materials are prepared and frozen the better will be their quality. Generally, it is best to prepare and freeze perishable kinds of fruits and vegetables the day they are harvested. The ever-present myriad of micro-organisms, and the fruit gnats often present where berries and other fruits are being handled, are less likely to thrive if the fruits and vegetables are handled properly and promptly. In
the purchase of fruits and vegetables for home freezing, care should be taken to select those that are as fresh as possible and otherwise suitable.

**SCALDING (BLANCHING) AND CHILLING**

In freezing-preservation, if the correct procedure is carried out, the thawed, cooked product will resemble closely, in color, flavor, and nutritive value, that prepared from the fresh material. When unharvested vegetables are caught in the garden by an early frost, they discolor and develop unpleasant flavors, and generally are inedible. If vegetables are harvested and frozen without first being heated in boiling water or steam, the results will be similar to those experienced with vegetables frosted in the garden. The principal cause of this objectionable change in frozen vegetables that are not previously heated, is the activity of enzymes naturally occurring in the vegetable tissues. Heating of vegetables and some fruits in boiling water or steam prior to freezing arrests enzyme activity and helps the product retain, to a considerable extent, its fresh characteristics. (The terms “steaming,” “scalding,” and “blanching” are synonymous as applied to the treatment of foods for freezing.)

Scalding vegetables in boiling water may be the most convenient method for the average home. A kettle should be used that is large enough to hold 1 gallon of water for each pound to be scalded at one time. The product then is placed in a wire basket, cloth sack, or other suitable container, and submerged in the boiling water for the number of minutes prescribed for the particular vegetable. (See directions, beginning on page 18). The scalding period is recorded from the time the product is submerged in the boiling water. The water should be kept as near boiling as possible. While in contact with the boiling water, the product should be moved up and down at least 3 times to insure uniform heating of all pieces. Not more than 2 pounds of vegetables, such as snap beans, lima beans, corn on the cob, vegetable soybeans, carrots, and broccoli, should be scalded at one time. Leafy vegetables, such as turnip greens, should be scalded in quantities of not more than 1 pound at a time, in 2 gallons of boiling water. The number of minutes that the product is kept in the scalding water is of vital importance. If underscalded, it will not keep well; nor will the flavor and color be well preserved. At the end of the scalding period the vegetables are submerged for about the same length of time in cold water. If cold running water is not available, ice may be added to give quicker
chilling. Vegetables that are quickly and thoroughly chilled will retain their color, flavor, and nutritive value better in the frozen condition. Chilled vegetables are removed from the water, allowed to drain for several minutes, placed in moistureproof packages, and frozen without delay. Rapid handling of all green-colored vegetables from water-chilling to freezer is essential if best quality is to be retained after several months in the frozen condition.

PACKAGING AND FREEZING

Of the several factors that affect quality in frozen-stored foods, there is none of greater importance than the use of packaging materials that will protect the product against moisture losses in low-temperature storage. Since the relative humidity is low in storage cabinets that are held at near zero, there will be a loss of frozen water from the food product as vapor if steps are not taken to prevent it. The loss of moisture vapor from foods in the frozen state is often the cause of "freezer burn" of poultry, and tends to toughen vegetables. Frequent temperature changes within the freezer storage cabinet are accompanied by pressure changes within the packaged product, resulting in loss of moisture and its deposition as ice crystals on the surface of the product and on the inside of the wrapping material. The use of poor-quality packaging materials, or frequent temperature fluctuations, will result in desiccation (drying out) of the frozen product. Wrapping or packaging material must be used which moisture-vapor will not permeate. Our experiments with many kinds of vegetables have shown that when moisture is lost from the product in low-temperature storage there is a decided impairment of quality.

Prepared fruits and vegetables must be packed in containers that will protect them from loss of water. The containers must not impart foreign odors or flavors to the product or permit the absorption of odors from outside sources. Such packaging materials, therefore, must be moisture-vaporproof in zero-degree storage, and be made of inert materials of good quality and strength. Good protection to the frozen products, afforded by the better grades of wrapping and packaging materials, is necessary for the retention of quality and wholesomeness.

Enamel-lined tin cans for fruit and plain cans for vegetables, with friction tops, or with double-seam closures, may be used. Glass jars with rubber rings or other seals are satisfactory containers.
A glass jar designed especially for frozen foods is available. The jar is slightly tapered, without shoulder, and equipped with a one-piece, re-usable metal cap. Both cans and glass jars occupy more storage space than rectangular cartons, and the jars are easily broken.

There is a variety of wax-treated pasteboard cartons available for packing fruits and vegetables. They may be cylindrical, tub-shaped, square, or rectangular. All of these shapes are satisfactory from the standpoint of protection to the product, for a reasonable period of time, but the most economical use of space in storage is obtained with the square or rectangular cartons. Wax-coated pasteboard cartons with moisture-vaporproof cellophane or pliofilm linings, or bags, which are sealed with heat, are satisfactory for fruits, vegetables, and numerous meat, fowl, and fish products. Wet-strength paper bags with cellophane or pliofilm liners give excellent protection. Plain cellophane bags that can be heat-sealed are satisfactory if overwrapped with paper to give added protection against puncture. Aluminum foil for wrapping, and aluminum foil-type containers (packages) are available and provide excellent protection to meats and other products.

As foods freeze they expand. The expansion is in proportion to the amount of water they contain. In filling containers, a head space of \( \frac{1}{2} \) inch should be allowed for flat-type pints, \( \frac{3}{4} \) inch for tall pints, and \( 1\frac{1}{4} \) inches for quarts. This applies to all kinds of rigid, sealed containers, such as glass and tin, and permits expansion of the product on freezing without damage to the container. To eliminate air from the unfilled portion of pliable containers, such as cellophane, pliofilm, and other bags, the sides should be snugly pressed together from the contents upward, and then heat-sealed. Electric curling iron, flat iron, and other specially made instruments may be used for heat-sealing.

When filled and sealed, the packages should be placed in the freezer at about zero-degree Fahrenheit or lower until completely frozen, then transferred to the storage compartment, which should be held at zero. Prior to freezing, the packages should be labeled and dated so that the product can be readily identified. Do not pack more than the freezer will accommodate at one time. Packages in contact with the walls of the freezer will freeze before those in the interior; hence, it is advisable to shift the packages during freezing.
WRAPPING OF MEATS AND POULTRY

The most common causes for the development of undesirable flavors in frozen flesh foods—meats, poultry, and fish—are the oxidation of fatty tissue (rancidity), and loss of moisture from the product. Severe moisture loss results in a surface discoloration known as “freezer-burn.”

To protect meats and poultry against the entrance of atmospheric oxygen, and loss of moisture in 0° F. storage, wrapping materials must be of good quality and be properly applied. The wrap should be brought snugly into contact with the entire surface of the meat eliminating air pockets. There is always some movement of moisture-vapor from the interior to the surface of the meat. If the wrapper is impervious to moisture-vapor, and is tightly applied, moisture will be retained by the meat and dehydration will be prevented.

There are two commonly used methods (styles) of wrapping meats—the butcher’s wrap, and the druggist’s, or confectioner’s, wrap. Our experiments indicate that the druggist’s is better because it makes a tighter seal and requires less material. To make this wrap, first place the meat, or other product, in the center of the wrapping sheet. Bring the long sides of the sheet together over the product and fold together about one inch of the edges. Repeat the fold as necessary to bring the sheet tight and flat on the top of the product. Turn the package over, fold the corners toward each other, fold upward and over tight, and secure with tape or twine. Aluminum foil does not require binding.

To make the butcher’s wrap, place the product close to one corner of the sheet, fold sides over, and roll as necessary to reach the opposite corner. Secure with tape or twine.

Wrapping materials of 18-inch width will meet most home-wrapping needs. Extra-large chickens and cuts of meats may require papers of 24-inch width. Do not fail to place pieces of wrapping paper, preferably double pieces, between layers of meat prior to wrapping and freezing. It should be emphasized that locker plants often are in position to process, wrap, and freeze meats and poultry at a cost comparable to that of home processing. Do not overlook the locker plant in your community; it will render invaluable service in connection with your family food program.
Wrapping Materials of Proved Quality

During the past four years, we have conducted experiments to determine the protective quality, or resistance to moisture-vapor penetration, of various wrapping materials in zero storage. While undoubtedly there are other good wrapping materials that have not come to our attention, the following have proved satisfactory:

- Aluminum Foil. Laminated to paper base, coated on both sides for heat-sealing, .0015 gauge. Reynolds Metals Company.
- Cellophane MSAT 83 and 87. E. I. duPont de Nemours and Company.
- Freeztex Cartons and heat-sealing bags—bulk packages for locker use, and home-packaging units. Marathon Corporation.
- Safeway Locker Wrap, 4-ply laminated. Safeway Products Division, Yorkville Paper Company.
- Reynolon .002" gauge (Polyethylene). Reynolds Metals Company.
- Polythene 1.5 and 2.0 ml. sheet. E. I. duPont de Nemours and Company.
- Cry-O-Rap bags of about 12 different sizes. Excellent for packaging meats, poultry, and other materials. Dewey and Almy Chemical Company. For home use, a small water spigot airejector may be employed to remove the air and thus obtain a skintight wrap.
- Stockinette material, for overwrapping, Bemis Bros. Bag Company.

Wrapping and packaging materials of proved quality for home use may be purchased at department stores and locker plants.
Fig. 1—Wrapping materials and containers for frozen foods: 1, aluminum foil; 2, Freeztext Locker Wrap, cellophane-kraft laminated; 3, Duplex Loksure, laminated, and wax impregnated; 4, Pliofilm; 5, Mead Locker Wrap, laminated; 6, Safeway Locker Wrap, laminated; 7, Tite Locker Wrap, glassine-kraft laminated; 8, 14, waxed cups; 9, Trapak, aluminum; 10, Freez-Tainer, plastic; 11, Freezer Jar, glass, with re-usable screw tops; 12, ordinary glass jars; 13, tin can, enamel-lined; 15, side-opening cardboard carton for vegetables, showing open, closed, and overwrapped carton; 16, end-opening, cardboard cartons of three sizes—pint, quart, and two quart—in which heat-sealing bags are used; 17, Vapo-can, with friction lid. A square, tapered, Vapo-can with full-top opening and re-usable plastic lid is available; 18, end-opening, rectangular, cardboard carton with inserted heat-sealing bag, supporting a plastic filling funnel; 19, 20, Cry-O-Rap bags of different sizes, suitable for meats and poultry; 21, polyethylene bags and tubing. Polyethylene-coated locker paper is well suited for wrapping meats and other frozen foods; 22, cellophane bags. Cellophane sheet is an excellent wrapping material for frozen foods; 23, scotch tape and dispenser.
QUANTITY AND STORAGE CAPACITY

It is estimated that the yearly per-capita consumption of foods of all kinds in America is about 1800 to 1900 pounds. Fruits, vegetables, fresh meats, and poultry, suited to freezing-preservation, together with dairy and cereal products, many of which can be frozen, constitute the major part of the diet. If ample storage space were available it would not be difficult to plan the food program so that one-half of all food consumed could come from the freezer.

The total amount of the various foods to be frozen, plus those purchased in the frozen condition, will be limited by (1) zero storage space available in the home unit and the rented frozen-food locker, and (2) the rate of turnover—consumption and replacement. All frozen foods are best if eaten within reasonable periods of time (see table 1), thus permitting replacement with freshly frozen products. By processing on a seasonal basis to provide a variety of frozen items, and by using these properly, it is possible to handle in a zero storage space of 7 cubic feet (capacity 200 to 225 pounds), during a period of 12 months, between 700 and 800 pounds of frozen foods.

It is generally stated that approximately 35 pounds of packaged, assorted items of frozen food, if carefully arranged, can be stored in 1 cubic foot of space. In actual practice, however, the amount per cubic foot in the average home freezer will not exceed 30 to 32 pounds. Foods are not always compactly arranged in the storage compartment. Moreover, an air space of about 1 inch should be allowed between the top of stored packages and the cabinet lid. To obtain the approximate capacity, in pounds, of your zero storage compartment, multiply its area in cubic feet by 32. The standard-size frozen-food locker—width, 24 inches; height, 16 inches; length, 30 inches—has an area of 7 cubic feet and will accommodate 200 to 225 pounds of frozen, packaged foods.

It is emphasized that the frozen-food locker plants are performing an ever-increasing number of services—processing meats, poultry, and their by-products—that many homes, both rural and urban, that have small freezer units are not in position to do. Such units often are used to better advantage when they supplement, and do not attempt to replace, the rented frozen-food locker.
STORAGE OF FROZEN FOODS

Frozen foods of all kinds—fruits, vegetables, meats, poultry, eggs, and fish—retain their quality best if stored in a constant temperature of 0° F. If the temperature of the storage cabinet is allowed to fluctuate widely (0° to 10° above) from time to time, the quality and flavor of the frozen products will be impaired.

The length of time that frozen foods can be held in zero storage without appreciable impairment in quality will depend on (1) care exercised in selecting and preparing the products prior to freezing, (2) protection afforded by wrapping and packaging materials employed, (3) constancy of storage temperature (0° F.), and (4) kind of food. Table 1 shows the approximate time the different kinds of food may be expected to keep well in zero storage if instructions are carefully followed.

Table I—Approximate storage period of frozen food at 0° F.

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<th>Period of time</th>
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<td>Months</td>
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<td>2 to 3</td>
<td>Cooked foods, baked breads, baked cakes, sausage—unseasoned and seasoned—poultry livers.</td>
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<td>3 to 4</td>
<td>Unseasoned ground pork, uncured ham, fatty fish, beef liver, heart.</td>
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<tr>
<td>4 to 6</td>
<td>Fresh pork, ground beef, cut poultry, broilers, pork sausage seasoned with materials containing an antioxidant.</td>
</tr>
<tr>
<td>6 to 8</td>
<td>Lean fish, turkey, poultry (except broilers), veal.</td>
</tr>
<tr>
<td>8 to 12</td>
<td>Beef, lamb, liquid eggs, rabbit, game birds, practically all vegetables.</td>
</tr>
<tr>
<td>12 to 15</td>
<td>All dark-fleshed fruits packed with sugar sirup, and light-fleshed fruits packed with sugar or sirup containing ascorbic acid and/or small levels of sulfur dioxide.</td>
</tr>
</tbody>
</table>

PREPARING VEGETABLES FOR FREEZING

Vegetables for home freezing are best if harvested in the morning; they are cooler and more succulent at that time. As previously explained, vegetables should be prepared, packaged, and frozen without delay.

All vegetables must be thoroughly washed in cool water. With but few exceptions, vegetables for freezing are prepared as for immediate table use. For example, garden peas, field peas, lima beans, and edible soybeans are removed from the pods. Green beans are snipped and strings removed. Broccoli is cut lengthwise into pieces of suitable sizes. Corn must have husk, silk, and tips re-
moved. The products then are scalded (blanched), chilled, packaged and frozen.

**PREPARATION EQUIPMENT**

Most of the equipment needed for preparing fruits and vegetables for freezing is found in the kitchen. While the work is usually done by hand, there are special home-size labor-saving devices that may be used to advantage for peeling and coring apples, pitting cherries, shelling peas, and slicing and cubing. Containers for scalding should be of aluminum, tinware, enamelware, or stainless steel. Uncoated iron vessels should not be used for processing fruits and vegetables.

**DIRECTIONS FOR FREEZING VEGETABLES**

In the previous pages, many of the reasons and procedures for the various steps involved in home-freezing-preservation of foods have been discussed in some detail. On pages 18 to 23, in tabular form, are brief directions for selecting, preparing, and scalding (blanching) the various vegetables. The directions are comparatively simple, but should be strictly observed. After scalding, the products are cooled by submerging in cold water, allowed to drain for a few minutes, placed in packages, sealed, and frozen without delay. While cooling of the scalded material may be accomplished by spreading the product in a thin layer in front of an electric fan, the cold water-immersion method is much better.

**DIRECTIONS FOR FREEZING FRUITS**

Fruits for home freezing should be ripened on tree or vine; they will have better flavor than those picked somewhat green and allowed to ripen. Ripe fruits, if not prepared and frozen very soon after picking, should be held in a cool place. For varieties of fruits grown in Tennessee that are best suited to home and commercial processing, refer to Circular No. 84 of this Station.

Unnecessary handling of ripe fruit, especially berries, should be avoided. Spoiled fruits should be removed, and the remainder washed carefully as for fresh use.

The use of sugar (dry granulated), or sugar sirup (granulated sugar, or corn sirup dissolved in water) as packing media for fruits aids greatly in maintaining the natural characteristics of
## Selection and Preparation of Vegetables for Freezing

<table>
<thead>
<tr>
<th>Fresh vegetables</th>
<th>Selecting for quality</th>
<th>Preparation</th>
<th>Scalding time in boiling water, and other treatment</th>
</tr>
</thead>
</table>
| Asparagus        | Fresh, firm stalks, brittle at cut end, tips tightly closed, and bracts clinging closely | Sort into small - to - medium and large stalks. Cut to about 6-inch lengths. After scalding and chilling, pack whole or cut into desired lengths | Small - to - medium stalks 3
|                  |                        |             | Large stalks 4                                       |
|                  |                        |             | Large beans 3                                           |
| Beans: snap - bush and pole (green or yellow-podded) | Meaty, tender, snap easily, deep-green color | Snip, remove strings. After scalding and chilling, pack whole or cut into 1-inch lengths | Small pods 3
|                  |                        |             | Large pods 4                                           |
| Beans: soybean   | Beans well developed in pod, but still green and tender | Submerge in boiling water 5 minutes, chill, and shell | No further scalding necessary                        |
| Beets            | Smooth, clean, firm, deep-red color | Trim, remove tops, wash thoroughly | Small whole beets up to 1½-inch diameter 8
|                  |                        |             | Large beets: Cook until tender (about 28-30 mins.) Remove peel. Slice or cube as desired. |
| Broccoli         | Firm, tender buds with brittle stalks. Avoid broccoli with open flowers, as it is over-mature | To remove insects, place heads down in salt water (4 tablespoons salt in 1 quart water) for 30 minutes. Then wash in fresh water. Cut lengthwise into pieces of desired size | Small - to - medium pieces 3½
|                  |                        |             | Large pieces 4½                                          |

Note:—At the end of the scalding period, all vegetables must be chilled in water and allowed to drain for several minutes before packaging.
**Selection and Preparation of Vegetables for Freezing (continued)**

<table>
<thead>
<tr>
<th>Fresh vegetable</th>
<th>Selecting for quality</th>
<th>Preparation</th>
<th>Scalding time in boiling water, and other treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brussels sprouts</td>
<td>Firm, medium size, with uniform green color. Avoid sprouts with yellow leaves</td>
<td>Trim, and soak in salt water (4 tablespoons salt in 1 quart water) for 30 minutes. Wash in cold water</td>
<td>Small-to-medium heads 4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Large heads 5</td>
</tr>
<tr>
<td>Cabbage</td>
<td>Firm, heavy heads</td>
<td>Not generally preserved by freezing, except after converting into sauerkraut, which freezes well</td>
<td></td>
</tr>
<tr>
<td>Carrots</td>
<td>Young, tender, medium size. Avoid shriveled, fibrous carrots</td>
<td>Wash, peel, or scrape. Cut into ¼-inch slices, strips, or cubes</td>
<td>All shapes 3</td>
</tr>
<tr>
<td>Cauliflower</td>
<td>Firm, white heads. Avoid heads that are dark in color and have separated segments</td>
<td>Trim, discard leaves, and wash. Cut heads into about 1-inch pieces. Soak in salt water (4 tablespoons salt to 1 quart water) for 15 minutes. Then rinse in cold water</td>
<td>Medium to small pieces 3½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Large pieces 4½</td>
</tr>
<tr>
<td>Corn: sweet—on cob</td>
<td>Milk stage. Choose corn that responds easily to pressure of finger and has good milk content. Avoid corn that is overmature</td>
<td>Husk, trim ends, remove silk. Sort ears according to size—small to medium, and large. Larger ears may be cut into 3-inch lengths and holes bored lengthwise through cob, using ½-inch auger bit. This facilitates scalding of cob interior</td>
<td>Small to medium-sized ears 7½</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Large ears 10</td>
</tr>
</tbody>
</table>
### Selection and Preparation of Vegetables for Freezing (continued)

<table>
<thead>
<tr>
<th>Fresh vegetable</th>
<th>Selecting for quality</th>
<th>Preparation</th>
<th>Scalding time in boiling water, and other treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Corn: sweet—cut from cob</td>
<td>Milk stage, as described above</td>
<td>Whole kernel: Prepare as for corn on cob. Scald 4 1/2 minutes and cool. Cut kernels close to cob, place in cold water, skim floating material from surface of water, drain and pack. Cream style: Cut through kernel at about 1/2 depth from cob, gently scrape remaining parts of kernels from cob. Mix well and package.</td>
<td>No further scalding necessary</td>
</tr>
<tr>
<td>Eggplant</td>
<td>Firm, heavy fruit, of uniform dark-purple color. Harvest while seeds are tender</td>
<td>Peel, cut into 1/2-inch slices. To prevent discoloration prior to blanching, place slices in a solution of common salt, made by dissolving 4 tablespoons of salt in 1 gallon of water.</td>
<td>Dissolve 1/4 teaspoon of pure sodium bisulfite (procurable at drugstores) in 1 gallon of water. Heat to boiling, submerge in the boiling water about 1 pound of slices and hold for 4 minutes. Remove, and chill in iced water. Drain, place pieces of waxed paper between slices, pack and freeze.</td>
</tr>
<tr>
<td>Kohlrabi</td>
<td>Young and tender</td>
<td>Cut off tops, wash in cold water; peel, cut into 1/2-inch cubes</td>
<td>Cubes 3</td>
</tr>
<tr>
<td>Mushrooms</td>
<td>Small to medium, firm, tender. Avoid slimy plants</td>
<td>Wash, cut off lower part of stem. Cut large mushrooms into pieces of desired size. The addition of ascorbic acid to the scalding water (1 1/2 teaspoons per gallon) will serve to prevent darkening.</td>
<td>Small, whole 4 Pieces 3</td>
</tr>
<tr>
<td>Fresh vegetable</td>
<td>Selecting for quality</td>
<td>Preparation</td>
<td>Scalding time in boiling water, and other treatment</td>
</tr>
<tr>
<td>-----------------</td>
<td>------------------------</td>
<td>-------------</td>
<td>--------------------------------------------------</td>
</tr>
</tbody>
</table>
| Okra            | Young, tender, green pods | Wash, scald whole pods for the time indicated. Freeze whole pods, or cut into 1-inch pieces, if desired | Small to medium-sized pods 3 Minutes  
Large pods 4 Minutes |
| Parsnips        | Smooth, firm roots. Avoid fibrous roots | Remove tops, wash, and peel. Cut into slices, cubes or lengthwise | All 4 Minutes |
| Peas: field     | Peas fully developed in pod, but still tender | Shell, and remove overmature peas; If hard to shell, submerge whole pods in boiling water 2 minutes, and shell | Peas from unscalded pods 2 Minutes  
Peas from scalded pods 1 1/2 Minutes |
| Peas: green     | Well-filled, green pods. Avoid pods that do not snap easily—they are too mature | Shell, remove overmature peas | Small peas 1 Minute  
Large peas 1 1/2 Minutes |
| Peppers: green and pimiento | Deep-green or red color, glassy skin, thick flesh, tender | Scald whole in boiling water for 12 minutes. Remove peel and seeds. Freeze whole, or cut into halves, quarters, or slices as desired. Or scald whole in boiling water for 2 1/2 minutes. Remove seeds. Freeze whole, or cut as desired. | No further scalding necessary |
| Pumpkin: varieties suitable for pie | Optimum maturity, as indicated by deep-yellow color and tender texture | Wash, cut into slices 1-inch thick, peel, trim away inner fibrous part, cut into pieces not larger than 1 inch. Add 1 cup water to 5 pounds pumpkin, and cook until soft—3/4 to 1 hours in ordinary covered kettle. While still hot, press through colander or Foley food mill. To each 3 cups of pulped pumpkin add 1 cup sugar, mix thoroughly, chill, pack, and freeze | Note:—One pie will require 1 1/2 cups sweetened pulped pumpkin, plus other ingredients — milk, eggs, and spices. No additional sugar necessary |
### Selection and Preparation of Vegetables for Freezing (continued)

<table>
<thead>
<tr>
<th>Fresh vegetable</th>
<th>Selecting for quality</th>
<th>Preparation</th>
<th>Scalding time in boiling water, and other treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rhubarb</td>
<td>Deep-red skin, crisp, tender stalks. Early-spring varieties are best</td>
<td>Use only good stalks, trim ends, wash, and cut into 1-inch lengths. For pie, pack without sugar or sirup. For sauce, pack neatly in container and cover with 60-percent sugar sirup (see preparation of sirups)</td>
<td>No scalding necessary</td>
</tr>
<tr>
<td>Rutabagas</td>
<td>Tender, young roots: Long Island Improved and American Purple Top are good varieties</td>
<td>Trim, wash, peel, and cut into slices, or cubes of about ¼-inch size</td>
<td>All 4</td>
</tr>
<tr>
<td>Squash: summer</td>
<td>Tender stage of maturity, seeds small</td>
<td>Cut into half lengthwise as for baking, remove seeds</td>
<td>Small to medium pieces 4½, Large pieces 5½</td>
</tr>
<tr>
<td>baking types</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Squash: winter</td>
<td>Fully mature, hard shell, dry type of flesh</td>
<td>Cut open, remove seed. Cut into pieces and bake in oven at 350° F., or steam in pressure cooker until tender. Remove pulp from rind, and pass through a pulper. Cool, pack, and freeze</td>
<td>No further heating necessary</td>
</tr>
<tr>
<td>Spinach</td>
<td>Deep-green color, young, tender leaves</td>
<td>Cut off all large, fibrous stems. Discard overmature leaves. Wash in cold water</td>
<td>Small tender leaves 1½, Larger leaves 2½</td>
</tr>
<tr>
<td>Tomatoes: puree</td>
<td>Well-ripened, deep-red varieties are best</td>
<td>Wash, blanch in boiling water ¾ to 1 minute, and chill in cold water. Peel, cut out blossom end, and cores if necessary. Add ½ teaspoonful salt per pound (pint) of prepared tomatoes. Heat to near boiling temperature for 10 to 12 minutes, cool, and pack. Or, while still hot, pass the tomatoes through a Foley food mill, cool, and pack.</td>
<td>No further heating necessary</td>
</tr>
</tbody>
</table>
### Selection and Preparation of Vegetables for Freezing (continued)

<table>
<thead>
<tr>
<th>Fresh vegetable</th>
<th>Selecting for quality</th>
<th>Preparation</th>
<th>Scalding time in boiling water, and other treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tomatoes: whole</td>
<td>Firm-ripe, full-colored fruit</td>
<td>Wash, and freeze unwrapped tomatoes as rapidly as possible. Dip frozen tomatoes, one at a time, in cool water, and strip off their peel. Wrap tight in cellophane, and return to zero storage</td>
<td>Note:—Whole, frozen tomatoes are removed from zero storage, allowed to defrost only slightly, and sliced for salad. They are best if eaten while slightly frozen. They become very soft upon complete thawing.</td>
</tr>
<tr>
<td>Turnips</td>
<td>White or yellow flesh, strong flavor. Avoid woodiness</td>
<td>Wash, peel, cut into ½-inch slices, strips, or cubes. For sauce: cook until soft, mash through ricer, or other device, chill, pack, and freeze</td>
<td>Slices and cubes 3½</td>
</tr>
<tr>
<td>Vegetable greens:</td>
<td></td>
<td>Remove coarse, fibrous leaves and stems. Wash, scald about ½ pound at a time in 1 gallon of boiling water, and cool</td>
<td>Kale 2½, Chard 3½, Mustard greens 2½, Turnip greens 3½, Collards 3</td>
</tr>
<tr>
<td>Kale, chard, mustard,</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>turnip, and collards</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sweetpotatoes</td>
<td>Smooth, firm roots. Cured or uncured sweetpotatoes may be used</td>
<td>Wash, cook in water in a covered kettle until soft. Cool, remove skins, and mash to a fine pulp. To each 3 cups (standard measuring cup) of pulp add 2 tablespoons of lemon juice, and mix thoroughly. Package, and freeze</td>
<td>Note:—Frozen sweetpotato puree may be used for making pie and other dishes</td>
</tr>
</tbody>
</table>
fruit during zero storage and defrosting. Plain corn sirup (preferably the high-conversion types) and mixtures of granulated-sugar sirup and corn sirup can be used for packing fruits. Fruits packed in sirup will retain better texture than those packed in dry sugar.

As previously explained, prepared apples and peaches will turn brown if not treated. The discoloration of such fruits may be prevented largely by (1) blanching in boiling water or steam until heated through—usually 1½ to 2½ minutes, depending on size of pieces and condition of fruit; (2) mixing of fruit with sugar sirup containing small amounts of either ascorbic acid (vitamin C) or sodium bisulfite; and (3) dipping apples in a .05-percent solution of sodium bisulfite for 3 minutes, then packing with light sugar sirup (see page 26). Water or steam-blanced peaches are suitable for pie and preserves, but do not possess the fresh flavor that is desired in dessert peaches.

**Preparation of Sugar Sirups**

In tabular form are given the amounts of granulated sugar, corn sirup and water necessary to make 2 quarts each of light, medium, and heavy sirup of two kinds. Light-colored, high-conversion types, of corn sirup such as “Sweetose Crystal Syrup”, are preferred. Sirup No. 1 is composed of granulated-sugar solids and water. Sirup No. 2 is composed of 2/3 granulated-sugar solids, 1/3 corn-sirup solids, and water. No. 1 is slightly sweeter than No. 2 of equal strength. The two sirups, if of equal strength (light, medium, or heavy) contain the same amount of sugar solids and will give equally good protection to fruits. The use of sirup No. 2 (medium or heavy, depending on the kind of fruit) is recommended when a slightly less sweet product is desired. These sirups preserve well the natural characteristics of fruits and give a pleasing degree of sweetness that does not mask natural flavors.

In preparing sirups, the required amounts of the several ingredients are accurately measured into a container and stirred until a clear liquid is obtained. For example, to prepare 2 quarts of No. 2 medium sirup (50-percent sugar solids), place in a kettle of at least 3-quarts capacity, 4 cups and 2 tablespoons of granulated sugar; 1½ cups and 1 tablespoon of corn sirup; and 4-1/3 cups of water. Stir until sugar and corn sirup are dissolved. Heat may be applied to hasten solution of the sugars, but the sirup must cool before being added to fruit. Sirups to which no ascorbic acid is
added, as explained later, may be prepared several days in advance and held in the kitchen refrigerator. Sirups prepared without being heated are usually better, but require more time and stirring to effect solution of sugars.

**Adding Ascorbic Acid and Sodium Bisulfite to Sirups**

Substances that retard the discoloration of apples, avocados, peaches, white sweet cherries, and pears to some extent, are known as anti-browning agents. Ascorbic acid (vitamin C), sodium bisulfite, a combination of ascorbic acid and sodium bisulfite, with citric acid (the acid of lemons) as a stabilizer, are the anti-browning agents, of proved effectiveness and purity, commonly used to retard discoloration of certain fruits during zero storage and for a short time after defrosting. The successful application of ascorbic acid or sodium bisulfite requires that it be brought into close contact with the cut surface of the fruit. It is therefore incorporated in the sirup that is to be used with light-colored fruits, such as peaches.

Either of the heavy sirups (60% sugar solids) described in the formulas for sirups may be used for peaches. However, the anti-browning agent—ascorbic acid or sodium bisulfite—must be added. This is done as follows:

**Ascorbic Acid.**—Refer to formula on page 26 for quantities of ingredients to make 2 quarts of sirup. Measure sugar, or sugar and corn sirup, into kettle. Measure water into a separate container. Add to the water 1 teaspoon (well filled) of ascorbic acid, and $\frac{2}{3}$ tablespoons of fresh lemon juice, and stir until dissolved. Then add the whole to the sugar and stir until sirup is clear. Do not heat sirups containing ascorbic acid, or stir too rapidly, since heat and air tend to destroy the effectiveness of ascorbic acid. This sirup should be used the day it is prepared.

**Sodium Bisulfite.**—This is a pure, harmless, very effective, and inexpensive browning inhibitor. If it is to be used instead of ascorbic acid, proceed as directed for ascorbic acid: Measure sugar ingredients into a kettle. Measure water into a separate container. Add to the water $\frac{1}{8}$ teaspoon (a standard $\frac{1}{4}$ teaspoon measure not more than one-half full) of pure sodium bisulfite, then add to the sugar and stir until sirup is clear. Finally, add $2\frac{1}{2}$ tablespoons fresh lemon juice and mix well. The sirup should not be heated, but it may be stirred rapidly.
### Formulas for the Preparation of Sirup

**Sirup No. 1—Granulated-sugar sirup**

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Strength of sirup</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light (40% sugar solids)</td>
</tr>
<tr>
<td></td>
<td>Cups(^1) and Tablespoons(^2)</td>
</tr>
<tr>
<td>Granulated sugar</td>
<td>4(\frac{1}{2})  3</td>
</tr>
<tr>
<td>Water</td>
<td>5(\frac{1}{2})  0</td>
</tr>
<tr>
<td>Volume of sirup</td>
<td>2 quarts</td>
</tr>
<tr>
<td>Weight of sirup</td>
<td>4 lbs. and 14(\frac{3}{4}) ozs.</td>
</tr>
</tbody>
</table>

To make 1 gallon of sirup, double the quantities.
\(^1\)Standard measuring cup.
\(^2\)Standard measuring spoon.

### Sirup No. 2—Blend of granulated sugar and high-conversion corn sirup

(2/3 granulated-sugar solids, and 1/3 corn-sugar solids)

<table>
<thead>
<tr>
<th>Ingredients</th>
<th>Strength of sirup</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Light (40% sugar solids)</td>
</tr>
<tr>
<td></td>
<td>Cups(^1) and Tablespoons(^2)</td>
</tr>
<tr>
<td>Granulated sugar</td>
<td>3  2</td>
</tr>
<tr>
<td>Corn sirup (high conversion type)</td>
<td>1(\frac{1}{4})  0</td>
</tr>
<tr>
<td>Water</td>
<td>5   0</td>
</tr>
<tr>
<td>Volume of sirup</td>
<td>2 quarts</td>
</tr>
<tr>
<td>Weight of sirup</td>
<td>4 lbs. and 14(\frac{3}{4}) ozs.</td>
</tr>
</tbody>
</table>

To make 1 gallon of sirup, double the quantities.
\(^1\)Standard measuring cup.
\(^2\)Standard measuring spoon.
Caution.—Be sure that you buy and use pure SODIUM BISULFITE. Do not make the mistake of using chemical salts with names similar to sodium bisulfite, such as sodium bisulfate, sodium sulfate, sodium sulfite, and sodium sulfide—they will not do.

Sodium Bisulfite-Ascorbic Acid Combination.—Our experiments have shown that ascorbic acid and sodium bisulfite may be combined in heavy sirup for packing peaches, with excellent results. To add these substances, proceed as follows: Measure sugar ingredients, preferably those shown in formula No. 2, heavy sirup (60% sugar solids), into a kettle. Measure water into a separate container. Add to the water \( \frac{1}{2} \) teaspoon of ascorbic acid; also slightly less than \( \frac{1}{8} \) teaspoon of sodium bisulfite, and stir gently until dissolved. Add 2\( \frac{1}{2} \) tablespoons of lemon juice, and mix. Finally, add to sugar in kettle, and stir gently until sirup becomes clear. This provides an excellent sirup for protecting the color and other natural characteristics of peaches.

Lemon juice is added to sirups used for packing peaches, (1) to enhance the stability of anti-browning substances, and (2) to protect quality because of its anti-browning properties.

Several commercial preparations of ascorbic acid are being sold for use in freezing-preservation of fruits. These preparations usually are mixtures of ascorbic acid, citric acid, and a sugar. Some are mixtures of ascorbic acid and dextrose sugar, without added citric acid. The manufacturer's directions should be carefully followed.

It is suggested that the homemaker prepare and use heavy sirups (60% sugar solids) of the two kinds described in formulas for sirups on page 26, for packing peaches; also the two anti-browning agents, ascorbic acid and sodium bisulfite, in separate sirups of the same kind. By so doing, she can compare the quality of frozen peaches obtained by the different treatments, and arrive at her own conclusion as to which sirup and anti-browning agent are to be preferred.

It should be explained further that 2 quarts of sirup, prepared as described, will pack about 13 pounds of average-sized peach slices, in the ratio of 3 parts (cups) of neatly arranged slices to 1 part (cup) of sirup. This quantity of peach slices (13 pounds), with sirup added, will make a total pack of 18 pounds. One bushel of firm-ripe peaches will yield about 34 pounds of prepared peach slices, and will require about 5\( \frac{1}{2} \) quarts of heavy sirup—3 times the amount of sugar, corn sirup, water, and anti-browning substances required for the 2-quart batches above described.
Use of Dry Sugars in Packing Fruit

While dry granulated sugar or refined granular dextrose sugar may be used for packing cut strawberries, and certain other berry fruits, neither is as satisfactory for home use as sirups. When a dry sugar is used, the fruit and sugar must be mixed together until each piece of fruit is coated with sugar. With some fruits, such as peaches, mixing must be continued until the sugar is completely dissolved, resulting in withdrawal of considerable juice and shrinkage of the fruit. Fruits packed in sirup retain their normal characteristics better than those packed in dry sugar. Then, too, the adding of small amounts of anti-browning substance (ascorbic acid or sodium bisulfite) to dry sugar in a way that will insure their intimate contact with the entire fruit surface is difficult and of uncertain value.

PREPARATION OF FRUITS FOR FREEZING

Apples

Varieties.—Golden Delicious, Grimes, Stayman, Winesap, Jonathan, and other tart varieties. Summer varieties, such as Lodi, Williams, and Summer Champion, freeze well. As apples ripen, there are varietal differences in acid content; some are bland, having low natural acidity, and others are tart, having higher acidity. Apples of high acidity are best suited to freezing preservation, and make the best pie and sauce.

Selection for quality.—Apples should be ripe but not soft or mealy, since freezing tends to soften the texture. Badly bruised or partly rotted apples should be discarded. Apples that have been in cold storage for long periods of time—4 to 6 months—may not be satisfactory from the standpoint of texture and flavor.

Preparation.—Peel apples, trim out bruised spots, core, and cut into pie slices—eighths, twelfths, or 1/4-inch-square elongated slices. A small hand-operated “french-fry” cutter may be used for making the elongated slices. To prevent discoloration while handling, the slices should be held in a dilute solution of common salt, made by dissolving 4 tablespoons of salt in 1 gallon of water. The slices are then removed from the salt solution, placed in a wire basket or cloth, and submerged in a dilute solution of SODIUM BISULFITE for 3 minutes, drained, and allowed to stand for about 2 hours. The
slices are then neatly arranged in containers—glass jars, waxed cups, or cellophane bags—sealed, and frozen. Before sealing, the slices may be just barely covered with light (40-percent) sirup, either No. 1 or No. 2 (see page 26). The sodium bisulfite solution is prepared by dissolving 1 1/4 teaspoons of the salt (U.S.P. grade or better) in 1 gallon of water in a crock or a stainless steel or enameled container. The same solution may be used to treat about 10 pounds of slices, or the equivalent of about 1/3 bushel of apples; it must then be replaced with freshly prepared solution.

Instead of dipping in a solution of sodium bisulfite, the slices may be submerged in boiling water, or steam, for 1 to 2 1/2 minutes, depending on size of slices and their texture. Summer apples require only 1 minute. The slices are then cooled and packed, with or without light sirup. Scalded apple slices have a “cooked” taste that is disliked by some people. The packing of apple slices in dry sugar is not recommended.

Apricots
Use well-ripened fruit of uniform yellow color. Follow directions given on page — for freezing peaches. Unpeeled frozen apricots are not satisfactory for dessert use, but serve well for pie.

Avocados
Varieties.—Use any that are available.

Selection for quality.—Rind should be of bright-green color and free from blemishes. Fruit should be just soft-ripe, not hard or mushy-soft.

Preparation.—Cut fruit in half, remove pit, remove rind, and cut into slices of desired thickness. Place the slices, as they are cut, in a solution of ascorbic acid made by dissolving 1/4 teaspoon of ascorbic acid and 1 tablespoon of lemon juice in 1 quart of water. The slices may be cut into smaller pieces if desired. The prepared fruit is then placed in suitable containers—cellophane bags, glass jars, or waxed cups—and just covered with a very light sugar sirup. The sirup is prepared by dissolving 1 cup of sugar in 1 quart of water, and adding 1 teaspoon of ascorbic acid and 2 tablespoons of lemon juice. After sealing, the product should be frozen promptly.
Blackberries; Dewberries—including Loganberries, Youngberries, and Boysenberries; Raspberries, Black and Red Varieties

Varieties.—All may be frozen.

Selection for quality.—Use fully ripe, firm berries. Discard immature and defective berries. In dewberries, purple color and distinctive flavor are desired; loganberries should be of deep-red color and tart flavor. In blackberries, a fleshy, tender texture and rich flavor are desired.

Preparation.—Wash in cold water and allow to drain thoroughly. Berries may be frozen whole, crushed, or pureed (finely pulped). For dessert purposes, the whole berries are neatly placed in the container—can, glass jar, waxed cup, or cellophane bag—and just covered with medium sirup (50% sugar solids) either No. 1 or No. 2. For general purposes, such as pie, ice cream flavoring, and jam making, the berries may be mixed with granulated sugar in the proportions of 5 cups of berries to 1 cup of granulated sugar. The berries must be well coated with the sugar before being placed in the container. Berries may also be packed and frozen without the addition of sugar or sirup, but they will be somewhat inferior in quality to those packed in sirup.

Blueberries (Huckleberries)

Varieties.—Available varieties, wild or cultivated. Tender-skin varieties preferred.

Selection for Quality.—Blueberries ripen slowly and are not difficult to handle. They may be held for several days in the kitchen refrigerator, but should be protected from drying out. Sort to remove immature and extremely soft berries, leaves, and stems.

Preparation.—Wash and dip into boiling water for 1/2 minute, then into cool water for about 2 minutes, and allow to drain. Place in container and just cover with light sirup (40% sugar solids). The berries may also be packed and frozen without the addition of sirup, but they will be somewhat inferior in quality to those packed in sirup. Large-fruited cultivated berries usually have tender skins and need no scalding.

Cantaloup

Varieties.—Hale’s Best, Hearts of Gold, Rocky Ford, and other firm-fleshed varieties.
Selection for Quality.—Choose firm, ripe, preferably fine-textured cantaloupe. Immature cantaloupe should not be frozen.

Preparation.—Wash, cut into halves, and remove seeds. Cut flesh into balls or cubes of from 1- to 1½-inch sizes. Pack into containers, just cover with light No. 2 sirup (40% sugar solids), and freeze. Cantaloup pieces are best for salads if used while still partially frozen. In texture and flavor, frozen cantaloup is inferior to the fresh product.

Cherries: Sour

Varieties.—Early Richmond and Montmorency.

Selection for Quality.—Pick when fully ripe, while color is bright red. Overripe cherries are usually too soft.

Preparation.—Sort, wash, stem, and pit. Place in container and just cover with heavy sirup (60% sugar solids), either No. 1 or No. 2. Use for pie and cobbler. The coarsely mashed cherries may be used for flavoring ice cream.

Cherries: Sweet

Varieties.—Do not grow well in Tennessee. Black Tartarian, Lambert, and Bing are preferred.

Selection for Quality.—Proper maturity is important. For best quality, pick when fully tree-ripened but still fairly firm. Cherries that are extremely soft when fully ripe may be frozen and later used as crushed product for ice-cream topping.

Preparation.—Sort, wash, chill in iced water, drain, remove stems, and then pit. Place cherries in container and just cover with light sirup (40% sugar solids) containing ascorbic acid and lemon juice. For method of adding ascorbic acid and lemon juice, see page 25.

Cranberries, Currants, and Gooseberries

Varieties.—Use any available.

Preparation.—Sort, and discard damaged berries. Remove stems from currants, and blossom ends from gooseberries. Wash in cold water, drain, and pack without sugar or sirup. Freeze without delay.
Figs

Varieties.—Brown Turkey and Celeste.

Selection for Quality.—Harvest when tree-ripened but before shriveling begins. Ripe figs are very susceptible to attack by mold, and should be frozen within 12 to 16 hours after harvesting. They may be chilled and held in the kitchen refrigerator for several days.

Preparation.—Wash, sort, discard all fruit that shows evidence of rot. Cut off stems close to fleshy portion of fruit. Peel, cut into halves, neatly place in container, cover with light sirup (40% sugar solids), seal, and freeze. Discoloration of figs presents no problem; consequently, plain sirup of either No. 1 or No. 2 kind, without added ascorbic acid, may be used. Packing of figs with dry sugar, or without light sirup, is not recommended. Frozen figs may be used as dessert, or in making preserves.

Grapes


Selection for Quality.—Use vine-ripened fruit. It should be pointed out that most native varieties, such as those listed above, are not well suited for freezing preservation except for subsequent juicing or preserve-making.

Preparation.—Sort, stem, wash and drain. Place in containers and just cover with light sirup (40% sugar solids), either No. 1 or No. 2. After packing, grapes should be frozen immediately.

Peaches

Varieties.—Elberta, Early Elberta, Belle of Georgia, Halehaven, Fertile Hale, Hale, and Red Haven.

The freezing of clingstone varieties is not recommended unless they are to be used in making pie or preserves.

Selection for Quality.—Fully ripe fruit. Peaches for freezing should be slightly riper than for canning. When the flesh of the peach yields slightly under pressure of the thumb it is properly ripened for freezing.

Preparation.—Wash and peel. The peaches may be dipped in boiling water for about $\frac{1}{2}$ minute, and cooled quickly in cold water
to loosen the skin. The peeled peaches are split into halves, pits removed, and the halves cut into slices as desired—fourths, sixths, or smaller, depending on size of fruit. To prevent browning, the sliced fruit is placed in a dilute citric-acid solution until packed in sirup. The citric-acid solution is prepared by dissolving one tablespoon of powdered citric acid, or 10 tablespoons of lemon juice, in 1 gallon of water. A solution of ascorbic acid (1 1/4 teaspoons ascorbic acid per gallon of water) may be used instead of citric acid, to prevent browning of peach slices for a short time. The prepared peach slices are quickly drained, neatly placed in suitable containers—waxed cups, glass jars, and various kinds of bags—and covered with HEAVY sirup (60% sugar solids), either No. 1 or No. 2, to which has been added an anti-browning agent. (See pages 25 and 26 for methods of preparing sirups for peaches.)

Pears

Varieties.—Orient and Kieffer.

Selection for Quality.—Fully ripe but firm. Varieties free from granular flesh are best.

Preparation.—Generally, pears are better canned. However, if cut into thin slices, or cubes, they may be preserved by freezing. It is difficult to prevent the browning of uncooked, frozen pears. Consequently, the following instructions should be followed carefully: Wash in cold water, peel, split lengthwise through the center, remove core, and cut into 1/2-inch slices, or cubes for use in mixed-fruit salad. The pear has less acid than most fruits and its delicate flavor is easily masked by too much sweetness. The freshly cut pieces are packed immediately in light sirup (40% sugar solids) containing one of the anti-browning agents, as explained on pages 25 and 26. Make sure that the fruit is completely covered by the sirup.

Plums

Varieties.—Methley, Stanley, and Gold.

Selection for Quality.—Should be fully tree-ripened for best quality. After harvest, plums should be handled promptly.

Preparation.—Sort out defective fruit. Wash in cold water, cut in halves, and remove pits. Put into container and just cover with heavy sirup (60% sugar solids) of No. 1 and No. 2 kind, prepared as for peaches, using ascorbic acid (see page 25). The fruit may
be pulped and mixed with the heavy sirup in the ratios of 3 cups of pulped fruit to 1 cup of sirup. Freezing of the product should not be delayed. Frozen plums may be used in the following ways: Halves for pie, cobbler, and sauce dessert; pulped for sherbert flavor base, and making plum butter—a spread for breads and crackers.

Strawberries

Varieties.—Strawberries are one of the most popular fruits for freezing. Varieties suitable for home freezing are Blackmore, Tennessee Shipper, Tennessee Supreme, and Tennessee Beauty. Desirable varietal features are retention of shape, pleasing flavor, and bright color. They should be free from white or hollow centers.

Selection for quality.—Strawberries should be picked when they have attained full-red color. Sort to remove immature and defective berries.

Preparation.—Hull, wash in cold water, and drain. Strawberries may be packed whole or sliced. For the dry sugar pack, sliced (lengthwise) or whole berries are mixed with granulated sugar in the proportions of 4 to 5 parts, by weight, of berries to 1 part of sugar. For the sirup pack, whole or sliced, berries are placed in suitable containers—waxed cups, glass jars, or cellophane bags—and just covered with medium sirup (50% sugar solids) of either No. 1 or No. 2 kinds, sealed, and frozen without delay.

Watermelon

Full-ripe, good-flavored watermelon may be cut into balls or cubes of from 1- to 1½-inch sizes, packed with light sirup as explained for cantaloup. Watermelon should be used while still slightly frosted. In texture and flavor after thawing, the product is inferior to the fresh.

FREEZING PRESERVATION OF MEATS
(Beef, Pork, Veal, Lamb, and Mutton)

Selection and Slaughtering

Meats to be preserved by freezing must be handled properly in order to retain their original quality and flavor. Remember, while freezing does have a slight tenderizing effect, it will not transform a tough, flavorless cut of meat into a tender flavorful one. Meat
quality is developed largely in the animal, through breeding and feeding practices.

The successful preservation of meats depends on (1) selection of animals of proper age and quality; (2) clean, skillful job of slaughtering; (3) rapid removal of body heat, and aging for the proper length of time at about 34° F.; (4) protection of fresh cuts by the proper application of wrapping materials of proved quality (see page 12, Wrapping of Meats and Poultry); and (5) quick freezing, and storage in a constant temperature of 0° F. until used.

People who are not familiar with the breeds of animals and poultry, or the age and “finish” at which they are best for meat, should seek the advice of those who know about animal production. For example, beef animals are raised and marketed as (1) heavy fat calves, (2) baby beeves, (3) fat yearling, and (4) 2-year-olds and older.

Many rural homes are equipped for slaughtering animals, chilling and cutting carcasses, and dressing poultry, for freezing. Those who are not so equipped, and who lack skill in butchering and in dressing of poultry, should resort to the services offered by the locker plant. If locker-plant facilities are not available, an experienced meat cutter or a commercial poultry dresser may be employed to do the work.

Worth-while saving in money often is realized by the purchase of meats in quantity—quarters, or “wholesale” pieces—and preparation of cuts for table use as desired, prior to wrapping and freezing. The convenience and satisfaction of having on hand a supply of the various cuts of choice meats more than justifies the practice.

There are five U.S.D.A. grades of beef of importance to the home user—Prime, Choice, Good, Commercial, and Utility. Briefly stated, U. S. grades of beef carcasses are established by the amount and distribution of fat, and the age of the animal. For example, U. S. Prime carcasses usually come from steers or heifers that are less than 3 years old, and the layers of fat on the back should be ½ to ¾ inch thick. “Marbling” (lean interspersed with fat) must be present. U. S. Choice represents only slight differences, with respect to fat content and distribution from Prime grade. U. S. Good admits of greater age variation. Too much or too little fat may make an otherwise “Prime” grade only a “Good” grade. U. S. Commercial grade is given to a carcass whose fat covering is small, and usually colored yellow; “marbling” is usually absent. U. S. “Good” and “Commercial” are the most common grades. U. S. Utility carcasses
have very little fatty covering (poorly finished), and are bony. Similar U. S. grades are used to indicate the food qualities of veal and lamb. The discriminating homemaker, who wishes to give her family a nutritional lift, will select only the best grades of meats for the locker or home freezer. Beef in which fat is well distributed throughout the lean is more tender and juicy.

Those desiring detailed information on home methods of slaughtering meat animals and processing carcasses are referred to the following pamphlets:


“Lamb and Mutton on the farm.” Farmers’ Bulletin No. 1807.

Publications available from the Agricultural Extension Service, University of Tennessee, Knoxville, Tennessee:


**Chilling Meats**

After slaughtering, beef, pork, and veal carcasses must be chilled without delay. Avoid freezing the carcass. Prompt and thorough chilling to an internal meat temperature of 40° F. or lower within 20 to 24 hours is necessary to retard the activity of organisms which cause spoilage and inferior quality in meat. Then, too, chilled carcasses permit easier and smoother cutting. Farm slaughtering of meat animals should be done when weather conditions permit rapid cooling. If the outdoor air temperature is above 40° F. at the time of slaughtering, artificial refrigeration facilities should be resorted to. A chill-room temperature of 34° F. is the most satisfactory. To allow free circulation of air, carcasses should be hung in the chill room so that they do not touch.

**Aging Meats**

When thoroughly chilled, pork and veal carcasses are cut into table (“retail”) cuts, packaged, and frozen. Pork and veal are tender meats and need no further aging. Beef, lamb, and mutton car-
casses are aged in the chill room (34° to 36° F.) for 5 to 7 days before processing. For bony carcasses that are not evenly covered with fat, a 5-day aging period usually is long enough. The holding of carcasses in a cold room for several days beyond the time necessary for chilling is known as the aging, or ripening period. During this period, certain enzymes that naturally occur in the animal tissue are mildly active in producing changes that render the meat more tender and of better flavor. It should be emphasized that a chill-room temperature of 34° to 36° F. must be maintained during the aging period. At this temperature, the growth of bacteria and molds, oxidative changes that produce rancidity in fats, and enzymic activity, all of which are capable of producing off-flavors and spoilage, are considerably retarded but not completely stopped. Aging of beef, much beyond the number of days required to tenderize it, therefore, favors the development of off-flavors. Once developed in the carcass, the rancid-like flavor becomes no less pronounced in the frozen product.

Modern freezer-locker plants have separate chilling and aging rooms. It is desirable to keep the freshly slaughtered warm carcasses separate from the chilled ones. To prevent drying of the carcass, the aging room should be equipped to maintain a relative humidity of about 85 percent.

**Cutting Meat for Freezing**

**Beef.**—Meat for freezing-preservation is cut according to usual methods. A side of beef is cut as follows: (1) into hind- and fore-quarters, (2) quarters are divided into primary cuts, or (3) into table cuts of sizes desired by the homemaker. The usual method is to divide the hindquarter into flank, loin, rump, round, and shank; the forequarter into ribs, plate, chuck, brisket, shank, and neck. These primary ("wholesale") pieces are further reduced to meal-size cuts. Steaks of the desired thickness are cut from the rounds, loins, and shoulder chuck if desired. Roasts are made from the chuck and by boning and rolling the rump and the rib. Boiling meat may be cut from the plate. Other pieces, such as shanks, brisket, neck, flank, and plate, if not used for boiling, may be ground and used as hamburger or Salisbury steak and meat loaf, or in other inviting culinary preparations. It should be borne in mind that bone in the various cuts of beef, as commonly prepared, occupies storage space and adds very little to the quality of the cooked product. The term "partial boning" refers to a method of cutting a
Meat Cuts and How to Cook Them

BEEF CHART

Retail Cuts

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<tr>
<th>Retail Cuts</th>
<th>Wholesale Cuts</th>
<th>Retail Cuts</th>
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<tbody>
<tr>
<td>Ground Beef</td>
<td>Round Steak</td>
<td>Rolled Rump</td>
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<td>Heel of Round</td>
<td>Top Round</td>
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<td>Roast or Braise</td>
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<td>Bone or Simmer</td>
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<td>Hind Shank</td>
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<td>Soup or Simmer</td>
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<td>Pin Bone Sirloin Steak</td>
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<td>Rolled Flank</td>
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<td>Braise</td>
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<td>Flank Steak Fillets</td>
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<td>Plate</td>
<td>Standing Rib Roast</td>
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<td>Boiling Beef</td>
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<td>Simmer</td>
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<td>Corned Beef</td>
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<td>Rolled Rib Roast</td>
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<td>Knuckle Soup Bone</td>
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<tr>
<td>Soup or Braise</td>
<td>Standing Rib Roast</td>
<td>Rolled Rib Roast</td>
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<td>English Cut</td>
<td>Standing Rib Roast</td>
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<td>Arm Pot Roast</td>
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<td>Braise</td>
<td>Rolled Rump</td>
<td>Rump Roast</td>
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National Live Stock and Meat Board

Fig. 2—Retail (table) cuts of beef prepared from the primary (wholesale) cuts of a beef carcass. Only retail cuts should be frozen.

Quarter or side of beef into meal-size cuts with much of the bone removed. This is a special job, requiring an experienced meat cutter. Many locker plants perform this service for their patrons. All meats to be frozen must be wrapped in moisture-vaporproof material, as explained on page 12.
Meat Cuts and How to Cook Them

PORK CHART

Retail Cuts

Wholesale Cuts

National Live Stock and Meat Board

Fig. 3—Retail (table) cuts of pork prepared from the primary (wholesale) cuts of a pork carcass. Only retail cuts should be frozen.

Pork.—Subfreezing temperatures (−5° to 0° F.) are entirely practical for holding fresh pork for a limited period of time—3 to 6 months—depending on the type of meat, as explained later.

A side of pork is cut into ham, loin, belly, and shoulder. Spare-ribs are separated from the shoulder and belly. After removal of fat,
the loin is cut into chops or roasts. The ham, after trimming, is sliced for freezing. The shoulder is cut to form the bottom butt and the top shoulder piece. The shoulder is boned and formed into a roll. After trimming and boning, the butt is formed into a roll for roasting. The belly, if not cured as bacon, or used as salt pork, may be
ground with other cuts (shoulders and trimmings) in the making of sausage.

Sausage, seasoned or unseasoned, may be packaged, frozen, and stored as are other frozen meats. Frozen seasoned sausage should be consumed within 2 months; unseasoned, within 5 months.

Cured pork—hams, bacon, and smoked sausage—can be wrapped, frozen, and stored in 0° F. for 4 to 5 months. Bacon is best frozen in slab form rather than sliced. Full cured hams and bacon will keep well for 5 to 6 months if suspended in a cool, dry, ventilated, dark room of the house. It is not advisable to use zero locker or cabinet space for storing full-cured meats.

Most modernly operated locker plants have facilities for slaughtering, cutting, wrapping, freezing, and storing of meats. Locker plants also prepare pork sausage, render lard, and cure meats. These services can be performed at the locker plant more rapidly, safely, economically, and satisfactorily than at homes where facilities are inadequate.

**Veal.**—The veal carcass is divided into halves, and the halves into hind- and forequarters. The hindquarters are cut into round, rump, loin, and flank. The forequarters are cut into shank, shoulder, rack, and breast. These primary parts are then cut into the usual table cuts of desired size. Cutlets are derived from the round, and chops from the loin. For freezing, the shoulder, breast, and rump should be boned and rolled for roasts. Ground veal may be prepared from the flank and shanks. It will be recalled that the veal carcass is not held in cold storage longer than is necessary for chilling. Veal is tender meat and needs no aging.

**Lamb.**—Primary cuts of the lamb carcass are leg, loin, rack, shoulder, breast, and shank. These primary parts are reduced to the various table cuts. The lamb carcass is aged as previously explained. More detailed information on lamb cutting is given in Farmers' Bulletin No. 1807, "Lamb and Mutton on the Farm."

At this point it is well to repeat that meat must be snugly wrapped, in papers of proved quality, and frozen without delay. When several cuts of meat, such as chops or steaks, are wrapped together in one package, several sheets of paper should be placed between the pieces of meat to facilitate separation at time of cooking.
Meat Cuts and How to Cook Them

LAMB CHART

Retail Cuts

1 & 2
Leg of Lamb
(Two cuts from one leg)
Roast
Braise

Rib Lamb Chops
Roast

Lamb Crown
Roast

Frenched Rib Chops
Braise

Retail Cuts

American Leg
Roast

Frenched Leg
Roast

Loin
Lamb Chop
Lamb Chop
Roast or Braise

Roasted Loin
or Lamb
Roast

Lamb Patties
Braise or Broil

Lamb Loaf
Bake

Lamb Riblets
Braise or Stew

Lamb Shank
Braise or Stew

Mock Duck
Roast

Neck Slices
Broil

National Live Stock and Meat Board

Fig. 5—Retail (table) cuts of lamb prepared from the primary (wholesale) cuts of a lamb carcass. Only retail cuts should be frozen.

FREEZING-PRESERVATION OF POULTRY

Chickens, ducks, and turkeys can be successfully preserved by freezing. Only birds of good quality—young, healthy, and of good finish—should be frozen. Birds should receive no feed for at least 12 hours prior to killing, but should be allowed plenty of water. The
water serves to flush the crop and intestines, thus reducing the chances of off-flavors, and makes removal of viscera (internal organs) easier.

Poultry to be frozen are first dressed. The dressing includes killing, bleeding, and removing of feathers. The birds may be killed by “sticking” the brain and bleeding, by disjointing the neck, or by cutting off the head. Complete bleeding is necessary. If the “stick” method is used, the birds can be dry-picked. If other methods of killing are employed, semiscalding is necessary to loosen the feathers. To semiscald, the birds are immersed, and moved back and forth for 30 to 35 seconds, in water heated and maintained at a temperature of 128° to 130° F. After picking, the birds are singed, brushed to remove charred feathers, washed, and the internal organs removed. Removal of the internal organs is often referred to as drawing, or eviscerating. For home use, the birds should be eviscerated while still warm, and the oil sac at base of tail re-
Fig. 7—Two styles of turkey. The tom at the left is "New York Dressed" (meaning only feathers removed). If purchased, you pay for the head, feet, and entrails, which constitute about 20 to 25 percent of the total weight. The price of a tom weighing 19½ pounds, for example, should be compared with that of a drawn (head, feet, and entrails removed) tom of the same grade weighing about 15 pounds. Turkeys should be drawn before freezing. The turkey at right is a well-finished hen, drawn, and wrapped for freezing.

moved. The bird carcass and giblets then should be placed in crushed ice or in the kitchen refrigerator to remove the animal heat. Cooling is one of the most important steps in the preparation of poultry for freezing. Not only is flavor affected by the rate and thoroughness of cooling; the period of zero storage is favorably influenced by rapid and thorough cooling. Detailed information on this subject is given in Farmers' Bulletin No. 1377, "Marketing Poultry."

Poultry may be frozen whole or cut before packaging and freezing. Roasters and turkeys are usually trussed (legs and wings fastened to body), wrapped, frozen, and stored whole. Broilers may be left whole or cut into halves prior to wrapping and freezing. Fryers are cut up as desired for table use. For home use, the giblets (heart, liver, and gizzard) and neck should be cleaned, washed, wrapped, and frozen as a separate package. Turkey steak and fillets
may be prepared and frozen. All poultry must be well wrapped with materials of proved quality (see page 12). We now have good wrapping papers of various kinds—and if the wrapping is properly applied, freezer-burn (desiccation) will not occur.

The glazing of poultry or fish is accomplished by dipping the unwrapped, solidly frozen carcass into cold water several times, then wrapping and storing in the zero locker or cabinet. This is unnecessary if good wrapping materials are properly used.

Darkened bones often are found in young chickens that have been frozen. This is said to be caused by the passage of blood from the center to the surface of young, lightly calcified bones. While discoloration of bone detracts somewhat from the appearance of the product, it does not affect the quality of the meat.
FREEZING-PRESERVATION OF EGGS

Eggs to be frozen must be strictly fresh and clean. Liquid eggs are a good medium for the growth of bacteria. It is important, therefore, that the workers' hands and all utensils used in the breaking of eggs be thoroughly cleaned.

To avoid contamination by stale eggs, each egg should first be broken into a small dish and then poured into a mixing bowl. The liquid whole eggs are then mixed thoroughly but not vigorously, placed in waxed cups or other suitable containers, and frozen rapidly. Yokes and whites may be separated and frozen. Prior to freezing, egg whites need very little mixing, but the separated yolks should be thoroughly mixed. Frozen egg white, when thawed, will return to its original consistency and appearance, and can be used for all culinary purposes in which egg white is required. When egg yolk
is frozen, it changes to a jelly-like consistency, and will not become fluid on thawing. To prevent jelling of yolk, sugar, corn sirup, or salt should be added before mixing and freezing. One teaspoon of salt or one tablespoon of sugar, or corn sirup, should be added for each standard measuring cup of yolk to be frozen. In judging amounts of liquid egg to use, it may be helpful to know that 3 tablespoons of mixed whole liquid egg is equal to one fresh egg.

**FREEZING-PRESERVATION OF GAME BIRDS**

As soon as convenient after killing, game birds should be picked and internal organs removed, they should then be washed in cold water, cut up as desired, packaged, and frozen. Game birds should be processed in much the same way as poultry.

Read the following paragraph relating to the legal aspects of holding game fish and game birds:
Fig. 11—Chicken for frying. At the left is a “New York Dressed” (only feathers removed) frying chicken. At the right is the chicken cut into pieces—wings, breast which may be cut into three pieces, shoulder white meat, five pieces of dark meat, and giblets wrapped in cellophane. All pieces are placed in a package and frozen.

In Tennessee, it is unlawful to possess more than 3 days’ legal creel limit (creel limit refers to legal catch of fish per day), or 2 days’ legal bag limit (bag limit refers to the number of game birds and game animals that may be shot per day in the open season), or to hold or possess any game fish or wild life longer or more than 90 days after the close of the open season for the particular species. Write to the Director, Game and Fish Commission, Nashville, Tennessee, for a copy of the State’s latest game and fish laws.

**FREEZING-PRESERVATION OF FISH**

For best results, fish should be cleaned and frozen soon after they are taken from the water. If it is necessary to hold them overnight before freezing, they should be eviscerated and packed in crushed ice or placed in the refrigerator. Fish are prepared as for table use: The scales and internal organs are removed, the fins and
head are cut off, and the fish are washed thoroughly in cold water.

After cleaning, small fish usually are frozen whole, and large fish may be frozen whole for baking or cut into fillets, or into steaks. Large whole fish are better if consumed within four weeks after freezing.

The fatty types of fish, such as lake trout, bass, herring, and pink salmon, tend to become rancid rather quickly in zero-degree storage. The keeping quality of frozen fish of the fatty types can be enhanced by immersion of the cuts for 5 to 7 minutes in a solution of ascorbic acid, prepared by dissolving 2 teaspoons of ascorbic acid in 2 quarts of cold water.

Cuts (fillets and steaks) of the lean types, such as haddock and cod, should be immersed for 30 seconds in a cold salt solution, prepared by dissolving 1 standard measuring cup of common table salt in 1 gallon of water. In packaging fish, the very best moisture-vaporproof wrapping materials must be used. Observe the same precautions as for the wrapping of meat and poultry.

Fish deteriorate rapidly after thawing. Without removal of the original wrapper, fish to be cooked should be transferred from zero storage to the kitchen refrigerator and allowed to defrost. Cooking should be started while the fish is still very cold.

**FREEZING PREPARED AND PRECOOKED FOODS**

Freezing-preservation is not limited to fresh fruits, vegetables, meats and poultry. Many prepared foods, such as rolls; cakes; meat or vegetable casserole dishes; and mincemeat, fruit, pumpkin, and sweet potato pies, may be enclosed in cellophane or other moisture-proof wrapping or packaging materials and frozen. Prepared foods are defrosted, preferably in the kitchen refrigerator and cooked just before serving. Fruit salad often is eaten while still frosted.

Foods that are prepared, cooked, and then frozen to preserve quality until eaten, are referred to as “precooked” foods. This group includes a wide variety of items—fish, meat, poultry, soups, vegetable dishes, baked apples, Frenchfried potatoes, and many others. All, of course, must be cooled rapidly after cooking, and packaged or wrapped to exclude air and prevent drying, then frozen. They are defrosted and heated just before serving.

Prepared and precooked frozen foods should be consumed within a few weeks. This is especially true of highly seasoned precooked
foods, and bakery goods in which considerable shortening is used. The foregoing are just a few examples of hundreds of food items, raw and cooked, that can be preserved for a limited period of time by freezing.

Most of the space in the home-freezer unit should be devoted to the storage of meats, poultry, fruits, and vegetables. These items constitute the major part of the family diet, and can be used as desired in preparing the various appetizing foods. Meats, poultry, fish, fruits, and vegetables, if frozen separately, will have better quality and retain it for a much longer period of time than if they are combined in various ways, seasoned, and frozen before or after cooking. Besides, prepared and precooked foods in containers occupy considerable space in the zero compartment of the cabinet.

For detailed information on the freezing-preservation of prepared and precooked foods, the homemaker should write the College of Home Economics, University of Tennessee, Knoxville, Tennessee.

FREZING-PRESERVATION OF FRUIT JUICES

Fruit juices, such as apple, blackberry, red and black raspberry, boysenberry, loganberry, sour cherry, grape, and blueberry, may be preserved by freezing. Juices of the various fruits may be prepared in season, put into containers—waxed cups, glass jars, or enameled cans—and frozen. Later, they may be completely thawed and blended together as desired for beverage purposes. Some of the juices blend well with citrus juices in fruit punches and carbonated drinks. Juices of the blackberry, raspberry, grape, and sour cherry may be combined with sugar and pectin in the making of jelly.

Apple juice of best flavor is obtained from a mixture of about 5 different varieties of clean, undamaged fruit. After the apples are ground and the juice is pressed out, ½ teaspoon of ascorbic acid (vitamin C) is added per gallon, and the mixture stirred gently. The cider is then poured into containers and frozen without delay. The addition of ascorbic acid—proclicable at drug stores—aids in preserving the natural flavor of the cider during storage. In filling containers with juice, a head space of ½ inch should be allowed for flat-type pints, ¾ inch for tall pints, and 1⅛ inches for quarts. This permits expansion of the product upon freezing without damage to the container.
While juice of the small fruits may be prepared by several methods, the following is perhaps best suited to home conditions: Ripe, washed, and sorted berries are placed in an aluminum, stainless-steel, or enamelware kettle (not copper or iron) and gradually heated to 170° F., and held at that temperature for 5 minutes. A thermometer should be used. The fruit is stirred continuously to assure an even distribution of heat, and to aid in breaking down the fruit tissue. Heat also reduces the mucilaginous character of the berry tissue and thus facilitates the flow of juice. The juice is then separated from the pulp by pressing through a clean, sterile cotton cloth in a small juice press, or by hand.

Berry juices, except blueberry, have a relatively high acid and low sugar content, and their flavor is considerably improved by the addition of 1 1/2 standard measuring cups of sugar per gallon of juice. Blueberry or grape juice requires no sugar. After the sugar is dissolved, the juice is poured into containers as explained above, sealed, and frozen.

While frozen grape juice holds its flavor well, salts of tartaric acid ("argols"), naturally present in grapes, will continue to separate and show as a white deposit on the bottom of the container. After thawing, grape juice should be poured from the container very carefully to separate it from the argols, which have sour taste.

If ample freezing facilities are available, fruit juices of excellent quality may be prepared according to the following directions: Sort and wash the berries and place them in a large mixing bowl. Add sugar at the rate of 1 pound per each 10 pounds of fruit, and mix until all sugar is dissolved. Transfer to gallon-size (10-pound) tin containers with tight-fitting covers. Allow about 1 1/2-inches head space for expansion. Then place in the zero room to freeze. During the initial 8 hours of freezing, the cans should be rolled several times to facilitate cooling at the center. Later, the berries are allowed to thaw in the closed cans, then removed from the cans and crushed, and the juice strained or pressed out and poured into containers for freezing. This method preserves the natural flavor of the juice considerably better than methods employing heat. By first freezing the berries, we obtain a coagulation of the mucilaginous substances, thus making separation of the juice from the pulp relatively easy. Besides, berries may be frozen in season and juiced at a later date.
THAWING AND USING FROZEN FOOD
(Fruits, Vegetables, and Meats)

Foods are preserved for future use by being prepared and held under conditions that will prevent the growth of spoilage organisms, such as yeasts, molds, and bacteria. For example, in canning, foods are sealed against external contamination and subjected to heat, which renders them sterile until the containers are opened; while in freezing, the foods are exposed to extreme cold—before or after sealing, depending on kind of food and type of wrapping material employed—until frozen, then held at zero-degree Fahrenheit, which is much below their freezing point. When canned foods are opened, or frozen foods defrosted and exposed to the air, their preserving conditions are altered; airborne organisms soon find their way to such foods, and spoilage results. Heating or freezing changes the tissue structure of fruits, vegetables, and meats, providing a more favorable medium for the growth of spoilage organisms.

When a can of beans, for example, is opened, they should be eaten promptly. Likewise, when a package of frozen fruit, vegetable, or meat is removed from zero storage to ordinary refrigerator temperature (38 to 40 degrees F.), or to room temperature, it should be prepared for eating while still slightly frosted. This applies especially to vegetables and meats.

Fruits

While frozen fruits thaw rapidly in room temperature, requiring about 3 hours for 1-pound packages, they are usually best if allowed to thaw in the kitchen refrigerator. The latter method requires from 6 to 8 hours. Watertight packages of frozen fruits can be thawed in cool water in about 1 hour. Regardless of how the fruit is defrosted, it should remain in the sealed package until used. This is especially true of white-fleshed fruit, such as peaches, which discolor upon exposure to the air. Generally, frozen fruits are used for the same culinary purposes as fresh, or canned, fruits. Allowance must be made, of course, for the sugar added at the time of freezing. See directions for freezing fruits, pages 28-34. Persons who are accustomed to using frozen fruits appreciate the importance of handling them while they are still slightly frosted. Others will learn by experience.
Vegetables

Cooking of vegetables may begin while they are still solidly frozen or partially thawed. Corn on the cob, and greens—turnip, mustard, spinach, and others—will cook more uniformly if allowed to thaw almost completely. Cooking of all other vegetables may begin with the solidly frozen product. Vegetables should be cooked to tenderness as quickly as possible, in a small amount of water, usually about 1/2 cup per pound of vegetable. A kettle with a tight-fitting cover, or a pressure saucepan, may be used. Frozen vegetables may be cooked, seasoned, and served in all the various culinary ways employed with fresh vegetables. As a general rule frozen vegetables that have completely thawed should not be refrozen, but should be held in the kitchen refrigerator and used within 24 hours.

Meats

Cooking of meat chops, cutlets, and thin steaks, including patties, may begin while they are still solidly frozen. Thick steaks and roasts should be defrosted but still cold when cooking begins. Ground meat must be completely thawed, but kept cold, so that it can be made into patties, balls, loaf, and other shapes. The homemaker should plan in advance to allow ample time for defrosting in the kitchen refrigerator. Meats are best if thawed in the original package.

There is much to commend the kitchen refrigerator as a place to thaw meats and other frozen products. In case of delay in cooking, the refrigerator will protect the thawed product from spoilage for a reasonable length of time.

Poultry

Frozen poultry may be handled much the same as meat. Cut-up poultry wrapped in bulk package, should be partially thawed to separate the pieces and facilitate browning during the cooking process. Frozen cut poultry to be stewed may be placed directly in boiling water. Frozen whole birds to be stuffed and baked should be partially defrosted.
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