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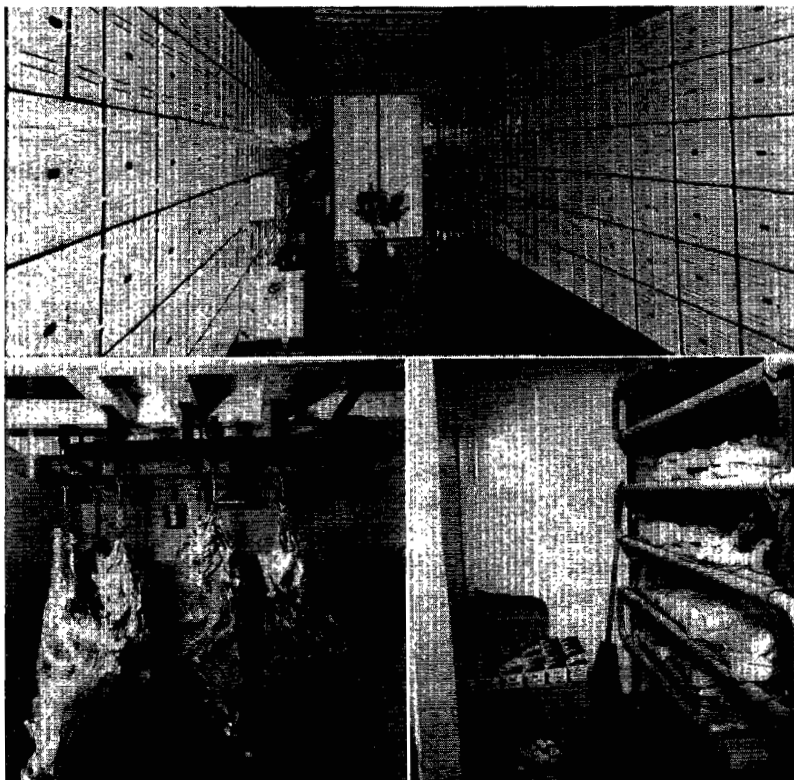
KANSAS STATE COLLEGE OF AGRICULTURE
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PRESERVING FOODS IN FROZEN FOOD LOCKERS¹

BY G. A. FILINGER and D. L. MACKINTOSH



The modern freezer-locker plant consists of the locker room (top), the chill room for chilling carcasses (lower left), and the sharp freeze room for freezing fruits, vegetables and meats (lower right).

1. Contribution No. 178, Department of Horticulture, and No. 146, Department of Animal Husbandry.

FOREWORD

The use of frozen food lockers by farm and townspeople for storing foods for their own use has increased rapidly in Kansas during the last few years. Refrigerated locker plants are located at present in almost every section of the state and their number and distribution is still increasing. There are about 200 plants now operating in Kansas, making over 50,000 individual lockers available for rent. The frozen food locker plant makes it possible for the family to utilize fresh home-grown meat, poultry, fruit and vegetables throughout the entire year and at a material saving in cost.

The maximum economy in use of the frozen food locker can be realized by those rural families who produce their own products; the urban resident, through careful planning and buying can also realize a real saving through the use of frozen food lockers. Because of the desire for information relative to the use of this type of preservation on the part of locker patrons, the following suggestions, based on trade practices and on research work conducted at the Kansas and other state agricultural experiment stations, are presented in this circular.

The use of frozen food lockers should be as carefully planned as any other farm or home operation. Seldom is money saved by renting a locker to store an occasional surplus of some perishable food. A definite saving in food costs can be shown, however, through the well-planned, year-round use of a locker.

Since the methods of preparing and packing fruits and vegetables differ so much from methods of handling meats, the information is presented in two parts.

The recommended sanitary regulations of the Kansas State Board of Health and additional suggestions for cutting and packing meat are appended—G. A. F., D. L. M.

PRESERVING FRUITS AND VEGETABLES IN FROZEN FOOD LOCKERS

By G. A. FILINGER

The preservation of fruits and vegetables by the quick freezing process, if properly done, preserves the flavor, the color and the vitamins better than any other method. The use of frozen products has increased rapidly during the last few years and commercial firms have kept pace with this demand by annually increasing their production of frozen fruits and vegetables. The use of community freezer lockers by farmers and townspeople has likewise increased. Many problems in connection with preservation of foods by freezing are still unsolved but sufficient progress has been made to assure good products of many kinds if a few simple directions are followed.

Fruits

There are five general methods of packing fruits for freezing:

1. *Packed whole without sweetening.*—A few fruits, such as strawberries, raspberries, cherries and blackberries, may be frozen whole without any treatment except sorting and washing. They must be kept at low temperatures and well sealed to prevent the fruit from drying. This method is not as desirable as those requiring the addition of sugar or syrup.

2. *Packed whole with sugar.*—This is the oldest and most commonly used method in freezing small fruits. This method is especially desirable if the fruits are to be used in baking. The fruit is sorted, washed, and packed with sugar. A common proportion is three parts of berries to one part of sugar. Some prefer less sugar and mix the fruit four or five to one. The berries and sugar should be allowed to stand for an hour or two to dissolve some of the sugar in the fruit juice before freezing. There is no advantage in adding sugar to dry fruits like gooseberries.

3. *Packed whole with syrup.*—If small fruits are to be used for desserts and thawed before use, they may be covered with a 40 to 50 percent syrup (See Table 1). The syrup dilutes the fruit flavor somewhat, but preserves the shape of the fruit and penetrates the fruit during storage.

4. *Sliced and packed with syrup.*—Large fruits, such as peaches, apricots, and plums are sliced, covered with a cold 40- to 50-percent syrup, and held for some time in a cool room to allow the syrup to penetrate the tissues of the fruit before freezing.

5. *Sliced or crushed and packed with sugar.*—Juice fruits, such as strawberries, may be crushed or sliced and mixed with sugar before packing into containers for freezing. Since no water is added, the flavor is unimpaired. This method is recommended for fruits of irregular size and shape.

Fruit juices and fruit pulps are excellent if preserved by freezing. They should be stored in air-tight containers. Glass containers which are narrower at the top than at the bottom may crack if used for fruit juice containers. Allow 1 to 1½ inches for expansion of the juices. (Fig. 2.)

Table 1 may be used in determining the amount of sugar and water to use in making up syrups. The proportions of sugar and water are based on weights, but volume measurements are sufficiently accurate. A pint of water weighs about a pound for this purpose and a slightly rounded pint measure of sugar, well settled, also weighs approximately a pound.

TABLE 1.—Amounts of water and sugar to use in preparing syrups.

Syrup Desired (percent).	Sugar.	Water.	Pints of syrup from one pound of sugar.
	(Parts).		
20.....	1	4	4.5
30.....	1	2½	2.7
40.....	1	2	2.2
50.....	1	1	1.7
60.....	1½	1	1.3

The amount of syrup necessary to pack a quart of fruit will vary with the size of the fruits or fruit pieces and with the tightness of the pack but usually from 1 to 1½ cups will be required.

Containers. — Containers for frozen fruits and vegetables should be reasonably air tight, moisture proof, strong, of a shape that is economical of space in the locker and allows removal of products easily, and economical in cost. A large number of containers are now on the market and many of them meet these requirements.

Glass Containers, such as the common fruit jars, may be used if they do not have a too decided shoulder and if they are not filled up into the tapered portion when a liquid is added. Wide-mouthed jars are preferred.

Heavily paraffined or waxed cartons, either cylindrical or tub-shaped, are satisfactory if the lids are practically air tight.

Square or rectangular cartons are more economical of space in the lockers but where cellophane linings are used inside of the cartons, the lining may not fit closely to the sides of the cartons, resulting in a waste of space within each container. The cellophane linings may be easily sealed at the top with a hair-curling iron. Metal containers either hermetically sealed or with tight friction or slip-on covers are satisfactory.

Although very little corrosion occurs at the low temperatures in a locker, a lacquer or enamel lining of metal containers prevents discoloring of fruits and vegetables.



FIG. 1.—Satisfactory types of containers for preserving fruits and vegetables in frozen food lockers. (1) Sealright—Cellophane lined carton for use where large amounts of fruit or fruit pulp are preserved. Too large for vegetables. (2) Bottle for fruit juices (wider at top than bottom). (3), (4), (5) Paraffined cartons made by Sealright Co., Inc. (6) Locker-Pak parchment cover with waxed inter-liner paper. Made by B. C. Betner Co. (7) Paper carton with metal top (opening is too small for best results). (8), (9) Wide-mouthed fruit jars. (10), (11) Lacquered tin cans with slip-in cover made by the American Can Co. (12) Paper carton with pleated cellophane liner. A cellophane top is sealed over the top and a cardboard lid placed over the top. Made by the Sealright Company, Inc. (13) Lily-Tulip cup with disc lid. Made by Lily Tulip Cup Corp. (14), (15) Cartons used by commercial frozen food companies. (16), (17) Cellophane lined cartons made by Interstate Paper Co. (18), (19) Cartons with cellophane bags used as liner. Made by the Lindley Box and Paper Company.

The time required to freeze a fruit or vegetable does not vary widely for containers of different types, but the quantity of the product in each container is important in this regard. Pint and quart size containers are preferred for ordinary use for quick freezing. The use of containers holding over 5 pounds is not recommended because too long a period is required for the products to freeze.

Fruit juices can be stored in the same types of containers as fruits and vegetables, but more space should be allowed within the container for expansion. Containers that taper toward the top should be avoided. If 10 to 15 percent space for expansion has been allowed, breakage due to freezing will be lessened by laying containers on their sides.

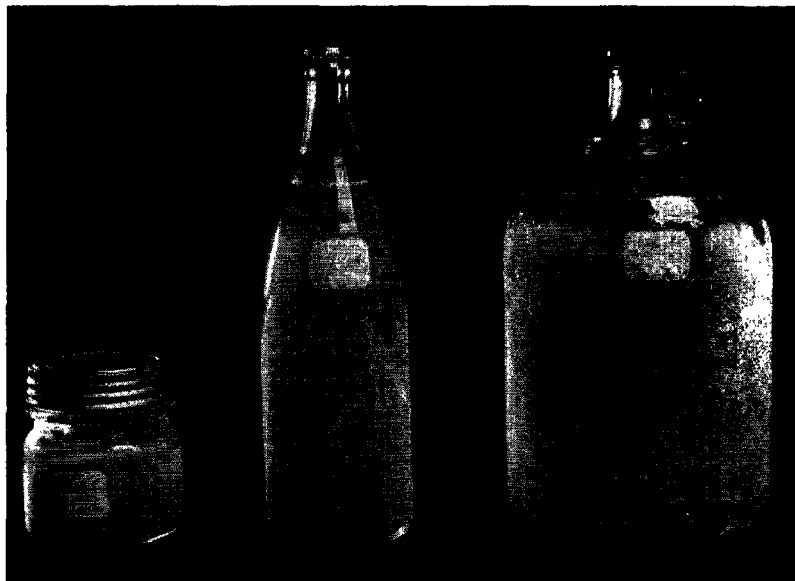


FIG. 2.—Containers used in storing fruit juices in frozen food lockers. (1) Wide-mouthed fruit jars with a small shoulder. (2) Bottle which tapers too much. Should be filled to a point below the label. Before freezing was filled to the top of the label. Note the amount of expansion. (3) Glass jug. Before freezing was filled to top of label. Note the amount of expansion of apple juice.

Products for freezing.—Only the best quality fruits should be stored in freezer lockers. Overripe, immature, blemished or spoiled fruit will be even worse when removed from the locker. The degree of maturity, the condition of the fruit and the methods of handling are more important than the variety. The varieties that are listed are those that have been tested in Kansas. Many others, no doubt, are desirable.

BLACKBERRIES

Varieties.—Eldorado was the only one tested and it was in every way desirable.

Preparation.—Pick at peak of ripeness. Handle carefully and quickly. Select the well-shaped berries, wash and drain thoroughly. (The soft and poorly formed berries can be sliced or crushed.)

Packing.—Use dry sugar, one pound to three or four pounds of berries or 40 to 50 percent syrup. Place in a chill room for several hours for penetration of sugar. Pack in paraffined paper cartons, cellophane lined cartons, lacquered tin cans, or glass jars. If syrup is used, allow 1 to 1½ inches for expansion in rigid containers.

Storing.—Freeze in sharp room at 0° to -10° F. and store at 0° to +10° F.

BLACK RASPBERRIES

Varieties. — Black Pearl and Cumberland were the varieties stored and both yielded an excellent product.

Preparation. — Pick at peak of ripeness and handle carefully to avoid crushing. Discard poorly colored, immature berries and over-ripe seedy ones; wash and drain.

Packing. — Pack whole without sugar or with one part sugar to three or four parts of berries. Black raspberries are excellent when crushed with sugar. A 30 to 40 percent syrup dilutes the flavor somewhat but is satisfactory for covering black raspberries. A heavier syrup tends to make the berries "seedy." Pack in paraffined cartons, cellophane lined cartons, lacquered tin cans, or glass jars.

Storing. — Freeze in sharp room at 0° to -10° F., and store at 0" to +10° F.

BUSH CHERRIES

Varieties. — Keyapaha, Oahe, Teepee and Wampum have been tried and all were good.

Preparation. — Pick when fully mature but before they get soft. Sort, wash and pack either whole or pitted. The pits are difficult to remove unless the fruit is fully ripe.

Packing. — Pack whole with 50 percent syrup or pit and pack with one part sugar to three parts of cherries. Paraffined cartons, cellophane lined cartons, lacquered tin cans, and glass jars were all satisfactory.

Storing. — Freeze at 0° to -10° F., and store at 0° to +10° F.

DEWBERRIES

Varieties. — Young and Boysen have been tried and, although they are soft in texture, they were satisfactory.

Preparation, packing, and storing. — The same as for blackberries.

GOOSEBERRIES

Varieties. — Houghton, Glendale, and Pixwell have been tried and all were satisfactory.

Preparation. — Gooseberries should be harvested when fully grown and when the ripest ones show some red color. The berries are sorted, stemmed and washed.

Packing. — Pack whole with 50 percent syrup. The berries are so dry that a sugar pack is not satisfactory with gooseberries.

Storing. — Gooseberries should be allowed to stand for two or three hours in a cool room and then be frozen at 0° F. to -10° F. and stored at 0° F.

PURPLE RASPBERRIES

Varieties.—Columbian, Ruddy, and Sodus. These varieties ranked very good, but were somewhat soft when removed from the freezer locker.

Preparation.—Harvest when fully mature but before the berries become soft or the drupelets start shattering. Purple raspberries must be handled carefully and quickly to avoid bruising. Sorting is best done at picking time to avoid rehandling. Wash thoroughly and place in containers.

Packing.—Pack whole without sweetening or with 40 to 50 percent syrup, or with one part of sugar to four parts of berries. Purple raspberries are excellent if crushed with sugar. Paraffined cartons, cellophane lined cartons, lacquered tin cans and glass jars were all satisfactory.

Storing.—Freeze at 0° to -10° F., and store at 0°.

RED RASPBERRIES

Varieties.—Latham and Chief have been tried and found very desirable.

Preparation.—Pick when fully mature but before the berries soften or shatter. Careful handling is necessary to avoid bruising the fruit.

Packing.—Pack, without treatment, with one part of sugar to four parts of berries or with 40 percent syrup. The sugar pack is perhaps the most satisfactory as it does not dilute the delicate flavor and the sugar penetrates the fruits while in storage. Crushed red raspberries with one part of sugar to four or five parts of berries makes an excellent product.

Storing.—Freeze at 0° to -10° F., and store at 0° to +10° F.

SOUR CHERRIES

Varieties.—Early Richmond and Montmorency. No doubt other varieties of sour cherries are equally desirable. Great quantities of this fruit are frozen annually for commercial use.

Preparation.—Pick when fully mature and avoid bruising, as bruised fruits discolor. Sour cherries may be packed whole or pitted. For most uses the pitted fruits are more desirable.

Packing.—The whole fruits can be packed with 50 percent syrup. Pitted cherries are packed with one part of sugar and four parts of cherries or may be covered with 50 percent syrup. Pack in container of any desirable size.

Storing.—Freeze at 0° to -10° F., and store at 0° to +10° F.

STRAWBERRIES

Varieties. — Howard (Premier), Blakemore, Dorsett, Progressive, Fairfax, Rockhill, Aroma, and Dunlap. Whole berries of Aroma and Dunlap are somewhat soft when removed from the freezer locker, but fruits of these varieties are excellent when crushed and packed with sugar. Other varieties give a desirable product.

Preparation. — Pick when mature but before the berries get soft. Sort to remove deformed berries. The deformed berries can be crushed for storage. Wash thoroughly and place in containers.

Packing. — Pack whole without sweetening or with one part of sugar to four parts of berries or with 40 to 50 percent syrup. The sugar pack seems the most desirable as it does not dilute the flavor and the sugar penetrates the fruits well.

Storing. — Freeze at 0° to -10° F., and store at 0° to +10° F.

FRUIT JUICES

Juices of apple, pear, cherry, and rhubarb have been successfully preserved by freezing. They may be sweetened to taste or packed without sugar. Since fruit juices expand considerably when frozen, they should be stored in paraffined cartons or in glass containers which are not tapered inward at the top. Sufficient space should be allowed at the top for expansion.

FLESHY TREE FRUITS

Tree fruits such as apricots, peaches and plums have been satisfactorily preserved by freezing.

Varieties. — Only a few varieties of these fruits have been tested, but most of the common varieties grown in Kansas, if properly handled, yield a satisfactory product.

Preparation. — Tree fruits should be fully mature on the tree in order to reach the best flavor. The customary sorting, washing, halving and pitting are necessary for best results. Peeling is not necessary unless the consumer objects to the skins. To peel easily, apricots and peaches may be scalded or treated with a weak lye solution and then rinsed with water slightly acidified with citric acid after the lye treatment to remove or neutralize the lye. Otherwise, oxidative browning might result. These fruits may be cut into smaller pieces than halves if so desired. The fruits should be packed immediately and covered with syrup to avoid discoloring. As the fruits are halved or cut into pieces they should be dropped into water or a weak citric acid solution (1½ to 1 percent) to protect the fruit from the air.

Packing. — Pack the quarters or halves in 40 or 50 percent syrup using sufficient syrup thoroughly to coat and cover the fruit. Sugar packs are not desirable because the fruit tissues discolor and collapse upon being removed from storage. The packing of unsweetened fleshy fruits is not recommended.

Storing. — Freeze at 0° to -10° F., and store at 0° to +10° F.

VEGETABLES

All vegetables must be blanched or scalded before freezing because they contain enzymes which, if not destroyed, would materially change the flavor of the vegetables even when frozen. Vitamins are not destroyed by the blanching, but break down rapidly if the products are not placed in the sharp freezing room promptly.

Blanching. — Blanching consists of a short heating or cooking in boiling water or with steam followed by quick cooling in fresh, cold running water or in a large volume of cold water. The vegetables are placed in a wire basket or perforated metal container and submerged in the boiling water for a period long enough to heat the material through, but not long enough to soften the products. The volume of boiling water should be three or four times the volume of the products blanched so the boiling or near boiling temperature may be maintained during the blanching period. (Fig. 3.) Table 2 summarizes the directions for preparing vegetables for freezing.

Although the vegetables packed by commercial concerns are practically all packed without the addition of liquid to the product, the use of a 2 percent salt solution has some advantages for products intended for home use. A level teaspoonful of salt to 1 cup of water will give approximately a 2 percent solution. The frozen brine tends to protect the products from drying out and the vegetables from discoloring. A brine solution stronger than two percent tends to make the vegetables tough.

Storing. — Owing to the character of most vegetables, it is absolutely necessary that delays between preparation and actual freezing be avoided. This is especially true during the warm days of the summer. The vegetables should be frozen in a sharp room from 0° to a -10° F. and stored at 0°.

USES OF FROZEN FRUITS AND VEGETABLES

In general, frozen fruits and vegetables can be used in the same manner as the fresh products. The frozen products contain virtually the same vitamins that are found in fresh fruits and vegetables and retain much of the fresh flavor. Frozen vegetables will require less cooking time than fresh vegetables. Vegetables frozen in brine are thawed over a low flame and cooked in the original brine. Those packed "dry" are placed in boiling water, seasoned, and cooked for a short time. The same precautions exercised in using canned vegetables should be observed with frozen products.

TABLE 2.—Preparation of vegetables for freezing.

VEGETABLE AND VARIETY.	Maturity.	Preparation.	Blanching period.	Pack.
Asparagus; Martha Washington, Mary Washington.	Tender tips.	Cut 6-inch lengths or 1 inch for soup.	Small stalks 2 min. Medium stalks 3 min. Large stalks 4 min.	In 2 percent brine.
Beans; Green and Wax Kentucky Wonder, Full Measure Burpee Stringless Green Pod, U. S. Refugee No. 5.	Young, tender.	Snip, cut suitable lengths.	2 min.	Dry or in 2 percent brine.
Beans; Lima Green Prolific and others.	Green, firm.	Shell.	Small 1 min. Medium 1½ min. Large 2 min.	Dry or in 2 percent brine.
Corn; Sweet, on cob, Golden Bantam, Golden West, Country Gentlemen, Whipple's.	Before grains become starchy.	Husk, trim, cut to suitable lengths.	Small ears 4 min. Medium ears 6 min. Large ears 10 min.	Dry.
Corn; Sweet, cut from cob (Save about 60 percent space).	Before grains become starchy.	Husk, trim, blanch before cutting.	4-5 min.	Dry or in 2 percent brine.
Peas; Laxtonian, Alderman, Thomas Laxton, Early Alaska, Little Marvel.	Sweet, before peas become starchy.	Shell, discard old peas.	Small 1 min. Large 2 min.	Dry or in 2 percent brine.
Rhubarb; Ruby, New Zealand, MacDonald.	Early, tender stalks.	Trim, cut stalks 1-inch lengths.	Small ½ min. Large 1 min.	In heavy syrup or dry.
Spinach; New Zealand, Savoy types.	Young tender leaves.	Wash thoroughly.	2 min.	Dry or in 2 percent brine.

Frozen Food Lockers

ADDITIONAL SUGGESTIONS

Fruits and vegetables used for freezing should be of the best quality and should be properly matured. Fruits should be ripe enough for immediate use and yet not soft. Vegetables must be "table-ripe," tender, succulent, and free from serious defects. Over-ripe vegetables are tough and flavorless.

Fruits and vegetables should be processed and placed in the freezer the same day they are harvested, preferably within an hour or two after picking.

Containers should not be filled more than within three-fourths to one inch of the top where liquid is added to the products. Containers that are narrower at the top should not be used for liquids.

Labeling.—Careful labeling of each container, stating the kind and variety of fruit or vegetable, the treatment, if any given and date, and the locker number will greatly assist the locker renter in quickly locating what he has in the locker.

Fruit and vegetable preservation by freezing is a relatively new industry and unless one has the necessary equipment and access to low temperatures for quick freezing and storage, he may be disappointed in results. The first attempt always should be on a small scale.

PRESERVING MEATS IN FROZEN FOOD LOCKERS

BY DAVID L. MACKINTOSH

Meat and meat products represent approximately three-fourths of the volume of foods now stored in frozen food lockers. The standard commercial locker contains about six cubic feet of space, and will accommodate between 250 and 300 pounds of meat if it is carefully packaged and packed. The average family of five will consume about 700 pounds of meat during the year, which means that if the locker is to be used for poultry, fruit and vegetables, as it should be, the handling of the products to be stored must be distributed throughout the year as much as possible. Because fruit, vegetable and poultry harvests are seasonal, it may become advisable to rent additional space for a short period to care for this peak load.

Some livestock are raised on nearly all farms, and where livestock are produced, at least part of the home meat supply should also be produced.

Healthy, well-finished animals provide the best quality meat for storage. Only animals showing good quality and finish should be slaughtered for home use. Suggestions as to the weight and time of year to slaughter if a variety of meats is to be maintained in storage throughout the year, are contained in Table 3.

TABLE 3.—*Approximate yields of edible meat and by-products of livestock carcasses.*

	Slaughter.	Live weight.	Dressed weight.	Packaged weight.	Lard.
Hog.....	October.....	225	180	130	35
Beef.....	February.....	750	410	325	.....
Hog.....	March.....	225	180	130	35
Lamb.....	June.....	90	45	35*	.....
Veal.....	June.....	200	110	90*	.....
Poultry.....	Summer.....	.....	.....	.....	.....

* Either or both lamb and veal may be used. (If veal, slaughter in August or September.)

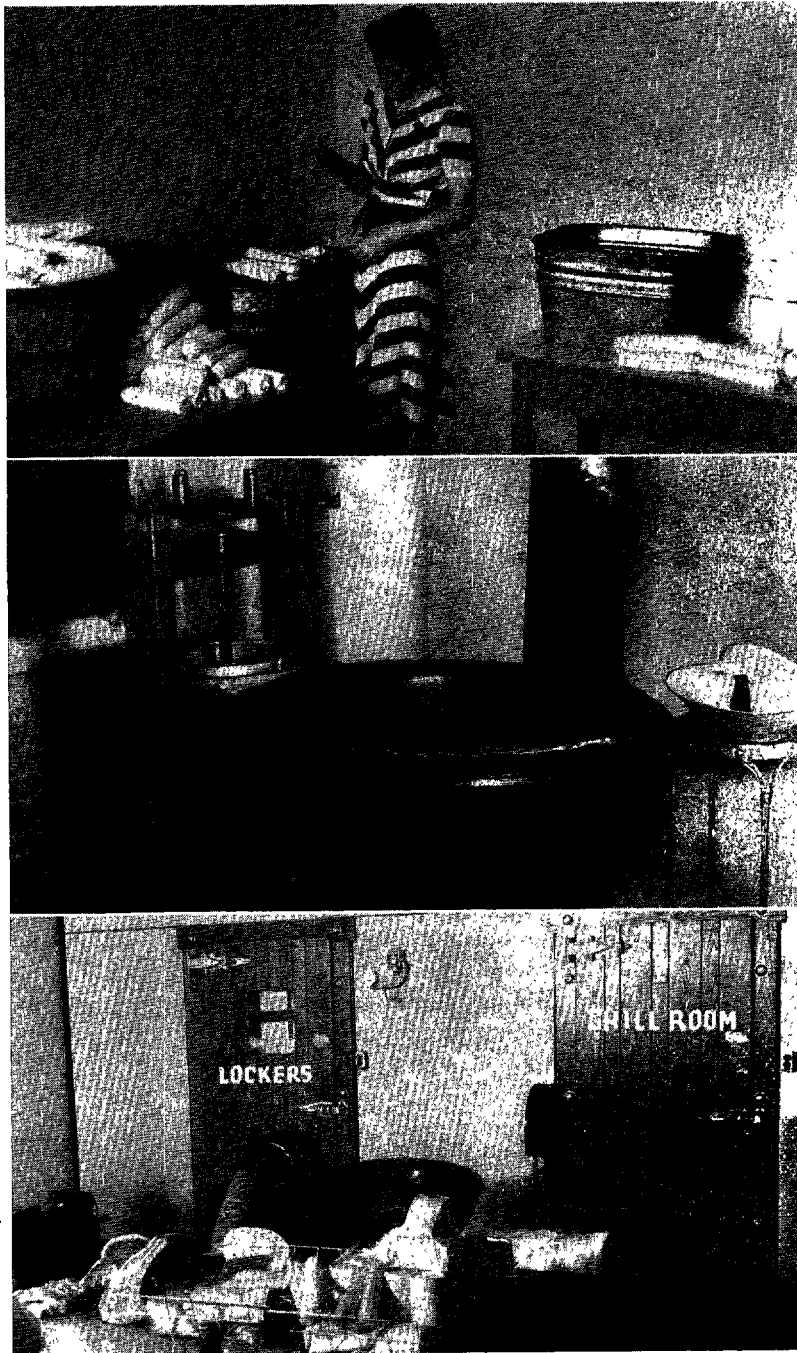


FIG. 3.—Many Kansas locker plants are equipped to process foods, and also operate retail markets in connection with the plant. A room for blanching vegetables is shown at the top of this page. A lard-rendering kettle provides more service (center) and a retail market may be operated in connection with the plant.

SLAUGHTERING

Slaughtering may be done on the farm or at the locker plant, but the most important precautions to insure good keeping quality are:

1. Sanitary conditions.
2. Immediate and thorough chilling of the carcass. During the warm months the carcass should be taken to the plant immediately in order to insure proper chilling.

Sanitation should be the watchword wherever food products are concerned. The Kansas State Board of Health inspects all frozen food locker plants operating within the state and requires each plant to meet certain sanitary standards, therefore each locker patron may feel fairly secure insofar as the sanitation and proper handling of food products in Kansas are concerned. With adequate sanitary precautions, there is no danger from food poisoning. The Kansas State Board of Health sanitary regulations for frozen food locker plants appears as an appendix to this circular.

All carcasses should be allowed to chill for 24 to 48 hours at a temperature of 34° to 36° F. before cutting. Pork and veal should be cut, packaged and placed in storage as soon after chilling as possible. Quality beef and lamb are improved by aging, and should be allowed to age or ripen in the chilling room for a period of 10 to 21 days. This ripening process increases the tenderness and develops flavor. Recent studies indicate that freezing has a tenderizing influence upon fresh beef. There seems to be no increase, however, in tenderness resulting from freezing following aging.

PACKAGING

Meat should be cut and packaged according to the family needs. The rough cuts may be boned or partially boned in order to conserve locker space.

The forepart of the carcass, sometimes known as the Kosher chuck, and including the square cut chuck, the brisket and shank offers an opportunity to conserve much space by boning. The three cuts named represent nearly one-third of the entire side of beef and that one-third contains approximately one-fourth bone.

In order to show what may be accomplished by boning this part of the carcass, the opposite sides from a carcass grading low-good were used. The three cuts combined from each side weighed 75 pounds. One side was cut in the regular style, leaving practically all the bone in the cuts, while the opposite side was boned and packaged as bone-free roasts, pot roasts, stewing and ground beef. A list of the resulting cuts from the two chucks and the weight and storage space saved are presented in Table 4.

TABLE 4.—*Conservation of locker space by boning cuts.*

Boned cuts		Lbs.	Regular cuts		Lbs.
Outside chuck, potroast.....	4.6		Shank soup bone.....	3.8	
Outside chuck, potroast.....	3.9		Shank soup bone.....	3.5	
Boned bread and butter potroast.....	5.1		Brisket boil.....	3.75	
Stew.....	2.2		Brisket boil.....	4.25	
Stew.....	2.1		Shoulder knuckle.....	4.8	
Stew.....	2.2		Boiling meat.....	4.7	
Boned brisket (boil).....	5.5		Bread and butter cut.....	3.6	
Inside chuck, roast.....	5.0		Top chuck, potroast.....	8.3	
Inside chuck, roast.....	5.6		Chuck rib, potroast.....	5.1	
Shoulder arm, potroast.....	5.9		Shoulder arm, potroast.....	5.6	
Ground beef.....	10.0		Shoulder arm, potroast.....	4.4	
			Chuck rib, potroast.....	5.9	
Total.....	52.1		Chuck rib, potroast.....	10.0	
Bones.....	20.3		Ground beef.....	5.0	
Loss in trim.....	2.6				
			Total.....	72.7	
Total.....	75.0		Loss in trim.....	2.3	
Volume, cu. ft.....	2.8		Volume, cu. ft.....	3.1	

The right side was cut in the regular manner and yielded 72.7 pounds of packaged meat, which occupied 3.1 cubic feet of space, or about one-half of the space in the average locker. In terms of costs on a yearly basis that would be nearly 7¢ a pound and only three-fourths of the meat packaged was edible, the balance being bone.

The left side was boned and rolled. It yielded 52.1 pounds of edible meat which occupied 2.3 cubic feet of space in the locker. The cost per pound for storage in this case is slightly higher than in the first, but it is for edible meat—not meat that is only three-fourths edible, and in addition 0.8 of a cubic foot of space in the locker was saved for other products. (See Fig. 4.)

The cutting costs per pound on the carcass basis would be the same, but boning work should be charged as an additional service. The time required to cut and package the bone in the chuck was 25 minutes, whereas one hour was required for boning, tying and packaging of the opposite side, therefore requiring an additional 35 minutes of time. Figuring the operator's time at \$1 per hour, 52 pounds were boned, tied and packaged in slightly over one-half hour of time or at approximately a cost of 1¢ per pound the patron saved storage on 20 pounds of bones which at 7¢ per pound would mean \$1.40 and at the same time had 0.8 of a cubic foot additional space to use for other products.

Under such conditions, boning meat is a justifiable service for all concerned. The bones removed from the right side produced two quarts of soup stock, which of course did not need to be stored in a frozen condition.



FIG. 4.—These two chucks weighed the same. The one on the right was cut in the regular manner, yielded 72.7 pounds of packaged meat which occupied 3.1 cubic feet of space. The one on the left was boned and rolled; it yielded 52.1 pounds of edible meat which occupied 2.3 cubic feet of locker space, at a saving of nearly 1 cubic foot of locker space.

WRAPPERS

Only paper recommended and proven as suitable for packaging meat for storage should be used. The chief requirements for such a paper are that it be tough, moisture-proof, and prevent the absorption of outside flavors and odors. The paper should not absorb blood, water, oil or grease, impart flavor to the meat or become brittle and crack at low temperatures. Because of these many requirements, it is only within the last two years that real good locker paper has been available. Today there are a number of papers available, any one of which fulfills nearly all of these requirements.

Everyone has his own individual technique for wrapping a package; but there are a few points that should be carefully observed when wrapping foods, particularly meat, for storage in a freezer locker. Some of these are:

1. Use a sufficient amount of paper to permit enveloping the meat completely. The ends should be carefully creased and folded so as to make the package as nearly airtight as possible.
2. Always use two wrappers. This gives added protection, aids in reducing shrinkage, and helps to make the package airtight.
3. Use only recommended papers for both inside and outside wrappers. In order to reduce the cost of packaging, some individuals

use ordinary wrapping paper for the outside wrapper. Such a practice offers no added protection to the meat.

4. Tie securely with cord or gummed tape. Wire staples should be avoided as stapling punches holes in the wrapper, and permits air to enter the package.

5. Mark each package plainly, giving the kind of meat, the cut of meat, date of packing and locker number:

Beef
2 T-Bone steaks
February 6, 1941
Locker No. 215

Suitable wrapping paper is available in different colors, and it is sometimes convenient to wrap each kind of meat in a different colored paper so that less time will be taken in locating beef, pork, veal or lamb as the case may be.

FREEZING

The meat should be frozen immediately after wrapping, otherwise the meat juices will tend to soak the wrapper. All products should be frozen as rapidly as possible. Where available, a "sharp freeze" (-20° to -30° F.) should be used. If a sharp freezer is not available, the packages of meat should be spread out in the coldest space available and allowed to remain there until completely frozen. Meat should never be placed in the locker until it has been frozen hard. Failure to take this precaution frequently results in unnecessary losses.

The storage room temperature should be 0° F. or lower, for most satisfactory results. In the case of vegetables, the loss in vitamin content is considerable at temperatures higher than 0° F.

All fats tend to become rancid in storage, and some, such as pork fat, develop rancidity sooner than others. Since a rancid flavor makes meat unpalatable to the majority of persons, there should be a consistent turn-over in the locker contents. Careful wrapping with good paper and a storage temperature of 0° F. will do much to prevent the development of rancidity. The following suggestions are offered with reference to the length of time meat can be stored safely.

- Fresh pork — Three to five months
- Beef — Six to 12 months
- Lamb — Six to nine months
- Veal — Six to nine months
- Ground beef — Maximum of three months
- Poultry — Six to 12 months
- Fish — Three to four months

Poultry.—Poultry should be handled according to the suggestions given for other meats. Only high quality poultry should be used for storage. Remember, freezing does not improve the quality of any food product. All classes of poultry are readily adapted to storage in a frozen food locker. Birds to be stored in this manner should be killed, thoroughly bled, and plucked either by the dry or

“slack scald” method. Chill over night, then singe, wash, draw and cut up as desired. There are three styles of dressing poultry for storage.

(a) *Roasters*. — Large meaty birds fully cleaned and drawn but not cut into pieces. This method of storing uses an undue amount of storage space, and the birds should be glazed before wrapping.

To glaze a fowl (or fish), it should be frozen without wrapping, then dipped into cold water two or three times. This will produce a thin film of ice over the entire surface of the meat, which should then be wrapped in the prescribed manner and stored in the locker. Glazing helps to prevent excessive drying.

(b) *Broilers*. — Young, soft-boned, soft-meated birds, fully cleaned, split down the back and drawn. The bird is divided into two equal pieces, and two or four pieces may be packed in one package.

(c) Fowl and fryers are fully cleaned, drawn, and disjointed into 12 pieces. These are usually packed in jars or cartons. The giblets should always be removed from the bird, and packaged separately. All poultry, unless glazed, should be wrapped or packaged before freezing, and all packages should be clearly labeled and dated. Use a sharp freezer and store at a temperature of 0° F. for best results. The availability of poultry and its suitability for different purposes is so distributed throughout the 12 months that poultry in some form should always be available in the locker.

Game. — Fish, game, and cured meat may all be stored in a locker if desired, provided the regular precautions regarding packaging and sharp freezing are observed. When storing game be sure to familiarize yourself with the regulations regarding the legal period of storage for each kind of game and the amount that may be stored.

It is always advisable to “glaze” fish before storing in the locker. Because fish, like pork fat, tends to develop rancidity easily, fish should not be stored for a period longer than four months.

Eggs. — Egg production is seasonable, but an ample supply of eggs for family use may be had at a minimum cost by freezing eggs when they are plentiful and the market price is low.

Fresh, chilled eggs are prepared for locker storage by breaking them into a clean bowl and beating or churning them thoroughly until the yolks are broken and well mixed with the whites. This churning prevents an undesirable coagulation of the yolk solids during storage. The whites may be separated from the yolks and packaged without churning, but the yolks should be well beaten.

Commercial companies package liquid eggs in sterilized airtight cans. Waxed paper cartons, as nearly airtight as possible, are used in most locker plants where tin is not available. Containers should be of such size that each one will contain about enough eggs for a meal of scrambled eggs, a cake, or a batch of salad dressing.

Frozen eggs may be thawed in the refrigerator or at room temperature; if the container is tight, they may be thawed in running water. Thawed eggs may be cooked or used in baking just as fresh eggs except that they should be used promptly after thawing.

COOKING FROZEN FOODS

Freezing food products does not sterilize them, it merely stops action of most types of bacteria and enzymes. When frozen foods are allowed to thaw the enzymes which are always present and the bacteria which may be present proceed with their work with increased vigor. Therefore all frozen foods should be cooked before they have completely thawed or soon after thawing. Never delay cooking of thawed meat.

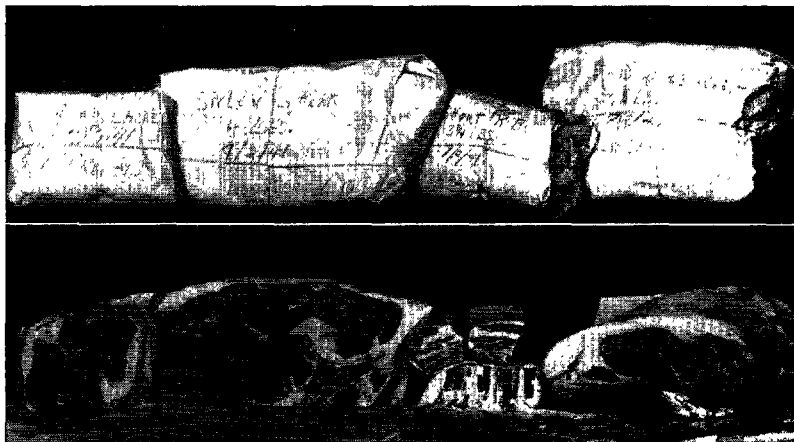


FIG. 5.—All items should be properly wrapped and plainly marked. The above illustration indicates a possible five-day supply of meat removed from the locker at one time. The pork chops should be used the first day; the short ribs would hold an extra day, the thick steak could be held in the ice box two or three days without deterioration and the roast could be held still longer. Such packages should be placed in the refrigeration without removing the wrapping paper until ready to cook.

A well planned menu and proper use of the household refrigerator makes it possible to store a week's supply of meat. Pork chops or other small cuts of meat may be held in the ice box for 12-24 hours before completely thawed. Swiss steak or other thick cuts may be held an additional day, and a fairly large roast will not be completely thawed for about three days.

All meat should be cooked at moderate temperatures. When frozen meat is cooked, low temperatures should be used and ample time allowed for both thawing and cooking. The "Time Table for Cooking Thawed and Unthawed Cuts" given in the appendix offers the best source of information on the time necessary for cooking frozen meats that is available at present.

APPENDIX

1. Time table for cooking thawed and unthawed cuts of meat.
2. Kansas State Board of Health Sanitary Regulations concerning frozen food locker plants.
3. Suggestions regarding use of frozen food lockers.
4. Meat cuts and how to cook them—Beef.
5. Meat cuts and how to cook them—Pork.
6. Meat cuts and how to cook them—Veal.
7. Meat cuts and how to cook them—Lamb.

Time table for cooking thawed and unthawed cuts.¹

Cut.	Method of cooking.	Thawed.		Unthawed.	
		Minutes per pound.	Total time, minutes.	Minutes per pound.	Total time.
Standing Rib Roast:					
Rare.....	Roasting at	18		43	
Medium.....	300 F.....	22		47	
Well-done.....		30		55	
Rolled Rib Roast:					
Rare.....		28		53	
Medium.....		32		57	
Well-done.....		40		65	
Beef Rump.....	Braising.....	30		50	
Porterhouse Steak:					
1 inch.....	Broiling	8-10		21-23	
1½ inches.....	(Rare to	10-15		23-28	
2 inches.....	Medium).....	20-30		33-43	
Club Steak:					
¾ inch.....			16-20		24-28
1 inch.....			20		30
Chuck Steak:					
½ inch.....	Panbroiling.....		7		11
Round Steak:					
½ inch.....	Panbroiling.....		7		11
Beef Patties:					
1 inch.....	Panbroiling.....		8		16
Lamb Chops:					
¾ inch.....	Panbroiling.....		10		15
1½ inch.....			20		25
Shoulder Lamb Chops:					
½ inch.....	Braising.....		15		20
Boneless Lamb Shoulder....	Roasting.....	40			50
Leg of Lamb.....	Roasting.....	30-35			40-45
Pork Chops:					
¾ inch.....	Braising.....		45		55
Pork Loin:					
Center cut.....	Roasting.....	30-35		50-55	
Rib or Loin end.....		50-55		70-75	
Sausage Patties:					
¾ inch.....	Panbroiling.....		10		15
1 inch.....			15		23

1. Food and Nutrition News, Vol. X, No. 4.



FIG. 6.—A well-equipped and sanitary processing room for meat products is essential.



FIG. 7.—A smokehouse such as this one illustrated enables the locker plant to supply more service to its patrons.

Kansas State Board of Health

Sanitary Regulations Concerning Frozen Food Locker Plants

(1) **Frozen food locker plants defined.** For the purposes of these regulations, a frozen food locker plant shall mean any plant which provides lockers, cabinets, boxes, baskets or other receptacles kept constantly under freezing temperatures for the storage of food products.

(2) **Means for cleansing and sterilizing tools and equipment.** Every frozen food locker plant shall be provided with adequate means for washing and sterilizing tools and other equipment. An adequate supply of safe water shall be provided and if hot running water is not available, means of heating shall be provided.

(3) **Sodium hypochlorite for sterilizing tools and equipment.** All tools and utensils used for the processing of meats shall be thoroughly cleaned after processing of each patron's meat and sterilized in a solution of sodium hypochlorite or equivalent chlorine preparation containing not less than 200 parts per million of available chlorine, before being used for further processing.

(4) **Toilet and handwashing facilities.** Each plant shall be provided with adequate sanitary toilets and proper handwashing facilities. Every person handling food products in the plant shall be required to wash his hands after use of the toilets. Clean individual towels shall be provided.

(5) **Personal uncleanness prohibited.** Where patrons of frozen food locker plants are permitted to prepare their own products for storage, they shall wear clean clothing, refrain from the practice of unclean habits and from the use of tobacco within the plants.

(6) **Inspection by plant operator.** All food products shall be subject to the inspection of the plant operator. Any meat products showing obvious sign of disease or decomposition shall be rejected for storage. Any vegetable or fruit products showing obvious signs of decomposition or infestation with insects shall be rejected for storage.

(7) **Packaging for storage.** All products shall be prepared for storage in frozen food lockers by packaging in some impervious type wrapper or container. The use of newspapers, bread wrappers and other similar materials is prohibited.

(8) **Human food only to be stored.** Only food products for human consumption shall be permitted to be processed in the processing room, or stored in a locker room or locker of any frozen food locker plant.

(9) **Products to be frozen before storage.** All food products shall be completely frozen before storage in lockers.

(10) **Place for processing.** All processing shall be done in an enclosed or semi-enclosed place, used only for the purpose of processing foods and not open to persons not engaged in the processing of foods for storage.

Suggestions Regarding Use of Frozen Food Lockers

Freezer lockers in Kansas vary in type from a single storage or locker room to a complete service plant. For future plant installation a complete service plant is recommended.

A complete service plant has the following units:

1. **Locker room.**—A temperature not higher than 0° F. should be maintained.
2. **Sharp freeze.**—A maximum temperature of 0° F. or lower *should be maintained.* Racks should always be used on the coils.
3. **Work room.**—Should be cooled—temperature 40°-50° F. Blocks, grinder, saw, wrapping table, etc.
4. **Chill room.**—Temperature of 32-36° F. should have adequate refrigeration to pull to 28° F. if necessary.

Additional Services:

1. **Rendering.**—Rendering equipment should be in separate room.
2. **Curing.**—May be done in chill room or separate cooler. Temperature of special cooler should be 35-40° F.
3. **Smoking.**—Smokehouse should be in rear.
4. **Slaughtering.**—Slaughtering facilities may be adjacent to plant. But most do slaughtering in the country and haul carcasses to cooler.
5. **Delivery.**—Know of no such service in Kansas.
6. **Processing fruits and vegetables.**—The rendering room may be employed for this type of service.

The following scale of charges seems typical in Kansas:

Complete service including chilling, cutting, packing, sharp freezing and placing in locker. One and one-half to two cents per pound in the carcass.

Locker rent:

(Approximately 6 cu. ft. in locker) \$9 by the year; \$1 per month. Special lockers more, smaller lockers less.

Individual charges:

1. Slaughtering—Hogs up to 250 pounds.....	\$1.00 to \$1.50
Over 250 lbs.—\$0.50 additional for each 50 lbs.	
Cattle	1.50
Calves .....	.75
Lambs .....	.50
Pick-up charges	1.00
2. Cutting, including wrapping.....	.01 per lb.
3. Grinding .....	.01 per lb.
4. Stuffing sausage .....	.01 per lb.
5. Curing and smoking.....	.01½-.02
6. Rendering lard .....	.02-.03
7. Sharp freezing only .....	.01 per lb.
8. Vegetables—complete service.....	.04-.06
9. Fruits—complete service .....	.05-.06
partial service .....	.03 per lb.
10. Poultry—sharp freeze—glaze and package.....	.03

The storage of fruits and vegetables in Kansas is advocated as a wise procedure for both locker patron and locker operator. Progress along these lines should be slow.

Types of Wrapping Paper:

Many varieties of freezer locker paper are now available. The chief requirements are: (1) tough, (2) moisture proof, (3) vapor proof, and (4) can be marked plainly.

- Special parchments
- Wax papers
- Special treated (Antioxidant)
- Pliofilm (Goodyear Rubber Company)
- Cellophane (Special treated)
- Cry-O-Vac (Latex)

Length of Storage Period:

1. Beef, 9 to 12 months
2. Pork, 3 to 5 months
3. Lamb, 6 to 8 months
4. Ground meat, maximum 90 days

Packaging:

- Pack in size pieces desired.
- Pack a minimum amount of bones.

Inventory:

An inventory card for the locker contents is very desirable.

QUALITY PRODUCTS ONLY SHOULD BE STORED











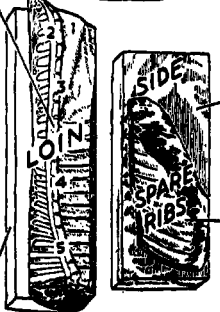








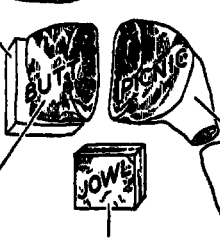
















BEEF CHART



HINTS ABOUT BEEF

There is a cut of beef for every occasion. . . . When selecting a beef roast or pot-roast, it is wise to choose a larger one than is needed for one meal because this makes second and third day meal preparation easy. . . . Meat adds tastiness to vegetables cooked with it. . . . Beef roasts and cuts to be broiled may be cooked rare, medium or well-done, according to personal preference, but over-cooking should be avoided. . . . The fat of any meat enhances its flavor.

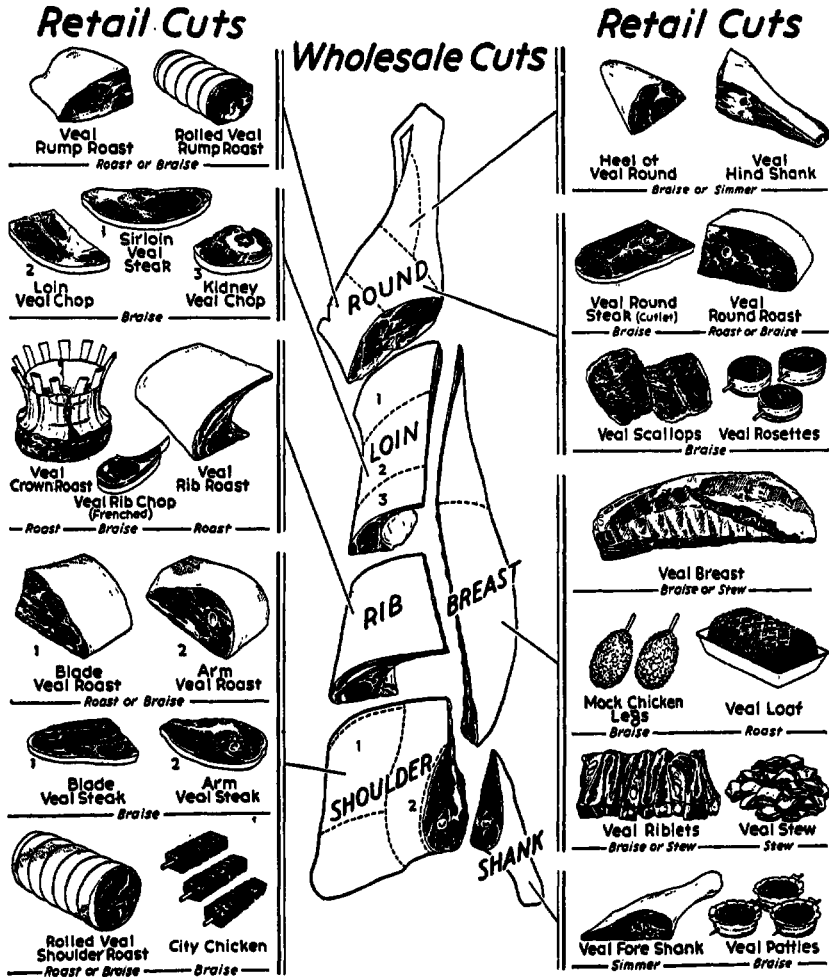
PORK CHART

Retail Cuts	Wholesale Cuts	Retail Cuts
 2 Sirloin Pork Roast Roast  1 DorR Tenderloin Frenched and Whole Broil or Braise		 Half Ham Butt End  Half Ham Shank End Bake or Simmer
 2 to 5 Canadian Style Bacon Broil  3 Loin Chop  4 Rib Pork Chop  6 Frenched Rib Chop  2 to 5 Butterfly Chop Broil or Braise		 Ham Butt Slice  Center Ham Slice Broil or Panbroil  Fresh Ham Roast  Rolled Fresh Ham Roast Roast
 1, 2 Loin Roast Ham End  3, 4 Loin Roast Center Cut  5 Loin Roast Shoulder End  4 Crown Pork Roast Roast		 Bacon  Salt Pork Broil, Panbroil or Seasoning  Spareribs Simmer, Braise or Roast
 Fat Back  Lord Lord - Salt Pork Shortening	 Bacon Square Seasoning, Panbroil	 Fresh Picnic Shoulder Roast  Smoked Picnic Shoulder Bake or Simmer  Cushion Style Picnic Shoulder  Rolled Picnic Shoulder Roast
 Blade Pork Steaks Braise  Smoked Cottage Roll Bake or Panbroil  Boston Style Butt  Rolled Boston Style Butt Roast		 Fresh Shoulder Hock Simmer  Arm Pork Stear Braise

HINTS ABOUT PORK

Pork always should be cooked well-done to bring out its rich delicious flavor. . . . All pork cuts should be cooked slowly. . . . Carving a pork loin is easier if the backbone is separated from the ribs before cooking. . . . Bacon for breakfast starts the day right. In cooking, place in a cool skillet and cook slowly. . . . Do not hesitate to choose a whole or half ham, because it is good to the last bite, either hot, sliced cold, or in combination dishes.

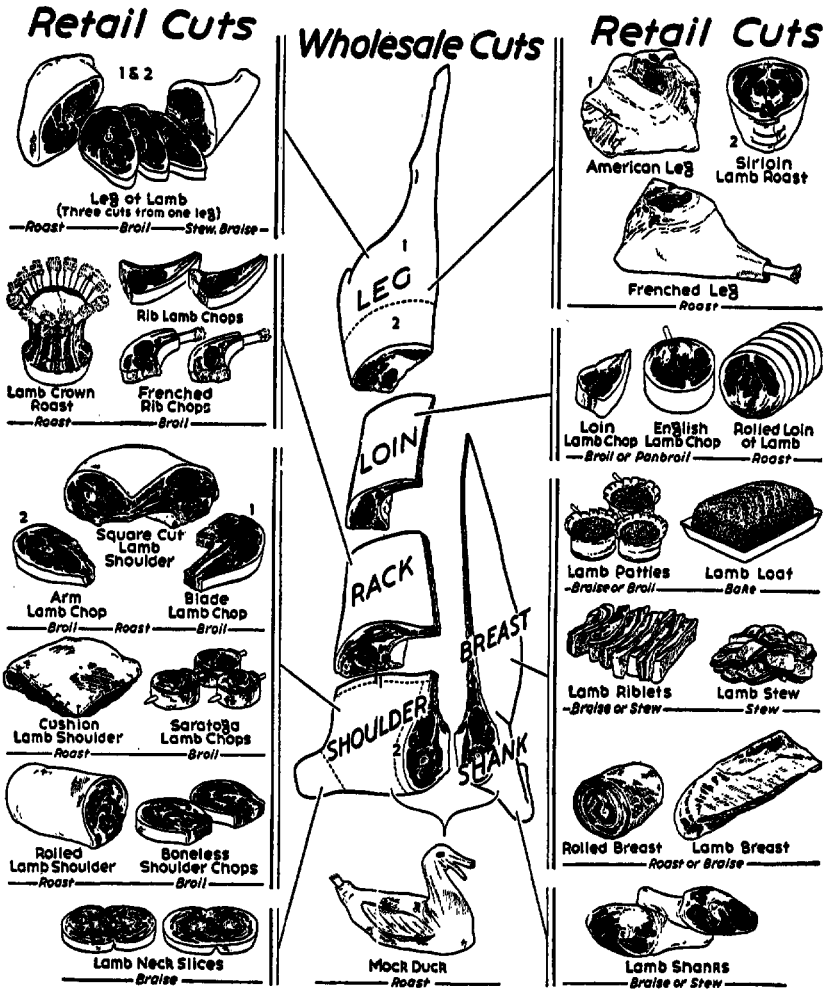
VEAL CHART



HINTS ABOUT VEAL

Veal is a very tender and delicately flavored meat. . . . Veal should be cooked slowly; veal roasts never should be seared. . . . Bacon or thin slices of salt pork may be placed on top of a lean veal roast for added fat. . . . Sour cream added to veal chops after browning gives a delightful flavor. . . . Veal birds are made by wrapping pieces of veal steak around a savory stuffing. . . . Leftover roast veal is excellent for a cold meat platter, sandwiches, salads or creamed dishes.

LAMB CHART



HINTS ABOUT LAMB

Lamb is a year around meat, always in season. . . . Every cut of lamb is tender and easily prepared. . . . The thin paper-like covering, known as the "fell," should not be removed from a leg of lamb for roasting. . . . Boning a lamb shoulder makes carving easy. The cavity may be filled with a savory stuffing. . . . Lamb is delicious if cooked just short of well-done. . . . Lamb may be served hot or cold, but never luke-warm. . . . The flavor of lamb combines well with all kinds of vegetables. . . . Lamb chops are best for broiling when cut thick, at least one inch.