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Frozen Locker Storage Developed Here

Investigation of Preservation Of Fruits and Vegetables By Freezing Conducted in Valley

EDITOR'S NOTE: Investigation of the freezing preservation of Texas fruits and vegetables is being conducted co-operatively in the Lower Rio Grande Valley by the Texas Agricultural Experiment Station, on crop production, and the U. S. Fruit and Vegetable Products Laboratory, on processing and freezing. This informal discussion of the preparation of these crops for frozen locker storage was presented at the Texas Annual Farmers' Short Course, College Station, July 11, 1940.

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Frozen locker storage has been developed primarily for meat products. However, when space is not filled, suitable varieties of fruits and vegetables, whole, sliced, pulped or in the form of juice, may be advantageously preserved, efficiently utilizing lockers and extending the season during which desirable products may be served in prime condition. A study of local fruits and vegetables and locker facilities, in relation to State Extension Service Food Supply Plans which have been tested are listed under discussions of individual fruits and vegetables, and advice relating to varieties suitable for planting in various parts of Texas may be requested from County Agents and Experiment Sub-Stations, in various parts of the State.

The purpose of freezing storage may be stated as the preservation of selected foods with minimum change in flavor, appearance and food value. To accomplish this purpose it is necessary to prevent injury by enzymes, spoilage organisms, oxidation, drying or contamination by odors from other products in the storage space. Several requirements must be fulfilled.

Varieties Carefully Selected

1. Varieties must be selected for color, flavor, texture and adaptability for production and freezing under local conditions. Such factors as shipping or canning quality are not important in selecting varieties for freezing preservation. Varieties which are excellent for immediate consumption, for canning, or for shipping may deteriorate objectionably during the frozen storage. Suitable varieties of apricots, berries, figs, nectarines, cherries, peaches, plums, asparagus, broccoli, brussell sprouts, cauliflower, corn, snap beans, lima beans, peas, squash and greens have been demonstrated. A number of tropical fruits and fruit pulps have been preserved by frozen storage. Citrus and tomato juices may be frozen. Whole celery,

THE RIO GRANDE



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lettuce, citrus fruits, cucumbers and tomatoes are not well adapted to freezing preservation.

Varietal tests are being conducted co-operatively in many sections by state and federal agencies. Varieties which have been tested are listed under discussions of individual fruits and vegetables, and advice relating to varieties suitable for planting in various parts of Texas may be requested from County Agents and Experiment Sub-Stations, in various parts of the State.

2. Fruits and vegetables for freezing must be harvested at the proper stage, usually approximating the best condition for immediate table use. Fruits should be fully mature in color, flavor and sweetness, but should not be mushy, moldy, bruised, or overripe. Vegetables should be succulent and tender. Slight overmaturity may not greatly lower the quality of vegetables for canning, but starchiness is a defect in products intended for freezing preservation, because little cooking is involved.

3. Fruits and vegetables must be prepared for freezing promptly after harvesting, and must be kept moist and cool during transportation from the field. With the exception of a few stable products like cranberries, freezing should be completed within a few hours after harvesting. Cold storage can only partly compensate for delay in freezing.

Equipment Is Needed

The equipment need for preparing fruits and vegetables for frozen locker storage includes the utensils used for preparing these commodities for

home use, including knives, kettles, a stove, a supply of clean cold water, and a sink and drain. Kettles should be enamelled, aluminum or stainless steel. Galvanized utensils should not be used for acid fruits. Wire mesh baskets with covers are convenient for scalding vegetables. Slicers, pulpers and juicers aid in the preparation of certain products. A can sealer is needed for sanitary cans. Thermometers, scales and cup, quart and gallon measures are convenient, when available.

Preparation Explained

Preliminary preparation includes such operations as cleaning, sorting, trimming, peeling, shelling, coring, slicing, pulping and juicing. Washing, grading and trimming should be adequate to insure clean products of fancy quality.

Peeling, shelling and slicing release enzymes and permit penetration of yeasts, molds, and spores, consequently, after these operations, preparation for freezing should be completed without delay. Fruits subject to browning should be covered with cold syrup, 2% citric acid solution, water, or dilute salt brine immediately after peeling or slicing. Pulp subject to rapid browning (peaches, etc.) should be mixed with 25% sugar as soon as prepared.

Peeled and sliced fruits which darken as a result of enzyme action, when in contact with the air, are usually covered with 40 to 60 per cent sugar syrup for freezing. Heaviest syrups are used for most acid fruits, and 45 to 50 per cent syrup are suitable for most fruits. If scales are not available, equal volumes of sugar and water (cup for cup) yield approximately 46% syrup. Syrups should be precooled before use.

Vegetables are scalded from 1 to 8 minutes in steam or clean boiling water to inactivate enzymes. A large kettle of boiling water may be used for water scalding. For scalding in steam, vegetables may be placed in a wire basket in the top of a pressure cooker containing one inch of hot water. The time of scalding is measured from the first flow of steam from the escape vent.

Insufficient scalding may result in deterioration in flavor and color, even under favorable storage conditions. Excessive scalding injures quality. Proper scalding times are suggested under discussions of individual vegetables. Wire mesh baskets similar to french fry baskets, or larger baskets equipped with wire mesh covers are convenient for scalding vegetables in water or steam.

After scalding all vegetables should be cooled rapidly by immersion in clean, cold water, and may be packed dry, or covered with precooled 2% brine (1 level teaspoonful of salt per quart of water) for freezing. Freezing should follow with as little delay as possible.

Glass Containers Best

Sanitary sealed tin cans and glass containers afford the greatest protection against evaporation, oxidation and absorption of foreign odors, and

are best for highly perishable products and for prolonged storage. If cans are used for red color fruits and vegetables, such as berries, cherries, beets, etc., cans lined with "berry" enamel should be obtained. These cans may be advantageously used for other products, as, at low temperatures, they resist corrosion by brine or acid juices.

Cans and jars should not be completely filled, as space should be allowed to accommodate for expansion (1 1/4 inch in jars, 1/2 inch in cans) during freezing. Friction top and slip top cans afford a degree of protection approaching that of hermetically sealed containers. Transparent rubber, or lacquered cellophane films provide considerable protection. Paper and cardboard, coated with paraffin are slightly porous at low temperatures, but make suitable containers for products not highly susceptible to damage by oxidation and evaporation.

Combination packages consisting of lacquered cellophane bags enclosed in waxed cartons or tubs, or in bags of kraft paper, glassine or asphalt-laminated paper are convenient packages for storage in limited space. Tub lids may be sealed with melted paraffin; and a coating of melted paraffin may be applied to the outside surface of tubs by means of a paint brush.

Freezing and Storage

Products may be frozen in the sharp freezer prior to packaging by spreading on wire or sheet metal trays placed on freezing coils or cooled by an air blast. In this manner the freezing of small products such as English peas, may be substantially completed in 25 minutes. The frozen products may be removed to a room at ordinary temperature, filled in packages and promptly returned to lockers for storage.

When products are frozen in packages, individual packages should not be stacked tightly, or placed in large cartons before freezing, but may be placed in single layers on trays or loosely scattered or piled in the sharp freezing room where the air is circulated by a fan. Still air is a poor conductor and spoilage may occur in packages before freezing, if the air is not circulated.

After freezing, products may be stored below 0° F. in lockers from 4 months to a year, varying with the products, the package and the uniformity and degree of temperature.

If, because of a plant break down, the storage temperature should rise sufficiently to permit thawing, non-acid products (vegetables) in sealed containers should not be tasted before being thoroughly cooked. No case of illness caused by frozen foods is known but it should be remembered that frozen products are not sterile, and are consequently perishable. They must be maintained in frozen condition until prepared for the table to avoid spoilage.

Fruits and vegetables prepared as for locker storage may be frozen and temporarily preserved in the ice cube compartments of gas and electric re-

frigerators, provided the temperature control is set for rapid freezing. Some new model refrigerators have large freezing compartments, making it possible to hold considerable quantities of frozen foods.

To prevent thawing of products during removal from locker storage for home use, packages may be protected by any suitable insulating material, such as felt, crumpled paper, corrugated card board, rock wool, coarse saw dust, wood shavings, etc. The degree of insulation which is needed varies with the length of time required for transportation and upon atmospheric temperatures.

Allow Fruit to Thaw

Frozen fruits may be allowed to thaw overnight in refrigerators or packages may be thawed rapidly in 30 to 90 minutes by placing cans or jars in water, not to exceed 100° F. The temperature should not exceed 45° F. for serving. Juices may be thawed for serving in the same manner as fruits. Rapidly frozen fruit pulps may be served, without thawing, as a frozen dessert, or may be used in preparing fruit ice cream (15 percent).

Frozen vegetables may be dropped into boiling salted water without thawing and the cooking time is measured after the mixture returns to boiling. The time for cooking frozen vegetables is ordinarily 25-50 percent shorter than that required for cooking fresh products.

Specific Vegetables Listed

Asparagus: Very little asparagus is grown in Texas. Suitable varieties possess bright colored and succulent stalks, and are free from woody fiber at optimum maturity. Asparagus should be kept cool and damp and prepared as for table use, scalded 3 minutes in steam or boiling water, (preferably steam) cooled and packed in tightly sealed tin cans or glass jars for freezing storage.

Lima Beans: Varieties with bright green color and tender texture, and which mature uniformly are preferred. Henderson, Baby Potato, Wood's Prolific, Long Podded Lima, Dreer's Bush, New Wonder, Fordhook and Wilson Improved Bush varieties have been frozen satisfactorily in South Texas. Starchy, dry and overmature beans should be rejected. After shelling, promptly scale 2 to 3 minutes in steam or boiling water. Cool at once and pack dry, or in 2 per cent brine for freezing storage.

Snap beans: Beans with dark green or bright yellow color, tender texture, and good flavor are preferred. Bountiful, Giant Stringless Greenpod, Keeney's Stringless Greenpod, Full Measure, Blue Lake, Tender Green, Stringless Valentine, Refugee, and Asgrow Stringless Greenpod are bush varieties which have been successfully frozen.

Wax podded bush type bean varieties which have been frozen include Roundpod Kidney Wax, Pencillpod Black Wax, Keeney's Stringless Kidney Wax.

Pole Beans have not been tested in South Texas, but varieties which

have suitable flavor, color and texture may be used.

Prepare freshly harvested snap beans as for table use. Scald 2 to 4 minutes in boiling water or steam, cool rapidly and pack with or without 2 per cent brine, for freezing storage.

Broccoli: Italian Sprouting broccoli has a dark green color and has been found well adapted to freezing preservation. For freezing, the center shoot is perfectly nipped when it appears, and side shoots, harvested upon reaching a length of 5 inches, make it possible to arrange an attractive asparagus style pack.

Scald 3 to 5 minutes in steam or boiling water, pack dry, or with 2% brine, for freezing storage. Brussels Sprouts: Firm compact sprouts of bright color are desirable. Avoid wilting; prepared freshly harvested sprouts as for table use. Scald 3 to 5 minutes in boiling water and freeze dry, or in 2% brine.

Carrots Rarely Frozen

Carrots: Carrots are rarely frozen alone, but mixtures of carrots and peas may be frozen.

Bright colored, coreless varieties should be peeled and cubed or sliced and cooked to the desired tenderness before mixing with peas. The mixture is then prepared for freezing as described for peas.

Cauliflower: Uniform color and tender texture are characteristic of desirable varieties. Prepare as for table use and scald 3 to 4 minutes in steam or boiling water. Pack dry or with 2% brine for freezing storage.

Sweet corn: Varieties such as Golden Bantam, Stowells Evergreen and Country Gentleman, which are grown in the north are not well adapted to production in South Texas. Yields are un dependable and these varieties are subject to excessive damage by earworms. However, growing tests by the Texas Experiment Station, and others, have demonstrated varieties and hybrids which produce satisfactory yields of fine quality sweet corn.

A long tight husk is characteristic of desirable varieties for the reason that it affords protection against damage by earworm. Most of the desirable varieties and hybrids are characterized by large vigorous stalks and large ears of corn, possessing a tender texture and desirable flavor. Of the white varieties and hybrids Long Island Beauty, Iogreen 729x 1071, Iogreen 191x1248 and Iogent (1012x1445) have produced well and have shown slight earworm damage in the Lower Rio Grande Valley. Yellow varieties which have produced promising yields of sweet corn of excellent canning and freezing quality include: Iogold (Perdue 60 x Iowa 45), Ioglen (Perdue 81 x Iowa 45), Iowan (Perdue 39 x Iowa 45), and Iogold (13 x Iowa 45).

Desirable hybrids developed at the Texas Experiment Station and not yet named, are identified by the following numbers: 3616-14-1 x Iowa 45, 36122-3 x Iowa 45, 37131-3 x Iowa 45, 36126-1-2-1 x Iowa 45.

Field corn and converted field corn are not adapted for freezing preservation, although several tight husked varieties are satisfactory for use as fresh roasting ears.

Corn Deteriorates Rapidly

Corn deteriorates rapidly after harvesting and unless chilled below 40° F. should be prepared for freezing within one hour after harvesting. Corn is husked, silked and trimmed as for table use and scalded in steam or boiling water. If corn is to be frozen on the cob, the scalding should be for 8 minutes, followed by rapid cooling in cold water. After freezing on trays the frozen ears may be tightly wrapped in waxed paper and bagged for storage, or may be filled in cans or other containers for freezing storage.

If corn is to be cut from the cob, four minutes for scalding in steam or boiling water is sufficient, and after rapid cooling the corn may be cut from the cob and should be packed without brine for freezing storage.

Peas: For freezing peas should possess a sweet flavor, tender texture, and a brilliant green color after scalding. Canning and field varieties of peas are not suitable for freezing preservation. Garden varieties are adapted. In South Texas only early maturing varieties have been found adapted to production during the fall months. Dark Podded Thomas Laxton, Glacier, Teton, Laxton's Progress, Thomas Laxton, World's Record, Early Gradus, Improved Gradus, Asgrow 40, Roger's Giant Podded, Hundredfold, Morses 101, and other sweet garden peas which thrive locally may be used. Dark Podded Thomas Laxton is preferred by commercial freezers for early fall planting in well irrigated soil.

Prepare freshly harvested peas as for table use. Scald 1 to 1 1/2 minutes in steam or boiling water. Cool rapidly and pack dry or with 2% brine for freezing storage. Greens: Spinach, Swiss Chard, Kale, Mustard, Turnip and Beet Tops and similar greens may be frozen. Varieties should be tender, possess a brilliant color after scalding, and should be free from woody fibre.

Prepare as for table use, washing and trimming carefully. Scald 2 minutes in boiling water and freeze in packages without brine.

Squash: Thinly sliced summer squash may be frozen after scalding 2 to 3 minutes, preferably in steam. Squash is less desirable for freezing than some of the other vegetables mentioned in this discussion. Succotash: A mixture of three fourths cut corn with one fourth snap or lima beans may be frozen after separate scalding. The quality compares favorably with that of the fresh product.

Suggestions for Preparing Fruits

With the exception of berries and citrus, fruits are not grown in the Lower Rio Grande Valley. Deciduous fruits and such tropical fruits as guava, mango, etc., are raised un-

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FROZEN

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der Mexican Fruit Fly quarantine regulations.

Freezing preservation investigations have not been conducted on fruits other than berries and citrus in our laboratory, and the suggestions outlined here are based upon observations made in other sections of the country.

Apples: Little is to be gained by the freezing preservation of apples as this fruit is well adapted to cold storage and canning. However, sliced apples, protected by syrup, or by vacuum packing may be frozen for use in pies.

Apricots, nectarines and peaches: The preservation of these fruits is similar, with the exception that peaches are ordinarily peeled after scalding 15 to 30 seconds in boiling water, and chilling in cool water to loosen the peel so that it may be slipped off. Yellow free stone peach varieties, which resist browning are best adapted. The Hale, Slappey, Candoka are somewhat more resistant to browning than the Elberta varieties. However, any peach possessing a desirable flavor, texture and color may be frozen, and tests with local varieties will reveal which are best adapted in any community.

Most varieties of apricots, and nectarines, which have a strong flavor, high sugar content and brilliant color and mature uniformly are adapted to freezing. Tilton, Blenheim, Royal and Moorpark apricots have been used. Fruit should be selected at the firm to slightly soft ripe stage, and immature and mushy fruit discarded. Apricots and nectarines may be frozen without peeling; peaches should be peeled. All these fruits should be halved and the seeds removed. Halves may then be frozen or they may be quartered, sliced or pulped for freezing. Slices should be immediately covered with sugar syrup or citric acid solution, and the pulp should be immediately mixed with not less than 25 per cent of sugar to retard browning. Slices and pulp should be promptly packed and frozen.

Berries: Blackberries, loganberries, raspberries and strawberries may be frozen. Available varieties may be used. Varieties which ripen evenly, resist bruising and have superior flavor, color and texture, free from seediness, are generally best. Berries may be frozen whole, sliced, pulped, or in the form of juice. Berries should be cleaned, sorted and hulled, if necessary, and washed and drained.

Whole and sliced berries may be covered with 40 to 50 per cent sugar syrup and frozen promptly. Pulp may be formed by passing the drained berries through a continuous screw type pulper, with screen perforations of 0.033 inches, or other device, and should be mixed with not less than 25 per cent of sugar, and frozen rapidly as possible.

Cherries May be Preserved

Cherries: Some varieties of cherries may be preserved by frozen storage with fair success. Cherries should be thoroughly washed and the seeds removed. Of the sour varieties, Montmorency is considered one of the best; of the sweet varieties Lambert is generally preferred.

Forty per cent sugar syrup is necessary for sweet varieties, whereas 55 to 60 per cent sugar syrup is required for the acid type of fruit. Experiments with local varieties will indicate which are best adapted to freezing storage. Cherries should be frozen in tightly colsed cans or jars, completely covered with sugar syrup to avoid loss of flavor and color. Proper maturity is important and cherries which are immature or over-ripe should be discarded.

Figs: The Magnolia is the only fig variety of which appreciable quantities are available in Texas.

Peaches: See apricots.

Plums and Prunes: Italian and French prunes; Damson, Santa Rosa, Elliott and Diamond plums have been frozen successfully. Fruit should be washed, halved and pitted without peeling, covered with 40 to 60 per cent sugar syrup, depending upon the tartness. Freeze in glass or enameled tin containers.

Rhubarbs: Bright colored, tender succulent varieties, free from woodiness and with a pronounced flavor are preferred. Clean, trim and prepare as for table use in pies or sauce. Cut into short pieces and freeze covered with 40 to 50 per cent sugar syrup.

