

Home Food Preservation

Canning—Drying—Salting
Smoking—Storing

Many authorities at Oregon State College have cooperated to bring you this bulletin. They have tried to give details and schedules that will give practical results if carefully followed. Much of your success, however, will depend on painstaking care in following each step. Especial care is needed to ensure that your processing temperatures in canning are high enough and that you really process foods the required time. With hot water bath, keep the water at a constant rolling boil. With the pressure cooker, have the gauge tested yearly or install a thermometer on the cover. Write down the time at start and finish of processing, so that nothing will interfere with adequate length of processing. Success depends upon your careful technique.

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Home Food Preservation

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THE preservation of surplus products at home for family use or exchange makes possible a variety in diet and reduces the cost of living for many families. Winter gardens and storing, salting, drying, and freezing of foods may well be increased and canning limited to those foods that cannot be preserved successfully by these less expensive or less laborious methods. Good aims for canned products are: safety for use, freedom from spoilage, and desirability for eating. Another important consideration is careful planning of the amounts and choice of foods so that balanced meals can be prepared.

CANNING

PREVENTION OF FOOD SPOILAGE

Causes of food spoilage

Foods spoil from two causes. First, complex substances in living tissues, called enzymes, are naturally produced by the food itself and if allowed to develop cause the food to ripen and finally to spoil. Second, the growth of very small forms of plant life, called micro-organisms, which exist everywhere about us, in the air, in the soil, on foods and elsewhere, causes food to spoil. These small living bodies include yeasts, molds and bacteria. The fermentation of stewed fruit and the mold on bread are familiar evidences of spoilage due to these yeasts and molds. Both yeasts and molds, however, are quickly destroyed at the temperature of boiling water.

Bacteria may pass from the growing or vegetative form into the resistant or spore form. This fact is of special interest in canning, because bacterial spores may not be destroyed by even prolonged boiling. The *Clostridium botulinum*, which causes food poisoning, has been known to live through six hours of boiling in canning foods in which little or no acid was present. Although this dangerous micro-organism has caused a very small proportion of deaths, yet home canners must acknowledge that it does exist, and they should recognize that a certain amount of risk, therefore, is involved when using non-acid foods canned by the hot-water-bath method, unless the practice of boiling home-canned products before tasting the food is always followed. For a number of years no outbreak of botulism has resulted from the use of any canned products processed by nationally recognized commercial canneries.

Publications by the Bureau of Home Economics of the United States Department of Agriculture and by the Extension Service of a number of states give no directions for home canning of vegetables by any other method than by pressure cooker. Because thousands of Oregon families are unable to purchase pressure cookers, and *must* do home canning, and because the number of deaths from botulism is less than one-tenth of one per 100,000 population, directions for

*Valuable cooperation has been given in the preparation of this bulletin by members of the Departments of Foods and Nutrition, Animal Husbandry, and Bacteriology, Oregon State College.

canning at boiling temperature are included in this bulletin, but without recommending this method.

The botulinus organism itself is not harmful, but the toxins that it produces in the food are poisonous. Although boiling does not destroy the botulinus organism, the poison it produces is destroyed by boiling 20 minutes. Because of the danger of poisoning in home canned products, all nonacid home canned foods should be boiled 20 minutes immediately after opening the jar, *before tasting. The danger of spoilage cannot always be detected by either appearance or odor.* If the product is obviously spoiled, destroy it immediately by burning it, or by burying it with one tablespoonful of concentrated lye per quart. Do not place it where animals can reach it.

The danger from home-canned tomatoes and fruits of low acidity is slight; poisoning from these foods has been reported, however, and proper care should be taken in preparing and processing them.

The steam pressure cooker is the only method recommended for canning nonacid foods such as vegetables, meat, fish, and other sea foods. Even with this method it is essential that the pressure cooker gauge be accurate, and that directions for the use of the cooker be carefully followed. The pressure cooker is no guarantee of safe canning unless it is in proper condition and used correctly. The pressure cooker should be equipped, if possible, with a thermometer. While much canning of nonacid foods has been done in a wash boiler or similar equipment without spoilage, the pressure cooker may save its cost in one season alone by reducing loss by spoilage.

Two fundamental procedures in prevention of spoilage

1. *Application of adequate heat:* Every particle of food within the jar or can must be brought to a sufficiently high temperature and held at that temperature a sufficiently long time to destroy the bacteria and other organisms that cause spoilage. Processing is the term applied to this heating of food that brings about sterilization or conditions that prevent the growth of organisms. Incomplete processing is a common cause of spoilage of canned goods.

2. *Air-tight seal:* Jars must be sealed so tightly at the end of the processing that air, which carries micro-organisms, cannot enter. Lack of air-tight seal is very frequently the cause of spoilage in jars and cans.

OTHER FACTORS IN SUCCESSFUL CANNING

Products. Can only sound, fresh products. Two hours from garden to can is a good rule to follow in canning vegetables and fruit. Quick handling reduces enzyme action and bacterial growth, both of which are hastened when food is allowed to stand in a warm place. Acid products are most easily canned, as bacteria do not grow easily in acid medium.

Cleanliness. Food that is clean is less likely to harbor organisms dangerous to health than dirty food. Canning success depends to a considerable degree upon clean food, clean equipment, clean methods, and personal cleanliness.

Jars and lids. A good jar is simple in construction, can be sealed perfectly, and can be washed easily. Jars with bubbles in the glass should be avoided. Wide-mouth jars are convenient for packing large pieces of food that should be removed from the jar without injuring their shape, such as halves of pears

and peaches, and pieces of salmon and meat. Half-gallon jars are recommended only for highly acid fruits. Adequate heat may not penetrate to the center of large jars. Half-pint jars are convenient for sieved vegetables to be used for young children.

No metal cover (unless lacquered) comes in direct contact with the food. Caps for screw-top jars should have smooth level edges that make perfect contact with the rubber rings. Glass jar tops should be free from nicks and cracks.

Self-seal lids should be fresh when purchased, not last year's manufacture. Self-seal lids should also be flat when laid on the jars. The composition ring on the lower side should be free from dirt or other substance that would obstruct the seal. Old clamps that have lost their spring may in some cases be adjusted by bending them. Before processing a jar of this type, the clamp is fastened over the lid. The composition ring in the lid is softened by heat, and on cooling becomes hard, which, together with the vacuum in the jar, forms an air-tight seal. Do not screw the lid down after processing; to do so may break the seal.

Claims that vacuum-pack lids will take the place of processing are erroneous. It pays to buy new lids and jars for canning rather than to use defective ones.

Testing jars. Examining jars and testing them for leakage saves time and money. The glass where the rubber rests and all other parts that function in producing a tight seal should be smooth and free from nicks and lumps. Any obstruction or roughness between the glass and the rubber or the composition lid may cause an imperfect seal.

To test jars that have rubber rings for leakage, place water in each jar, adjust the rubber and lid, and invert. If a screw-top jar leaks, see if the lid is bent up at the edge. A slightly bent lid may sometimes be straightened with pliers or by placing it on a jar with a rubber and carefully forcing the bent portion down. Dented, bent, or nicked lids are caused by prying open a jar of food or by careless handling. Metal or glass jar lids should never be pried up from the rubber if they are the type that can be used again. To open a jar with a rubber having a lip, pull out the lip of the rubber, with pliers if necessary. Inverting the jar in warm water also aids in opening it.

If a jar having a glass top and wire clamps leaks when tested, the cause may be traced to the top, the rubber, or the wire clamp. If the lid rocks when placed on a jar without a rubber, it is not likely that a good seal can be obtained. Leakage may be caused by a bulging rubber due to too tight a clamp, or by too loose a clamp. To tighten the clamp, remove the larger wire and bend it down until adjusted; to loosen it, bend it up.

Defective jars that cannot be adjusted to give a perfect seal with the water test should be reserved for jam, jelly, or other foods that can be sealed with paraffin, or for the frozen pack.

Rubbers. Buying good rubbers is true economy. A good rubber is elastic, not brittle. To test a rubber, pull it out to approximately twice its size. It should return to its original size when the tension is released. Another test is to double a single thickness of rubber sharply between the thumb and forefinger. It should show no cracks or breaks. Since time and heat cause rubber to deteriorate, new rubber rings should be used each year. The use of two rubbers on a jar is not recommended. A good rubber rests flat on the sealing shoulder of the jar, yet fits snugly against the glass.

It is easier to adjust rubbers to cold jars than to hot ones.

PACKING GLASS JARS

Hot pack describes the packing method by which boiling hot food is placed into the jars before processing.

Cold pack describes the packing method by which cold food is placed into the jars before processing.

Blanching. This term is sometimes applied to a short precooking prior to packing, to loosen skins of fruits or reduce certain vegetables by wilting.

Precooking and packing. Precooking the food in a saucepan or kettle until thoroughly boiling hot throughout helps to insure well-filled jars because it shrinks the product. Precooking meat and fish is recommended. Nonacid vegetables should always be precooked and packed hot. Precooking is not necessary with fruits and tomatoes when processed in the hot water bath; precooking these foods assures better heat penetration, however, and shrinks the product, thus making possible fuller jars than with the cold-pack method.

When the open-kettle method is used, the jar is filled to the top with the cooked food and liquid. When any other method is used, the jar is filled to $\frac{1}{2}$ inch from the top, to allow for expansion during processing. The only exceptions are that in canning corn, beans, and lima beans the jars are filled to 1 inch from the top. When sirup, water, or other liquid is added to the food in the jar, the liquid should fill the jar to within $\frac{1}{2}$ inch from the top, with the exceptions just mentioned.

Pack all nonacid vegetables, meat, or fish loosely enough in the jar to allow the ready passage of heat to the center of the jar, especially in the cases of corn, greens, pumpkin, and other foods of compact, viscous texture. If packed tightly, food in the center of the jar may not reach a high enough temperature during processing, and hence may not keep. Use an adequate amount of liquid in packing nonacid foods, as liquid aids in heat penetration. The solid food in jars should be covered by the liquid used. Insert a knife to remove air after adding liquid.

Currents of heat travel upwards in the jar during processing. It is well to pack foods vertically to aid heat penetration, especially those difficult to can, such as vegetables.

METHODS OF PROCESSING

Food may be processed by one of three principal methods: hot water bath, pressure cooker, or open kettle.

PROCESSING BY HOT WATER BATH

This method is safe only for acid fruits and tomatoes and rhubarb.

Fruits and tomatoes are satisfactorily canned by the hot-water-bath method. This method has supplanted the open-kettle method in much home canning.

(1) Fill a wash boiler or other large container with enough water to cover the jars 1 inch (Figure 1). Provide a rack that raises jars about 1 inch from the bottom of the cooker to allow circulation of water. The cooker should allow a space of 3 or 4 inches between the water and the cover of the cooker. Heat.

(2) Wash and rinse the jars, lids, and rubbers. Place rubbers on jars. Place in a pan of water and heat. To prevent breakage, use perforated tin lids or rack in bottom of pan.

- (3) Clean and prepare food for jars.
 (4) For hot pack keep the hot jars in a pan of hot water.
 (5) Pack the food in the jars to $\frac{1}{2}$ inch from the top.
 (6) Add boiling hot sirup to fruits to $\frac{1}{2}$ inch from top of jars. (See Table 2, page 11.) Hot tomato juice is added to tomatoes.

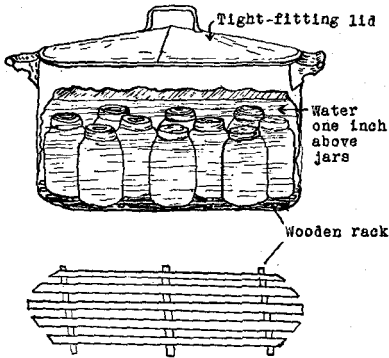


Figure 1. Arrangement of jars in boiler. Note suggested type of wooden rack to be placed in bottom of boiler.

(7) Partly seal jars. With the screw-top jars screw the top down and then screw it back an inch. If using glass top with screw band, turn band back one inch. With wire-clamp jars, the smaller wire is left up and loose. With self-seal jars, lids are laid in place and screw band is turned only firmly tight. Keep jars in a pan of hot water until all are packed.

(8) When all the jars to be processed at one time are ready, place them in the water bath on a rack. If a jar and its contents are close to the boiling temperature after packing, it may be placed in boiling water. The jars will not break unless the difference in temperatures between jars and water is too great. The water should reach 1 inch above the tops of the jars. Jars should not touch.

(9) Cover the boiler tightly so that the water will boil again as quickly as possible.

(10) *Begin counting time when the water starts a full bubbling boil.* Keep the water actively boiling for the necessary time as shown in Table 7, page 34. Add boiling water from time to time if necessary to keep the boiling water 1 inch above the tops of the jars. Spoilage may result if the heat is insufficient to keep the water boiling continuously.

(11) When the jars have been processed according to time table, remove immediately and complete the seal, unless self-seal types.

(12) Wipe the jars and set aside away from drafts, some distance apart so that they will cool quickly. Test the seal before storing the product. Tapping the lids of self-seal jars gently with a spoon should give a clear ringing note, not a dull low sound. The seal of other types of jars can be tested by inverting for a few moments and watching for leaks. Do not try to tighten screw-top jars after cooling. To do so may break the seal.

(13) *Caution.* After emptying jars and before tasting home-canned nonacid vegetables, meats, and fish, boil the food for 20 minutes on the same day eaten. *Do not taste of these foods before boiling them 20 minutes.* Be sure they boil the full length of time. Note: Intermittent processing is not recommended.

PROCESSING BY PRESSURE COOKER

This is the only safe method for nonacid foods. The pressure cooker is a kettle so constructed that it will withstand steam under pressure. It is equipped with a steam cock to release air and steam, a safety valve to release steam automatically if pressure becomes too great, and a pressure gauge to indicate the amount of pressure within the cooker. A thermometer can be installed on any cooker and is desirable equipment because it indicates the degree of heat

within the cooker. The gauge should be tested for accuracy each year. (See County Extension Agent.) Petcock and safety valve are often combined.

Successful use of the pressure cooker not equipped with a thermometer depends on the accuracy of the gauge, the mechanical perfection of the cooker, and careful following of directions.

Care. After it is used the cooker should be washed and dried thoroughly. Avoid getting water or grease into the pressure gauge. Do not place top of cooker upside down until it has been wiped off. Clean the safety valve by taking it apart and washing and drying the parts. Draw a piece of tape through the safety-valve and steam-cock openings. Store with lid upside down in top of cooker. This protects the apparatus on the lid, tends to reduce corrosion, and permits a circulation of air in the cooker. Have several thicknesses of paper between lid and cooker to protect the sealing surfaces. Cookers that are stored tightly closed may give an off-flavor. Release spring of safety valve when not in use.

Value. Nonacid foods, such as meat, fish, poultry, and all vegetables except tomatoes, are safely canned only in a pressure cooker. Processing under pressure is recommended because the *Clostridium botulinum*, a deadly bacterium found in the soil in many states, has been known to withstand the temperature of boiling water (212° F.) continuously for six hours.

Three rules for safe use of pressure cooker

1. Clean safety valve each day that the cooker is used.
2. Have $\frac{3}{4}$ inch water in bottom of cooker each time before using.
3. At end of processing, allow pressure to return to zero before opening cooker.

Steps in using the pressure cooker with glass jars. When canning in glass jars, the following steps in using the pressure cooker should be followed:

- (1) Place the rack in the bottom of the cooker without its pins.
- (2) Pour water in the pressure cooker until it reaches a depth of $\frac{3}{4}$ inch. Use hot water in hot cooker for hot jars. Use lukewarm water for cold jars.
- (3) Prepare jars as described for hot water bath, page 6, sections 2 through 7.
- (4) Place filled jars on rack in cooker. Place cover on cooker, steam cock open. Match arrow on cover with arrow on cooker, if so marked.
- (5) Fasten cover into position. With covers having several clamps, fasten opposite clamps gradually until cover is tight.
- (6) Test safety valve by pulling upon stem.
- (7) Apply heat under cooker.
- (8) Heat until steam escapes freely from the open cock. Let steam escape freely for 5 minutes if cooker is 10-quart size; 7 minutes if 18-quart size, to insure that all air has been driven out of the cooker. Otherwise the pressure gauge may indicate air pressure, not steam pressure within, and the temperature will be lower than the pressure gauge indicates. Steam pressure, not air pressure, is required to produce a high temperature.
- (9) Close the petcock and continue heating until the desired pressure or temperature is reached. (See Tables 6 and 8, pages 30 and 36.) Bringing the pressure up quickly improves quality of the product.
- (10) Begin to count cooking time when the gauge registers the correct pressure. If the cooker is equipped with a thermometer, disregard the gauge except for safety, and go by the thermometer.

(11) When the correct pressure or temperature is reached, reduce the heat or move the cooker back on the stove. It is important that the pressure remain constant. Fluctuation of pressure draws juice from jars. In using a wood range, a mat or rack might be placed under the cooker to keep the heat even.

(12) When the cooking time is up, remove the cooker from the stove and let it cool slowly *until the gauge reaches zero*. Then open the steam cock gradually. If steam cock is opened wide immediately, liquid is drawn from the jars.

(13) When the hissing has stopped, open the cooker. Remove jars as soon as violent bubbling stops. Tighten the lids at once unless of self-seal type. Cool quickly but avoid placing glass jars in drafts or on a cold surface. Test the seal before storing. In case of leakage, reprocess the full length of time.

TABLE I. APPROXIMATE TEMPERATURES OF STEAM UNDER PRESSURE

Steam under pressure of—	Temperature
Pounds	Degrees Fahrenheit
0	212
5	228
10	240
15	250
20	259

PROCESSING BY OPEN KETTLE

This method is safe only for acid fruits and tomatoes. In the open-kettle method, the entire processing is completed before packing the jars. Fruits and tomatoes may be processed by this method, but they tend to be firmer and more attractive by hot water bath. Cooking in the jar results in less contact with air and conserves vitamins better than the open-kettle method. A full pack is more easily obtained by the open kettle. Jams, marmalades, fruit butters, and pickles are usually canned by the open-kettle method.

(1) Place the rubbers on jars and boil the jars, lids, and all utensils that are to come in contact with the food, such as cup, funnel, knife, etc., for 10 minutes. Have jars boiling hot when packed.

(2) Wash, trim, and prepare food for cooking.

(3) Add sirup or sugar, water, or other liquid and flavorings.

(4) Bring to boil. Boil gently, in a kettle that is not tightly covered, until centers of the sections of food have reached the boiling temperature, which will be from 10 to 20 minutes.

(5) Place funnel in jar, if convenient to the type of food.

(6) Practice indicates that in case of small fruits and other solid packs placing a sterilized knife in the jar until jar is filled will help to prevent breakage.

(7) Fill jars completely with fruit and sirup. A full pack is necessary by the open-kettle method, as no further processing is done and any air above the food might contain micro-organisms that cause spoilage.

(8) Remove food and juice from rubber or other sealing surface.

(9) Take lid from boiling water and place on jar. Complete seal.

(10) Wipe jar and set aside to cool. Test seal before storing. (See Cooling, Labelling, and Storing, page 19.)

OTHER PROCESSING METHODS NOT RECOMMENDED

The purchase of a steamer for canning is not recommended. Unless the water in the bottom of the steamer is kept boiling rapidly and an abundance of

hot steam is kept continuously circulating about the jars or cans, sufficient heat may not reach the center of them and spoilage may result.

The oven is not recommended for canning until more safe and reliable methods have been developed. Many explosions of jars have been reported in connection with oven canning. Also much spoilage has occurred in oven-canned goods due to poor conduction of heat by hot air and resulting difficulty of obtaining safe processing temperature at the center of the jar. The centers of three jars of peas that were processed for 70 minutes reached 240° F. in a pressure cooker; 210° F. in a hot water bath; and 168° F. in an oven. It is especially important to avoid use of the steamer or oven with nonacid foods.

The method of presealing glass jars before processing is not recommended. Less loss of liquid occurs than when partly sealed. The pressure formed within the presealed jar, however, is not released until some time after removal from the cooker. The possibility of violent breakage during this period makes the preseal method doubtful in safety.

CANNING FRUITS

Time table and directions for different fruits are given at back of bulletin, pages 34 to 35.

Fruits are most commonly canned by hot-water bath (pages 6-7) and by open kettle (page 9). Most fruits have a better appearance and flavor when they are processed in the jar, cold pack, but keeping qualities and full jars are better assured by the hot pack. Unripe or partly ripe fruits should be cooked longer than ripe fruit, in order to render them palatable.

The use of the pressure cooker is not recommended for fruits and tomatoes as the high temperature is not needed. The pressure cooker may be used as a hot water bath. Use a large kettle cover instead of a clamped lid. If fruit is canned under pressure the usual 5-minute period of emission of steam from the petcock may be omitted and the juice is thereby kept in the jars. Pack the raw fruit into hot jars standing in hot water, add boiling sirup to $\frac{1}{2}$ inch from top of jars and partly seal. Have $\frac{3}{4}$ inch water boiling in pressure cooker and place jars in cooker. Leave petcock open while fastening cover, then close it immediately and process at 5 pounds pressure for 5 to 15 minutes, depending on size and acidity. Pears, tomatoes, and sweet varieties of cherries, because of their low acidity, require more time in processing than other fruits. When using the pressure cooker, these fruits should be processed from 12 to 15 minutes at 5 pounds pressure. In the case of fruits such as pears, some people like to add a small amount of acid (1 teaspoon lemon juice per quart) in order to increase the acidity. Winter Nelis pears are an example of pears that are less acid to taste, especially if overripe. It is recommended that Winter Nelis pears if canned, be processed in the pressure cooker rather than in the hot water bath.

Use firm sound fruits that are well ripened. Can no fruit that is withered, unduly soft, partly decayed, moldy, or bruised. Freshness means improved flavor and improved keeping qualities. To prevent crushing soft varieties such as berries, gather in shallow boxes, baskets, or trays that permit free circulation of air and prevent bruising. Most fruit should be carefully washed.

Fruits that are peeled, such as pears, apples, and peaches, may be washed in a weak salt solution after peeling to prevent discoloration. Use 1 level tablespoon of salt to 3 quarts of cold water. Rinse in cold water before canning.

SIRUPS FOR CANNING FRUITS

When using the cold-pack method with fruit, the jars are heated and kept in hot water during packing and a hot sirup is then poured over the fruit, to $\frac{1}{2}$

inch from the top of jar. Sirup is made by dissolving sugar in water and bringing it to the boiling point. One quart jar of fruit requires from 1 to 1½ cups of sirup, depending on size of fruit and closeness of pack.

Thin sirup. Use 1 cup of sugar to 3 cups of water (25 per cent). *Thin* sirup is used for apples, pears, and raspberries and for other sweet berries if the fruit is to be used for pies or other foods to be sweetened later.

Medium sirup. Use 1 cup of sugar to 2 cups of water (33⅓ per cent). *Medium* sirup is used for grapes, prunes, plums, peaches, apricots, apples, pears, rhubarb, blackberries, gooseberries, huckleberries, raspberries, and cherries, if fruit is to be used chiefly as sauce.

Thick sirup. Use 1 cup of sugar to 1 cup of water (50 per cent). *Thick* sirup is used for strawberries, peaches, apricots, pineapple, sour cherries, rhubarb, currants, gooseberries, pears, and quinces, if a sweet product is desired.

Very thick sirup. Use 3 cups of sugar to 2 cups of water. *Very thick* sirup is used for loganberries and rhubarb if a rich product is desired. For

TABLE II. SIRUP DENSITIES AND SUGAR FOR ONE DOZEN CONTAINERS

Fruit	Sirup density	To make sirup for one dozen containers			
		Qt. jars and No. 2½ cans		Pt. jars and No. 2 cans	
	Average quality	Sugar	Water	Sugar	Water
	<i>Per cent</i>	<i>Cups</i>	<i>Cups</i>	<i>Cups</i>	<i>Cups</i>
Apples	30	6½	15	3½	8½
Apricots*	40	9	13½	5	7½
Blackberries	40	7	11	5½	8
Cherries	30	6½	15	3½	8½
Gooseberries	40	7	11	5½	8
Huckleberries	30	5½	13	3½	8
Loganberries	50	10	10	6½	6½
Peaches*	40	9	13½	5	7½
Pears	30	6½	15	3½	8½
Prunes	30	6½	15	3½	8½
Raspberries	40	7	11	5½	8
Rhubarb	40	9	13½	5	7½
Strawberries	40	7	11	5½	8

*For peaches and apricots add 1 cracked pit to each quart of sirup, boil 2 minutes, strain.

peaches, 3 cups of sugar to 1 cup of water may be used if an extremely sweet product is desired.

Sirup flavors are improved by substituting fruit juice made from small and imperfect fruit for part of water.

REMOVING SKINS

Removing skins of peaches and tomatoes. To remove skins of peaches and tomatoes place them in a bag of thin cloth or a wire basket, and dip in boiling water for 1 minute, or until the skin can be loosened easily.

Lye peeling of peaches and apricots. Some peaches need to be dipped into lye solution. Use an enamel or iron kettle, never an aluminum or tin vessel. Make a solution of 2 tablespoons of granulated lye and 1 gallon of hot water. Stir with a stick or wooden spoon. Avoid getting lye on hands. Bring to a boil, and while boiling immerse cloth filled with fruit in the lye solution until fruit skins are loosened or partly dissolved; this usually requires from

$\frac{1}{2}$ minute to 2 minutes. Wash fruit at once, in running water if possible, until skin and lye are removed. Thoroughly rinse fruit after washing.

TOMATOES*

Tomatoes are canned by the same methods used for fruits, except that no sirup is added. For home use, substitute hot tomato juice for the sirup. If desired, 1 teaspoon salt may be added to each quart. See tomatoes and tomato juice in table in back of bulletin, page 35.

CANNING VEGETABLES

Select young vegetables because they are more tender and have better flavor than mature ones. Much of the loss of nonacid canned vegetables so frequently reported could be prevented by observance of the following rules:

(1) Gather vegetables not longer than 2 hours before canning if possible. The composition of many vegetables, such as peas, beans, and corn, undergoes a rapid change after picking. Can them before they lose their sweet fresh flavor. Gather in ventilated containers such as baskets. Pick in the cool of the morning and keep them cool until used. Can as soon as possible.

(2) Gather and can only small quantities at a time. Spoilage often occurs before canning, because of keeping too long in a warm room.

(3) Wash vegetables thoroughly until every trace of soil is removed. The most dangerous bacteria and those hardest to kill are in the soil. Lift vegetables out of the water rather than pouring the water off from them.

(4) Precook vegetables until thoroughly heated through, and pack boiling hot into hot jars. Precooking shrinks the product before packing and allows fuller jars after processing. Precooking softens the product, eliminates undesirable flavors and allows a boiling hot pack.

(5) Pack vegetables loosely to $\frac{1}{2}$ inch from the top, except in the case of corn, beans and lima beans, which are packed to 1 inch from the top to allow for swelling. Do not crowd the jars by too tight packing.

(6) Add the hot water in which the vegetables were cooked to $\frac{1}{2}$ inch from the top. Use a sufficient proportion of liquid to solid, as liquid aids heat penetration. Add $\frac{1}{2}$ teaspoon salt to each pint jar.

(7) Start processing as soon after harvesting as possible. See Common Difficulties in Canning, pages 17 to 19, and Time Tables pages 30 to 33.

Nonacid vegetables, that is, all vegetables except tomatoes,* are safely canned only in a pressure cooker, because of the higher temperature attained. The addition of small quantities of acid, such as vinegar or lemon juice, to a nonacid food, such as vegetable or meat, does not change the acidity enough to prevent the growth of dangerous bacteria. Bacteria will not grow, however, if enough acid is added to pickle the food.

After emptying jar and before tasting, boil for 20 minutes all home-canned nonacid vegetables, meats, and fish on the same day eaten. Do not taste of home-canned nonacid food before boiling 20 minutes. Be sure that it boils the full time.

*Because of the rare possibility of botulism in the acid foods, such as canned tomatoes, that have been made neutral by other organisms, those that show any signs of spoilage should be boiled 20 minutes before tasting or using, like other nonacid foods. It is possible for acid foods to be made nonacid by contaminating organisms due to poor canning methods.

CANNING MEATS AND FISH

Meats. Butcher only fat, healthy animals. Bleed well. Have meat entirely free from animal heat. Allow from at least 12 to 24 hours after butchering before canning, the time depending on the weather. Handle meat with all possible cleanliness. To clean meat, wipe with clean damp cloth. Cut into pieces suitable for serving and to fit the jar. Wide mouth jars are convenient for packing meat. Meat is packed hot, seared, roasted, fried, stewed, or made into cakes, paste, sausage, or soup. Pork may be ground and seasoned, formed into balls and seared. Flour, meal, breadcrumbs, or other starchy coating should not be used in preparing meat for canning, because such a coating may obstruct the passage of heat to the center of the jar. When meat is roasted, fried, or seared, the meat drippings are diluted with water, brought to a boil, and poured over the meat in the jar. Boiling broth made from the large bones is poured over stewed meat. Frying meat before canning tends to make it hard and dry.

Meat should not be packed tightly. Bones may be left in or removed. Bones are better conductors of heat than the flesh of meat and aid in sterilization. Fat retards the penetration of heat. Leave only enough fat to give flavor. Pack hot meat to within $\frac{1}{2}$ inch of top of jar. Use 2 teaspoons salt to each quart of meat. Add boiling liquid to $\frac{1}{2}$ inch from top of jar. Remove grease from sealing surfaces before adjusting lids. Partly seal. Place hot jars in the hot pressure cooker. If meat is packed cold, add no liquid, partly seal, then place jars in cold Cooker. Follow pressure-cooker directions (page 7). Precooked meat requires the same length of processing as raw meat. (See Time Table, page 36.) One to one and one-fourth pounds of meat will usually fill a pint jar or number 2 can.

Caution. *After emptying jar, and before tasting home-canned meats, fish, poultry and nonacid vegetables, boil the food for 20 minutes on same day eaten. Burn canned products that show any signs of spoilage, or mix with 1 tablespoon of lye and bury. Do not taste of home-canned nonacid food before boiling 20 minutes. Be sure that it boils the full time.*

The liquid over canned meat may or may not form jelly, depending upon the amount of gelatin in the meat.

Poultry. By canning surplus cockerels in the summer and nonlaying hens at culling season, feed costs may be reduced and a delicious food provided for the season when it is expensive and unavailable.

Bleed poultry well and cool thoroughly. Clean without soaking in water. Cut into pieces as for frying. Remove flesh from breast and shoulders. Retain other bones. Use neck, wing tips, and breast bones for broth. Heart and gizzard may be canned with the rest, but not the liver, eggs, and kidneys.

Chicken may be canned stewed, fried, or roasted. To pack stewed chicken, place a drumstick in a hot jar, then place the thigh next to the drumstick, and two wings next to the thigh, fitting the elbow of one wing into the elbow of the other. Fit in remaining pieces to fill lower part of jar. Cover with breast meat. Pack poultry $\frac{1}{2}$ inch from the top of the jar. Add 2 level teaspoons salt to each quart jar. Add boiling broth to $\frac{1}{2}$ inch from top of jar. Remove any grease or other particles from the sealing surface of the jar. Partly seal glass jars. Process according to schedule. The steam pressure cooker is the only method recommended for canning poultry, since meat offers a favorable medium for the growth of the more resistant spore-forming bacteria. (See page 3.)

To can fried chicken, prepare in the same way as for stewed chicken, then season and brown in hot fat. Do not dip in flour, crumbs, or meal; these hinder heat penetration. Cook meat until about three-fourths done. Pack while hot into

hot jars. Pour boiling diluted drippings from frying pan to $\frac{1}{2}$ inch from top of jars. Partly seal. Process same length of time as for uncooked chicken. Seal chicken immediately after processing.

To can roast fowl, prepare in same manner as for serving at a meal. Cook until done. Cut meat from bones, pack into hot jars. Skim excess grease from drippings and pour boiling drippings over meat to $\frac{1}{2}$ inch from top of jar. Partly seal glass jars. Process a longer period of time than for unboned chicken. See Table VIII, page 37. Remove from canner and seal immediately.

Rabbit may be canned following same directions as for chicken. Skin.

Wide mouth jars are convenient for packing poultry and rabbit.

After emptying jar, before tasting, boil all home-canned poultry or rabbit for 20 minutes on same day eaten. See Caution, page 36. Do not taste home-canned nonacid foods before boiling 20 minutes. Be sure that the food boils the full length of time.

Fish. Can only absolutely fresh fish. It is best to bleed fish directly after catching, by cutting the throat with a knife. Remove head, tail, entrails, and any dark membrane. The skin and backbone are usually removed from large fish, though the fat that lies just underneath the skin of salmon adds greatly to flavor and food value. The fat of tuna fish must be removed by precooking as it imparts an undesirable flavor. (See page 39.) Chowder may be made from the backbone and the flesh that adheres to it. Press the blood outward toward the backbone. In the case of small fish, skin and bones are retained.

If the skin is to be retained, some kinds of fish must be scaled. To remove scales pour boiling water over the fish, and scrape against the scales. Clean fish by wiping with a clean damp cloth, or by washing quickly in water.

Cut large fish into convenient-sized pieces for serving and for packing into jars. Wide-mouth jars are convenient for packing fish. Pack raw (except tuna) or cooked, loosely to $\frac{1}{2}$ inch from top of jar. Add 1 level teaspoon of salt to each pint jar. If desired, 2 teaspoons of salad oil may be added to a pint jar of fish. The oil enriches the fish and makes it easier to retain shape of pieces. Add no other liquid, if packed raw. Thoroughly clean all sealing surfaces, especially if oil is used. Partly seal glass jars and process in steam pressure cooker. (See Table VIII, page 38.) After removing from cooker, complete seal immediately.

To can trout and smelt, remove head, tail, and entrails and any scales. Pack raw or browned in hot fat. Shallow or deep fat may be used for browning. Pack in a up-and-down direction in jar, cutting into proper lengths to fit jar if necessary. Add 1 teaspoon salt per pint, and if desired, 2 teaspoons salad oil. Add no other liquid, if packed raw. Thoroughly clean sealing surfaces. Partly seal glass jars and process in steam pressure cooker. (See Table VIII, page 39.)

Clam soup or chowder made from canned ground clams is a delicious and wholesome dish. Slit clams open with knife or place in strainer over small amount of hot water and steam for a few minutes until shells open. Save juice and strain. Cut clams from shells. Wash thoroughly to remove sand. Pour hot water over black membrane on neck and remove. Discard all broken or discolored clams or those with open shells. Put clams through food chopper. Heat in strained juice to boiling. Pack hot and loosely in clean jars to $\frac{1}{2}$ inch from the top. Add 1 teaspoon salt to each pint. Partly seal glass jars. Process in steam pressure cooker. (See Table VIII, page 38.) See *Caution*, page 36.)

Oysters may be canned whole or ground by method similar to clams.

CANNING IN TIN

Tin cans have several advantages over other types of containers. The first cost is lower, the tin permits foods to be heated and cooled quickly, and there is no loss from breakage. On the other hand, canning in tin necessitates investment in a sealer, and tin cans are used safely only once for canned fruits, meats, and vegetables. Tin cans may be staggered in layers in the cooker, one above the space below with a rack between layers.

Kinds of tin cans. Tin cans are sold by hundred lots or thousand lots in standard sizes. Three kinds are obtainable as follows:

Plain. Safe for all purposes so far as food value is concerned but unsatisfactory for certain foods, especially the highly colored foods. Satisfactory for tomatoes and meats.

Inside Enamel. Bright gold color. Preserves the color of such highly colored products as red berries, cherries, prunes, and beets.

C-Enamel. Dull gold color. Prevents discoloration of products containing sulphur, such as corn, peas, succotash, hominy, crab meat, clams, fish, and chicken. Never used for acid products.

Can sizes. Common sizes for home canning are No. 2 and No. 2½. (See Table III.) The sealer can be adjusted to different sizes by an expert. It is best practice to use only one size can on home sealers.

TABLE III. COMMON SIZES OF TIN CANS

Standard can	Average net weight	Average capacity
	Ounces	Cups
No. 1	11	1½
No. 1 (tall)	16	2
No. 2	20	2½
No. 2½	28	3½
No. 10	106	13

Testing the tin can sealer. Once the sealer has been tested and adjusted, a test should not be necessary until several hundred cans have been sealed or until a readjustment has been made to accommodate a can of a different size.

To test sealer, place two tablespoonfuls of cold water in an empty can and seal. Have on hand a pan of boiling water sufficient to cover the can. Set aside and immerse the can until it is entirely surrounded by the hot water. This heats the water in the can and creates a pressure within the can. Can ends will bulge. Keep the can under the surface for five minutes and if by that time no bubbles arise from the can seam, the can has been sealed air tight.

If bubbles arise from the can, the seam is not sufficiently tight, and one or both of the seaming rolls need adjusting. Usually the second roll needs adjusting. To adjust, follow manufacturer's directions.

Steps in using the pressure cooker when canning in tin cans.

- (1) Clean and prepare product.
- (2) Examine can. Do not use a can with dented rim or torn side seam.
- (3) Mark can with sharp instrument, or tin can ink, with name and date.

(4) Pack product in the marked cans. Pack hot or cold according to directions given below under (5) or (6). Fruit, tomatoes, meat, and fish may be packed cold or hot. Nonacid vegetables should be packed hot.

(5) COLD PACK.

- a. Fill the cans with food. Avoid a tight pack.
- b. Add boiling sirup to fruits to within $\frac{1}{4}$ inch of the top of the cans. When packing meat or fish, add salt and liquid, which may be made by stewing the bones. Add only salt to tomatoes.
- c. Exhaust or preheat the can. To exhaust, heat the filled cans in a pan of boiling water reaching to within 1 to $1\frac{1}{2}$ inches of the top of the cans, until the temperature of the center of the cans is approximately 150° F. Keep the exhausting pan covered. The purpose of this preheating is to expand the contents of the can so that expansion after sealing will not be sufficient to break the seams of the cans; also to expel the air from the product, and to prevent corrosion of the tin.
- d. When the cans are sufficiently heated, or exhausted, seal them promptly on the tin can sealer. Follow directions with sealer.
- e. Process meat and fish in pressure cooker, fruit in hot water bath or pressure cooker.

(6) HOT PACK.

- a. Pack all nonacid vegetables boiling hot. Fill cans to within $\frac{1}{4}$ inch of the top.
- b. Add boiling water in which they were cooked, to within $\frac{1}{4}$ inch of the top of the can. Add salt.
- c. Seal each can directly after filling. Follow directions with sealer.

(7) When a batch of cans is sealed, place the cans in the pressure cooker immediately. The cooker, with the hot water reaching $\frac{1}{2}$ inch above the rack, should be ready and very hot. If the cooker is large, or the product requires a long period of cooking, more water may be needed.

Heat penetration to center of can is aided by placing cans so that layers of food within the cans are vertical. Spinach cans should be laid on their sides; cans of asparagus stalks and whole beans should stand upright.

(8) Place the cover on the cooker. Follow directions page 7.

(9) As soon as the desired pressure is reached write down the time when the processing is to be finished. Process at the necessary temperature for the required length of time. (See Tables VI and VIII, pages 30 and 36.)

(10) When the cooking time is up, open the steam cock *wide* except under the following three conditions when a sudden release of pressure might result in buckling of the cans: (1) When pumpkin, corn, or spinach is being cooked. (2) If cans are larger than $2\frac{1}{2}$. (3) When the cans were sealed at too low a temperature. Under the conditions indicated, lower the pressure gradually.

(11) When the gauge indicates zero, open the cooker and remove the cans.

(12) Cool the cans completely and quickly by placing them under cold running water. Watch for signs of damage and spoilage.

(13) Observe cans for at least 2 weeks to see if bulges or leaks appear. If any spoilage develops, examine all the cans that were processed in the same lot.

(14) Label and store in the coolest place available. The storage place should be dry enough to prevent rusting of cans.

COMMON DIFFICULTIES IN CANNING

Keeping liquid in jars. Loss of liquid from jars can be in some measure prevented when using the pressure cooker by observing the following directions accurately:

- (1) Keep the pressure steady. Allow no variation.
- (2) Prevent steam blowing off from the safety valve.
- (3) At the end of the processing period, remove cooker from the fire. Allow the pressure to reach zero. Then open the petcock slowly. Open the cooker and remove the jars and complete the seal immediately unless self-seal type.
- (4) Handle the cooker so that the jars remain level at all times.
- (5) See special method in canning fruits, page 10.
- (6) Blanch food sufficiently thus driving out air.
- (7) In packing, expell all air from spaces. Run knife down into jar.
- (8) Pack jars evenly with same looseness at top and bottom. Leave full $\frac{1}{2}$ inch head space. Some leave 1 inch headspace with sirup.

To prevent loss of liquid with hot water bath, try the following suggestions:

- (1) Pack hot jars with hot food or liquid only to $\frac{1}{2}$ inch from top of jar.
- (2) Immerse hot jars in boiling hot water. Have water 1 inch over the tops of jars, and replenish to keep at that height.
- (3) Keep water boiling continuously during processing period.
- (4) Seal jars immediately after processing.

Spoilage. Any one of a number of causes may be responsible for spoilage.

- (1) Use of stale, moldy, overripe, unclean or unsound products.
- (2) Jars and lids not tested for leakage before packing. Defective seals.
- (3) Use of old rubbers, or two rubbers on one jar. Use of old self-seal lids.
- (4) Using lids on jars not intended for that type of lid.
- (5) Using too large jars or cans. Large containers heat more slowly.
- (6) Having food in jar at too low a temperature at the beginning of processing. Hot pack and immediate processing help to prevent spoilage.
- (7) Too dry a pack. The presence of liquids aids in heat penetration.
- (8) Packing jars tightly, causing slow heat penetration. Starchy foods such as corn, pumpkin, and sweet potatoes, conduct heat very slowly.
- (9) Filling jars too full, especially in canning corn, beans, greens, and lima beans, which may swell and raise the lid.
- (10) Particles of food, grease, or other obstruction on sealing surfaces.
- (11) Too long delay between steps in canning; canning too much at a time; food waiting too long in warm kitchen, especially if piled in deep, covered containers; filled jars waiting too long at lukewarm temperature before processing, delay in sealing after processing.
- (12) Failure to hold self-seal lid steady while adjusting screw band. Screwing down too hard.
- (13) Too short a processing period. Inaccurate time keeping.
- (14) Not allowing extra time when canning in high altitudes.
- (15) Temperature too low, or irregular, during processing period.
- (16) Pressure of clamp or any other outside pressure against rubber.
- (17) Opening jars to refill after processing.
- (18) Cooling glass jars too slowly. A draft, however, should be avoided.
- (19) Tightening lids after jars have cooled, thus breaking the seal.
- (20) Lifting jars by tops, or other strain causing break in the seal.
- (21) Storing jars at too warm, or at freezing temperature.

(22) In the open-kettle method, using unsterilized jars, lids, rubbers, funnel, cup, knife, or other equipment that comes in contact with food.

Recognizing spoilage. When in doubt as to the wholesomeness of canned food, burn or bury it. *Do not taste it unless it has been boiled 20 minutes.*

Although food may be spoiled, and give no indications, the following signs of spoilage are usually readily apparent:

- (1) Poor seal of jar.
- (2) Off-odor of food.
- (3) Change in texture of product: slippery, slimy, mushy, moldy. Molds get into a jar through an imperfect seal. Molds themselves are not harmful, though unpleasant.
- (4) Presence of gas. Sputtering of liquid on opening.
- (5) Swelling or bulging of ends of tin cans.
- (6) Off-flavor of food. *Do not taste nonacid home-canned foods before boiling them 20 minutes.*
- (7) Cloudiness of liquid. Overmature peas and beans, however, may be cloudy although not spoiled.

***Discoloration of canned products.** Light-colored fruits such as peaches and pears may turn dark after canning. The cause is not entirely understood but is thought to be due either to overheating, to underheating, or to oxidation. Avoid oven canning; avoid pressure cooker canning for such fruits; avoid too long or too short processing, and too slow cooling. In order to prevent oxidation, drive the oxygen out of the fruit by cooking pears and peaches 4 to 8 minutes before packing for the hot water bath. (See page 35.) As soon as peeled, wash light-colored fruits in cold brine (1 teaspoon salt to 1 quart water).

A pink color in canned pears is usually due to overcooking.

Discoloration of vegetables occurs occasionally and may be due to the use of hard water in packing. Hard water may also tend to harden vegetables.

The use of iodized salt is not recommended in canning as it may have an undesirable effect on color and flavor.

Cloudy liquid in peas and beans is often due to the presence of overmature products that have given their starch to the liquid; or to overcooking.

The yellowish crystals often seen in asparagus are caused by ingredients that the vegetable naturally contains. They are harmless.

Copper and iron utensils should not be allowed to touch such foods as corn and meat, which contain sulphur. A darkening of color may result.

Safety precautions. Hot water, steam, glass, knives, and tin involve dangers to workers. Accidents can be prevented if care is used.

(1) Be sure that handles of utensils in which hot water or hot food are to be carried are in good condition.

(2) Do not lift or carry a boiler filled with hot water. Transfer hot water in small quantities. Keep children away from hot foods and liquids.

(3) Let pressure return to zero before unfastening the lid of the pressure cooker. Have $\frac{3}{4}$ inch water in cooker.

(4) Test spring of pressure-cooker safety valve each time before using. Clean safety valve each time cooker is washed. Have gauge tested each year.

(5) Avoid injury from breaking glass. Place cold jars in cold cooker and hot jars in hot cooker.

(6) Keep fingers and hands away from all cutting edges of machines and knives, also away from lye, steam, and hot water. Avoid using wet cloth holders in lifting hot articles. Protective holders may be made of old inner tubes.

*Also see Canning in Tin, page 15.

(7) Handle sharp edges of tin cans with extreme care.

(8) Do not allow meats to stand in galvanized containers as they may take up harmful zinc. *After emptying jar, and before tasting home-canned meat, fish, poultry, or nonacid vegetables, bring the foods to a boil, and boil them for at least 20 minutes, on same day eaten.* Some advise boiling 30 minutes. Canned food having signs of spoilage should be destroyed immediately by burning or by burying with 1 tablespoon of lye mixed with each quart of food. Spoiled food should not be placed where animals can find it. *Do not taste of home canned nonacid foods before boiling 20 minutes. Be sure that food boils the full length of time.*

COOLING, LABELING, AND STORING CANNED FOODS

Drafts of cold air should not strike glass jars after taking them from the canner, as this might cause breakage. Neither should jars be stacked close together. Undue delay in cooling may cause overcooking, deterioration in flavor, and sometimes spoilage.

Cool jars in an upright position as the seal is aided by the pull of the vacuum formed in the jar during cooling. Jars may be inverted after cooling to test seal, except self-seal jars, which are gently tapped on the lid. A clear ringing sound indicates that jar is sealed, when tapped with bowl of a teaspoon.

Jar lids should not be tightened after cooling; to do so might break the seal.

Tin cans should be cooled quickly in cold running water.

After the canned product has cooled, wash and dry each jar. Paste on each jar a label giving name of product and date of canning. It is helpful in checking results to write also the type and time of processing on the label. Allow jars or cans to stand a week so that they can be inspected to see if spoilage develops.

Group canned goods according to variety. Edges of shelves may then be labeled instead of jars. Store in a cool, dry, frostproof, dark place with temperature 45° to 60° F. Protect jars from strong light, which will fade or discolor food. To prevent rusting, store tin-canned products in a dry place.

TABLE IV. APPROXIMATE YIELD OF CANNED PRODUCT
FROM RAW PRODUCT

Raw product	Amount	Canned product
		<i>Quarts</i>
Apples.....	1 bushel or 48 pounds	20
Berries.....	1 crate or 18 pounds	10 to 14
Cherries.....	1 lug or 24 to 28 pounds (flat weighs 12 pounds)	18 to 22
Peaches.....	1 lug or 24 to 28 pounds (flat weighs 14 to 18 pounds) (bushel weighs 40 to 50 pounds)	8 to 12
Pears.....	1 box, or 40 to 45 pounds	20 to 24
Prunes.....	1 bushel, 45 to 50 pounds	30
Tomatoes.....	1 bushel, 45 to 50 pounds (lug, 28 pounds) (flat, 20 pounds)	14 to 18
Asparagus (whole).....	3 pounds	1
Beans, string.....	20 pounds	14 to 16
Beets, baby.....	1 bushel, or 60 pounds	17 to 20
Carrots.....	1 bushel or 50 pounds	17 to 20
Corn.....	2 doz. ears	2 to 3
Peas, green.....	8 pounds	2
Pumpkin.....	4 pounds	1
Spinach, Swiss chard, beet tops.....	2 pounds	1
Fowl.....	2 pounds	1 pint solid meat, or 1 pint stock thick enough to jell
Beef, boned.....	5 pounds	4 pints

DRYING FRUITS AND VEGETABLES

Drying is an economical and satisfactory method of preserving many fruits and vegetables in Oregon. Dried products may be used to supplement the canned foods that in many homes fill every available jar.

PREPARATION OF FOOD FOR THE DRIER

Good quality in dried products depends on the use of fresh, ripe, firm, and perfectly clean food. One decayed fruit or root may give the entire lot an undesirable flavor. Blanching in boiling water for 2 to 5 minutes improves the color and flavor of green vegetables and other products that oxidize readily.

Most fruits and vegetables, in order to be dried quickly, must first be peeled and sliced or cut. Various machines for slicing are available at reasonable prices, but simple equipment consisting of stainless steel knives and large-sized bread boards will be found satisfactory. All cutting surfaces of machines or knives should be kept clean and bright to prevent food from discoloring. Food is cut into $\frac{3}{8}$ - or $\frac{1}{4}$ -inch slices or cubes. Pieces or slices of uniform thickness dry more evenly. It is then placed in thin layers on racks, trays, or plates.

METHODS OF DRYING

Food is dried by the heat of the sun or a stove or in a rapid current of air. Desirable temperature for drying is between 140° and 150° F.

Drying time varies with the thickness and texture of the food. Stir the product and turn the shelves end for end several times a day during the drying process, in order to obtain a uniform product. When halves are dried, start cut side up on tray to retain juice. Drying should be sufficiently slow to prevent loss of juice by dripping. Test a drying product by breaking a section in two at the thickest part. If no moisture can be squeezed from the broken end, the food has dried sufficiently. Dried fruits should be leathery and pliable; dried vegetables should be brittle. The food should be dried uniformly throughout, but not baked or scorched. Food insufficiently dried will mold.

Asparagus. Wash and cut into $\frac{3}{4}$ -inch pieces. May be blanched to improve color.

Snap beans. Wash, stem, and tip. Cut into pieces $\frac{1}{2}$ to 1 inch long. Blanch 2 to 5 minutes in boiling water, depending on maturity of the beans. Drain and dry between two cloths. Shell pod beans and blanch two minutes.

Corn. Gather only very young, fresh, tender corn. Prepare immediately. Boil 2 to 5 minutes, long enough to set the milk. Cut from the cob in whole grains, or cut tops of kernels and scrape off remainder.

Peppers. Wash, cut in half, and remove seeds.

Peas. Wash, shell by hand or by wash wringer, blanch.

Spinach and other greens. Trim, remove leaves from roots, wash, blanch. Chopping hastens drying.

Tomatoes. Cook ripe tomatoes for 10 minutes. Strain through ricer. Cook pulp as dry as possible without burning. Spread on plates in $\frac{1}{2}$ -inch thickness and set in drier. When paste is dry on top, turn it over. Continue drying until paste is brownish red. Use in gravies, soups, and many other ways in which canned tomatoes are used.

Apples. Peel, core, trim, and cut into eighths or slice in rings $\frac{1}{4}$ -inch thick. To prevent discoloration, dip into cold salt bath, using 1 teaspoon of salt to 1 quart of water. Remove surplus moisture.

Apricots. Wash, pit, "sulphur" if desired (see Pears and Quinces). Dry cut side up.

Pears and quinces. Dry same as apples. Steam 10 minutes before drying if desired. Pears are sometimes given a sulphur-dioxide bath for from 4 to 6 hours to preserve their color. To sulphur, place wooden trays of freshly cut pears out of doors under a tight box, in which a pan of sulphur has been placed and ignite with live coals or shavings.

Berries. Wash, stem, spread in thin layers and dry slowly to prevent loss of color and flavor by dripping. Large strawberries should be cut in two and placed cut side up on the rack. A common rule is to stop drying at the point at which berries fail to stain the hand when pressed.

Peaches. Peel, pit, and cut into halves or preferably into smaller pieces. "Sulphuring" as for pears retains the color.

Cherries. Wash, stem, and dry with or without pitting. May be pitted when partly dry.

Prunes. Use tree-ripened prunes. Prunes dry slightly more quickly if dipped into boiling water until skins check. May then be pitted.

Apple sauce. Core and peel well-flavored early apples and cook with small amount of water. Put through sieve. Dry like tomato paste.

STORING DRIED PRODUCTS

Food taken from drying trays is not uniformly dry. Portions that are more moist than others may cause mold to develop. To obtain an even degree of moisture, place the material in deep containers and pour it from one container to another once a day for 8 to 10 days. This process is called conditioning. If the food is found to be too moist after conditioning, return it to drying trays.

Infestation by certain beetles and moths may occur during storage, resulting in loss of the entire dried product. As a precaution, just before sealing and storing, spread products an inch deep on pans or trays and set them in an oven with temperature from 150° to 160° F. Heat for 30 minutes, then store at once. Stout paper bags and tight boxes or cans are suitable containers for storing dried products, but the ends must be securely sealed with glue or tape. Cloth bags are not sufficient protection from insects, but sealed paper bags may be placed inside cloth bags and hung from hooks or nails.

Store dried foods in a dark, dry place. They change color if exposed to light. It is a good practice to store the products in small units, so that the entire quantity will not be exposed to the air each time the container is opened.

Examine dried products every few months, and as a precautionary measure reheat them in an oven 30 minutes at 150° F.

PREPARING DRIED FOOD FOR THE TABLE

Wash. Then soak several hours or over night in lukewarm water. Cook products in the same water until tender. Season as desired.

Dried foods may also be brought to a boil, then soaked 2 or 3 hours, and cooked again until tender.

Add cream to dried corn when tender and serve hot. Use dried peas and celery and other greens chopped in soup with meat stock. Use dried fruit as sauce, or in salads, short cakes, upside-down cakes, filled cookies, bread pudding, gelatin desserts, breakfast cereals, etc.

HOME-MADE EVAPORATORS

An oven at very low temperature (150° F.) or a warming oven may be used for drying. Leave the door partly open to allow the moisture to escape.

A variety of evaporating trays and cabinets can be made at home from odd pieces of seasoned lumber, boxes, and tin cans. For trays, galvanized wire screening with $\frac{3}{8}$ -inch mesh, or white cloth netting on wooden slatted shelves, is used. Wire-screen trays are not desirable for loganberries and other foods where acid juices will be in contact with the tray.

An evaporator should be built to allow heated air to enter, circulate freely around the product being evaporated, and leave the evaporator.

The cabinet in Figure 2 is 12 inches deep, 21 inches wide, and 27 inches high, and is open at the bottom and top to allow unimpeded air circulation. It contains eight interchangeable and reversible trays of $\frac{3}{8}$ -inch mesh galvanized wire screen, inserted between double wooden frames. The base is of galvanized iron sheeting, of 24 or 26 gauge thickness, and is nailed to the cabinet by $\frac{3}{8}$ -inch flanges turned in at right angles on the upper edges of the metal base. This base is 8 inches high, 21 inches wide, and 21 inches deep, this depth allowing the foot to gather heat from under the warming oven. One-inch openings at the bottom on all four sides allow free intake of air close to the hot surface

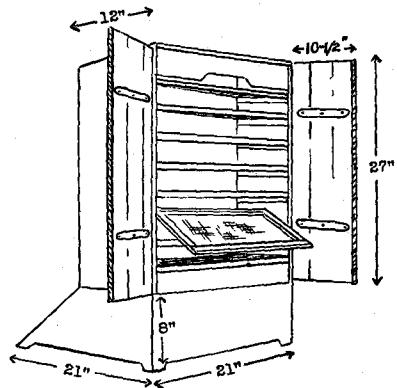


Figure 2. A home-made cabinet evaporator.

of the stove. Doors are attached to the cabinet by hinges and can be fastened shut by two catches. The top of the cabinet is covered with a piece of fly screen.

When first put into the drier, food is placed on the lower shelves and gradually moved to the upper shelves for completing evaporating.

The evaporator shown in Figure 3 is made from an apple box, 12 inches wide, 10 $\frac{1}{2}$ inches high, and 19 $\frac{1}{2}$ inches long. Remove one end of the box, being careful not to split the boards. Strengthen this end by nailing lath across the top and sides of the box. Nail three $\frac{3}{4}$ -inch cleats or similar strips, horizontally along the inside of each side of the box, the first one 3 inches from the top, the second 3 inches below the first, and the lowest 3 inches below the second. These cleats give support to the three trays.

Next construct the three trays, 11 $\frac{1}{2}$ inches by 17 $\frac{1}{2}$ inches. Each tray is made from a piece of $\frac{3}{8}$ -inch galvanized wire mesh, 11 $\frac{1}{2}$ inches by 20 inches. The 20-inch length allows for the wire to be folded over the ends, thus strengthening the trays. Make framework of four $\frac{3}{4}$ -inch strips or similar pieces, side strips

being $17\frac{1}{2}$ inches long and end strips a little less than 10 inches long. Fit end strips in between the side pieces and nail. Staple wire mesh on to frame and bend edges over.

For the door, use the end originally removed from the box. Attach it to the box by means of four pieces of leather 1 inch wide and 5 inches long. If desired, metal hinges can be purchased for a few cents. The door illustrated is fastened by a slitted strip of oiled shoe leather, hooked over a bent nail on the side of the box. To open door, bend nail forward.

Support the box drier by four perforated No. 2½ tin cans, fastened to the corners of the box by 2 wires each.

Prepare strips of tin to direct the heat from the stove into the box. With a can opener cut out the sides of four No. 10 tin cans, a size commonly used

at bakeries and restaurants. Flatten and straighten the tin with pliers. Nail two of these pieces of tin along the two long sides on the outside of the box. Cut the other two pieces of tin into $11\frac{1}{2}$ -inch lengths. To cut tin (if tin shears are not available), bend it and cut it with can opener where bent. Nail one piece on back of drier in same manner as on sides. Nail the other piece to the brace inside the front end. Cut three strips of tin to cover the lower sides of the two ends and the brace, to prevent charring from heat. Cover top with fly screen.

Air circulates at the bottom of the evaporator between the strips of tin at the corners. The slats at the top allow the passage of air.

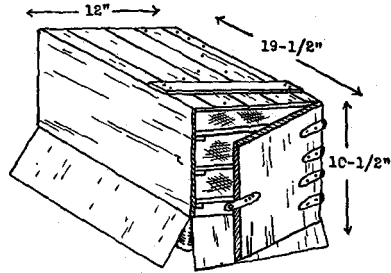


Figure 3. Home-made evaporator constructed from an apple box.

CURING

PRESERVATION OF VEGETABLES BY SALTING

Salt draws water from vegetables by the process of osmosis, forming a brine that acts as a germicide and so prevents spoilage. Vegetables may be salted in two ways: With a small proportion of salt which allows fermentation, and with a larger proportion of salt which prevents fermentation. Considerable food value is lost by either method.

DRY SALTING WITH FERMENTATION

Cabbage, string beans, beet tops and turnip tops are the vegetables most frequently preserved by dry salting with fermentation.

Sauerkraut. Equipment needed: (1) A stoneware crock, a hardwood keg free from undesirable flavors and odors, or glass jars. (2) A good grade of dairy salt. (3) Scales. (4) Knives or kraut cutter. Boards to cut on. (5) Containers for weighing the cut cabbage. (6) A wooden head or round piece of hardwood board about 1 inch thick and just small enough to slip in and out of the keg easily. A plate may be used instead of a board. (7) Clean stones or bricks to weigh the cabbage down in the brine (not limestone). A 5-gallon keg of kraut requires approximately a 10-pound weight. Increase weight with size of container. (8) White muslin or several thicknesses of cheese cloth cut 6 inches larger than the crock or keg, to cover the cabbage after it is packed.

Procedure in making sauerkraut. Use only sound cabbage. Trim off any undesirable parts. Wash cabbage. Shred fine, retaining core if desired. Weigh shredded cabbage and weigh $2\frac{1}{2}$ to 3 per cent as much salt as cabbage. That is, use from $2\frac{1}{2}$ to 3 pounds of salt to 100 pounds of shredded cabbage. Two and a half per cent of salt is the same as 1 pound of salt to 40 pounds of cabbage or 4 ounces of salt to 10 pounds of cabbage. The smaller amount of salt may be used with very clean cabbage, very clean utensils and the right temperature. The more salt, the less risk of spoilage. Too much salt, however, spoils the flavor.

Place a 3-inch layer of shredded cabbage in the container and pack down with the hands or with a tamper. Sprinkle with some of the salt. Add more cabbage, pack in firmly and add more salt. Continue placing alternate layers of cabbage and salt and pack down each layer firmly, until the container is $\frac{3}{4}$ full. The weighted salt should be evenly distributed throughout the cabbage, but in case extra salt is left, sprinkle it on the top layer. Spread the cloth over the mixture, tucking it down at the sides. On the cloth place the board or plate and on the board place the stone. The weight should be heavy enough to cause a brine to come up to the cover in a day or two. Leave in a warm clean place, preferably at 80° F. until bubbling or fermentation stops. The time needed for fermentation varies from two to four weeks. If scum or mold appears, skim it off, as it may completely spoil the kraut. After fermentation stops, seal the kraut in one of various ways. A common method used is to move the container to a cool place, remove the cloth and any scum or mold, adjust the amount of brine and weight so that the brine comes up to, but not over the cover, and pour very hot melted paraffin over the surface of the brine that is exposed. Do not move the container after pouring in the paraffin. After kraut is taken from the container, cover soon again with paraffin. Scum and mold must be prevented from forming, if the kraut is to keep a considerable length of time. See page 24

Kegs of sauerkraut may also be sealed by heading the filled keg and filling to the top through a bung-hole with brine using $\frac{3}{4}$ cup salt to a gallon of water. Keep the brine level in the bung-hole. Sauerkraut may also be canned.

To preserve other vegetables than cabbage by dry salting with fermentation, wash and trim them as for cooking and proceed by the same method described for sauerkraut.

DRY SALTING WITHOUT FERMENTATION

String beans, corn, dandelion greens, beet tops, spinach, chard and kale are preserved by salting without fermentation.

Use one-fourth as much salt as vegetables by weight, that is, 1 pound of salt to 4 pounds of vegetables. This proportion of salt largely prevents fermentation and growth of molds.

Proceed by the method described under Sauerkraut, except that layers of vegetables should be about 1 inch thick. If a brine does not form in 24 hours after application of the weight, add a strong brine until it comes up to the cover, using 1 pound of salt to 2 quarts of water.

USING BRINED PRODUCTS

Soak food preserved in salt without fermentation several hours in cold water before cooking, changing the water several times. Cook and season as in preparing fresh vegetables, except that salt is omitted.

CURING MEATS AND FISH

Curing agents. Salt is the main ingredient in all curing processes. The principal agents used in curing meats are the following:

- (1) Salt. Dairy salt is preferable. (See Table V.)
- (2) Sugar. Used in nearly all brining recipes and always in sweet pickling. Either white or brown sugar is satisfactory. Brown sugar imparts its characteristic flavor to meat. Sirup or molasses can be substituted for sugar.
- (3) Saltpeter. Saltpeter gives the characteristic red color to cured meat. A small amount is generally used. It is not necessary, but if omitted meat will have an unattractive, gray color.
- (4) Miscellaneous: Pepper, spices, onion.

TABLE V. FORMULA AND SCHEDULE FOR CURING MEATS

Kinds of meat	Mixture for each 100 pounds meat			Dry curing time to the pound in each piece	Brining time to the pound in each piece
	Dairy salt	Sugar	Saltpeter		
	<i>Pounds</i>	<i>Pounds</i>	<i>Ounces</i>	<i>Days</i>	<i>Days</i>
Hams and mutton leg.....	8	2	2	3	4
Shoulders, pork or mutton..	8	2	2	2	4
Bacon and mutton loin.....	8	2	2	2	3

Dry-curing meat. Meat may be cured without the use of brine as follows:

- (1) Prepare the necessary amount of salt mixture (see Table V).
- (2) Divide the mixture into two parts.
- (3) Use one portion to rub on the meat and around the bone of the meat.
- (4) Pack pieces of meat in a barrel or pile them on a table. Place last piece with skin side up.
- (5) After 3 days rub all pieces of meat again thoroughly with one-half of the remaining salt mixture. At this time repack the meat, placing the bottom pieces on top.
- (6) After 7 more days (on the tenth day) again repack the meat, rubbing into it the remainder of the salt mixture.
- (7) Cure the meat for the required length of time (see Table V).
- (8) Soak the cured product in fresh water 1 to 2 hours, then smoke or use.

Brining or sweet-pickling meat involves the following procedure:

- (1) Work in a cool place.
- (2) Provide an earthen jar or hardwood barrel.
- (3) Prepare the necessary amount of salt mixture (see Table V). If plain brine is desired, omit the sugar but use the other ingredients.
- (4) Save out one-fifth or one-sixth of the salt mixture.
- (5) Rub meat with the salt mixture which was saved out. Let the meat stand over night, or pack it immediately.
- (6) One day before the brine is to be used, prepare it by dissolving the salt mixture in boiling water. Allow 5 gallons of water to each 100 pounds of meat. Let cool over night.
- (7) Pack the meat in a jar or barrel.
- (8) Weigh the meat down with a clean hardwood board and a clean rock.
- (9) Cover the meat with the brine.
- (10) Mark on each jar or barrel the time when the pieces are to be taken out of the brine.

- (11) On the third day repack the meat. Shift the bottom pieces to the top.
- (12) On the tenth day, again repack the meat.
- (13) Leave the meat in the brine for the required time (see schedule, Table V, page 25).
- (14) If the brine sours, remove the meat, wash thoroughly, and add new brine. New brine should contain slightly less sugar and salt than the original.
- (15) When the curing time is up, remove the meat from the container and smoke or use.

Smoking cured meat. The active agent in smoking meat is the creosote in smoke which preserves and gives flavor. If a mild-flavored meat is desired, smoke only a small amount at a time. Bacon, the most difficult of meats to store, becomes rancid readily.

- (1) Cure meat by the dry-curing or brining method.
- (2) Soak hams, legs of mutton, shoulders of pork or mutton, and mutton loin, for 2 hours in cold water. Soak bacon for 30 minutes. Scrub the product with a stiff brush. This treatment gives smoked meats a brighter color and a milder flavor.
- (3) String hams, legs and shoulders through the shank, and bacon and mutton loin through the flank. If a regular stringing needle is not available, use a narrow bladed knife to make an opening through the shank of meat and pull the string through with a loop of wire. To keep bacon or a boned piece of mutton loin square while hanging in the smoke, run a wooden or wire skewer through the flank end of the strip and insert a string just below it.
- (4) Hang cured, washed meat in smokehouse over night to drain and dry. Be sure that no two pieces touch.
- (5) The next day, as soon as the meat has stopped dripping, start the fire. If the meat is still dripping when the smoking begins, the lower pieces will be streaked. Use any non-resinous wood. Hardwood sawdust or corncobs make good starters. Resinous woods such as fir discolor the meat, making it black.
- (6) Bring the smokehouse temperature to between 100° and 120° F. A heavy fog of smoke is not necessary.
- (7) Open ventilators, especially at first, to permit the moisture to escape.
- (8) Continue the smoking until the meat has the desired color. Meat should be a rich mahogany brown color if smoked for 2 or 3 days.

Smoked salt can be used satisfactorily for small amounts of meat. If smoked salt is used, the meat is not so deep a color as meat smoked in the usual manner, but the flavor is similar. Meat so cured may not keep as long as meat smoked by the usual method because it has more water in it. Follow directions that accompany smoked salt.

Wrapping and storing smoked meat. After meat is smoked it should be wrapped and stored as follows:

- (1) Cool smoked meat.
- (2) If desired, rub on the meat, to add flavor, ground black pepper, with or without a little red pepper.
- (3) Cover the meat with paper and put in muslin bag.
- (4) Fold down the top of the bag and tie it securely. In the outside tie-string, make a loop from which to hang the meat.
- (5) Hang in a dry, dark, cool place.
- (6) Rubbing the meat with dry soda may help to prevent molding.

To construct a smokehouse. If a large amount of meat or fish is to be smoked, a smokehouse is desirable. A common size is 6 by 8 feet square and 8 to

10 feet high (to the eaves). This height permits the meat or fish to hang 8 or 10 feet above the fire. Provide the smokehouse with plenty of ventilation so that the products will not get too hot. Build the fire on the floor of the smokehouse. (See Farmers' Bulletin 1186 for further details.)

A small, inexpensive smokehouse may be made on the side of a hill from a barrel to which smoke is conducted by a tunnel or stove-pipe from a fire below. Both ends of the barrel are removed, and a wire shelf is inserted near the top, which is covered with burlap.

Corning beef. Use the cheaper cuts of meat, such as the plate, rump and chuck, in making corned beef. Meat from fat animals makes better corned beef than meat from thin animals. It is desirable to corn at one time only such an amount as can be used within a month or six weeks.

(1) Cut the beef into pieces 5 or 6 inches square. Cut pieces uniform in thickness so they may be packed in even layers in the barrel.

(2) Cool meat thoroughly, then proceed with corning as soon as possible. Meat that has begun to spoil is unwholesome and will probably sour during the corning process. Do not cure meat that is in a frozen condition.

(3) Weigh the meat and for each 100 pounds allow 8 pounds of salt.

(4) Sprinkle a layer of salt $\frac{1}{4}$ inch in depth over the bottom of a clean stone jar or wooden barrel.

(5) Pack the cuts of meat as closely as possible, making a layer 5 or 6 inches thick.

(6) Add alternate layers of salt and meat, being careful to cover the top layer of meat with considerable salt.

(7) Allow the salted meat to stand overnight.

(8) Make a brine as follows: For each 100 pounds of meat use

- 4 pounds sugar
- 2 ounces baking soda
- 4 ounces saltpeter
- 1 gallon lukewarm water
- 3 gallons cold water

Dissolve sugar, soda, and saltpeter in lukewarm water. Add the cold water and cool.

(9) Pour brine over meat, after the meat has stood overnight.

(10) Keep the meat entirely under the brine by using a loose board cover with a weight on it. If any of the meat is not covered with brine, the brine will spoil in a short time.

(11) Keep brine in a cool place, as the sugar in the brine has a tendency to ferment.

(12) Keep the meat in brine from 28 to 40 days, to effect a good cure.

(13) Watch the brine closely for spoilage. Meat cured during the winter that must be kept into the summer season is more likely to spoil during the spring than at any other season. If the brine appears to be ropy, the pieces of meat should be removed, washed vigorously with a stiff brush and hot water, then repacked and covered with new brine.

Salting salmon. Use only fish that is absolutely fresh.

(1) Remove head, tail, fins, and entrails.

(2) Scrape and wash in salt water, $\frac{1}{4}$ cup salt to 1 gallon water. It is unnecessary to scale salmon. Drain after washing.

- (3) Remove backbone and cut fish in two, lengthwise.
- (4) Press blood out toward cavity left by removing backbone. Wipe with clean damp cloth.
- (5) Cut each side of fish into pieces 6 inches long.
- (6) Place $\frac{1}{4}$ -inch layer of salt in the bottom of an earthenware jar or hardwood keg.
- (7) Place a layer of fish over the salt, skin side down.
- (8) Cover the fish with $\frac{1}{4}$ -inch layer of salt.
- (9) Alternate layers of fish and salt.
- (10) Place the last layer of fish, skin side up, and cover well with salt. Cover the container with a cloth or board.
- (11) Let stand 3 days. A brine forms in the bottom of the container.
- (12) At the end of the third day, wash salt from fish by holding it a few seconds under running water. Clean salt and brine from container. Do not use this salt again.
- (13) Make a saturated brine. To do so, pour water over a quantity of salt, stir, and add more salt until crystals remain undissolved. Let cool thoroughly. Strain solution through cloth if rock salt is used.
- (14) Place the fish in the saturated brine and cover with plate or clean hardwood board. Place a clean stone on the board. No portion of the fish should project above the surface of the brine. Cover the container.
- (15) Let stand 1 week. Then change to a second saturated salt solution. Pack as described in section 14.
- (16) Store in a cool place. Examine occasionally. As the brine evaporates, add more brine to keep the fish completely covered. If the odor becomes too strong, discard the old brine and add fresh saturated brine.
- (17) Before using, freshen by breaking into sections and soaking overnight in cold water. If still too salty, freshen in a second water.
- (18) Salted fish may be creamed, escalloped, fried, or used in potato balls, salads, and other dishes. Boil all home cured fish thoroughly before tasting.

Smoking salmon. Smoking fish gives a more tasty product than salting.

- (1) Follow the directions given for salting salmon, to the end of the third day, sections (1) through (11).
- (2) Remove the fish from the salt and wash it in running water for 10 minutes. This bath removes part of the salt from the outer layers of the fish and aids in the penetration of creosote. Drain. Dry with a clean cloth.
- (3) Lay on wire shelves in the smokehouse. Avoid the use of hooks as mold may later develop where hooks enter fish. Fish should be at least 8 feet from the fire. Use a smoldering, smoking fire of nonresinous wood, such as oak, apple, or alder. Do not allow the fish to become so hot that it drips fat.
- (4) Keep the fire burning steadily. If the fire should go out, rebuild and continue smoking the fish as soon as possible. Turn the fish occasionally.
- (5) Smoke the fish until it is coated evenly with a brown color slightly darker than that generally used for meat. This requires from 3 to 4 days and nights of steady smoking.
- (6) Store by wrapping in paper and hanging in a bag in a dry, dark, cool place.
- (7) Examine occasionally for mold. If mold starts, remove with a clean cloth and resmoke the fish.
- (8) Before using, freshen the fish by breaking it into sections and soaking over night in cold water. If still too salty, freshen in a second water.

(9) If the fish has been sufficiently cured, it will keep for several months. Kippered salmon is given a very light cure, and being in the salt and smoke only a short time, it therefore deteriorates quickly. Smoked salmon may be creamed, fried, escalloped, or used in sandwiches, salads, potato balls, and other dishes. Boil all home cured fish thoroughly before tasting.

OTHER METHODS

STORING VEGETABLES

Vegetables that can be stored successfully in their natural condition, include potatoes, beets, carrots, parsnips, salsify, turnips, pumpkins, squashes, cabbage, onions, dry beans, and, for a limited period, tomatoes and peppers.

Late-maturing vegetables are most suitable for storage. Select specimens that are sound, in the proper stage of development, and free from blemish such as cracks, cuts, and bruises, which are usually conducive to rots and molds.

Temperature, moisture, and ventilation are important factors in storing vegetables. Moderately high temperatures cause shrinkage and breakdown, whereas temperatures below 32° F. may cause freezing and injury. With the exception of squash, pumpkin, dry beans, tomatoes, and peppers, temperatures ranging from a few degrees above 32° to 40° or 45° F. are most suitable. The optimum humidity or moisture varies with the vegetable being stored. Root

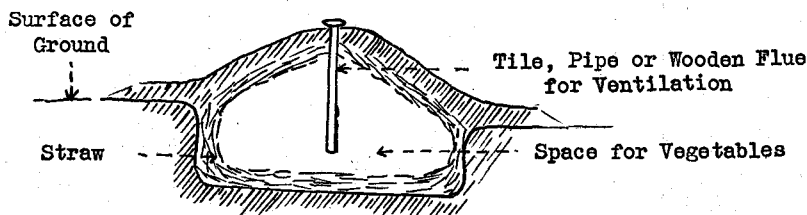


Figure 4. Pit for storing vegetables.

crops store well in an atmosphere of high humidity, but potatoes, onions, squash, and dry beans store best under relatively dry conditions. Air circulation helps regulate temperature and humidity and may also remove unpleasant odors given off by the products in storage.

For more details on vegetable storage see Extension mimeograph circular 339, Farm Vegetable Storage, and Farmers' Bulletin 879.

FREEZING FOOD

Many kinds of meat, fish, vegetables, and fruits can be successfully preserved by freezing. Lockers for this purpose can be rented at commercial locker plants. A few homes have their own freezing units. Careful preparation of products is necessary to success. Directions can be obtained from your county extension agent or from Oregon State college.

Directions and Time Tables for Canning

Table VI. VEGETABLES

***CAUTION.** Hot water bath method of canning is not recommended for nonacid vegetables, meats, and fish. If use of pressure cooker is not possible, the essential steps in the hot water bath method should be followed very carefully and the full period of time allowed for processing. After emptying jar and before tasting, boil home canned meat, fish and nonacid vegetables 20 minutes on same day eaten. Canned food showing any signs of spoilage should be burned, or mixed with 1 tablespoon of lye and buried. Avoid placing where animals can find it.

Pack boiling hot foods in hot jars standing in hot water. See page 12 for canning vegetables.

Product	Preparation for canning	Pressure cooker†						Hot water bath* (Boiling water, 212° F.) †
		Pint jars		Quart jars		No. 2 cans No. 2½ cans		
		Time	Pressure	Time	Pressure	Time	Pressure	Pint and quart jars
Asparagus*‡.....	Wash, trim, cut exact length to fit upright in container—tie in bundles—place butts in boiling water, cover tightly, boil 2 to 3 minutes. Or cut in ½ inch lengths, bring to boil in water to cover. Pack loosely to ½ inch from top of jar or ¼ inch from top of tin can. Add ½ teaspoon salt per pint. Add hot liquid in which food was cooked to ½ inch from top of jar or ¼ inch from top of can.	Min. 35	Lb. 10	Min. 40	Lb. 10	Min. 30	Lb. 10	Hr. 3*‡
Beans, string*‡.	String, wash, cut in ½ inch lengths if desired, boil 5 minutes uncovered, pack hot and loosely to 1 inch from top. Add ½ level teaspoon salt per pint. Add liquid in which cooked to 1 inch from top of jar or ¼ inch from top of tin can.	35	10	40	10	30	10	3*‡
Beans, lima*‡....	Shell, wash, bring to boil in water to cover, pack hot and loosely to 1 inch from top of jar. Add ½ level teaspoon salt per pint. Add liquid in which cooked to 1 inch from top	55	10	60	10	55	10	3*‡

Beets*†	of jar or $\frac{1}{4}$ inch from top of tin can. Can only young beans. Wash, leave 1-inch stems and all roots, boil or steam 15 minutes, slip skins. Pack hot and loosely to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can. Add $\frac{1}{2}$ level teaspoon salt per pint. Add boiling water to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can. Can only young, tender beets.	35	10	40	10	35	10	2*†
Carrots*†	Wash, peel, boil 5 to 15 minutes, pack sliced, diced, or whole. Pack hot and loosely to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can. Add $\frac{1}{2}$ level teaspoon salt per pint. Add hot liquid in which food was cooked to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can. Can only young carrots.	35	10	40	10	30	10	2*†
Corn, whole grain*†	Gather while inside of kernels is still slightly milky. Can as soon as taken from garden. Husk, silk, wash, cut from cob without precooking, add half as much boiling water as corn, heat to boiling point, pack hot and loosely to 1 inch from top. Add $\frac{1}{2}$ level teaspoon salt per pint. Add liquid in which food was cooked to 1 inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	75	10	80	10	70 (No. 2) can	10	3*†
Corn, cream style*†	Prepare for cutting same as whole grain corn. Cut off tops of kernels, scrape remaining portion and mix scrapings with cut kernels. Add half as much boiling water as corn, heat to boiling point, pack hot and loosely to 1 inch from top. Add $\frac{1}{2}$ level teaspoon salt per pint. Fill tin cans to $\frac{1}{4}$ inch from top.	105	10	....	....	100	10	3*†

*See CAUTION at head of table, page 30.

†In using the pressure cooker above 2,000 feet elevation, add one pound of pressure for each 2,000 feet. For water bath canning, for each additional 1,000 feet altitude above 1,000 feet, increase the processing time recommended in canning tables by 20 per cent.

‡Containers larger than pint jars or No. 2 cans are not recommended.

Table VI. VEGETABLES (Continued)

Product	Preparation for canning	Pressure cooker†						Hot water bath* (Boiling water, 212° F.) †
		Pint jars		Quart jars		No. 2 cans No. 2½ cans		Pint and quart jars
		Time	Pressure	Time	Pressure	Time	Pressure	
Greens*‡..... (includes spinach, beet tops, chard, etc.)	Wash carefully, trim, cook in small amount boiling water 2 to 5 minutes or until main stem wilts somewhat. Pack hot. Pack loosely to ½ inch from top. Add ½ level teaspoon salt to each pint. Cut across center of pack at right angles. Add hot liquid in which food was cooked to ½ inch from top of jar or ¼ inch from top of tin can.	Min. 60	Lb. 15	Min.	Lb.	Min. 55 (No. 2) 60 (No. 2½)	Lb. 15	Hr. 3*‡
32 Mushrooms*‡.....	Wash, peel, drop into water containing 1 tablespoon vinegar per quart, precook 3 to 4 minutes in boiling water which contains 1 tablespoon vinegar per quart. Pack hot. Pack loosely to ½ inch from top of jar or to ¼ inch from top of can. Add ½ level teaspoon salt to each pint. Add boiling water to ½ inch from top of jar or ¼ inch from top of tin can.	30	10	35	10	25	10	3*‡
Peas*‡.....	Wash, shell, bring to boil in water to cover. Pack hot and loosely to ½ inch from top of jar or ¼ inch from top of can. Add ½ level teaspoon salt per pint. Add hot liquid in which food was cooked to ½ inch from top of jar or ¼ inch from top of can. Peas may be shelled by dipping in boiling water and running, stem end first, through wringer or pea sheller. Can only young peas.	45	10	....	....	45	10	3*‡

Pumpkin and squash*†	Wash, cut into large sections, bake or steam until easily removed from shell. Pack hot and loosely to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of can. Add $\frac{1}{2}$ level teaspoon salt per pint. Add boiling water to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	70	15	....	....	70	15	3*†
Sauerkraut*	Bring to boil, pack hot to $\frac{1}{2}$ inch from top of jar, add kraut juice or boiled weak brine (1 tablespoon salt to 3 pints water) to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	15	10	20	10	15	10	35*
Spinach sieved for infants*† (See greens above)	Wash, trim, boil in small amount of water 15 minutes, press through ricer or sieve, bring to boil, pack loosely in half-pint jars to $\frac{1}{2}$ inch from top of jar. Add $\frac{1}{8}$ teaspoon salt to half-pint jar.	60	15	....	....	55	15	3*†
Tomatoes	See time table for fruits.							
Vegetable soup*†	Use any combination of vegetables desired or available, such as beans, corn, and tomatoes. Include a green vegetable. Wash, trim, chop, boil 5 minutes. Use process time of ingredient requiring longest cooking. Meat stock may be used as liquid for precooking and for filling jar, but needs same processing as meat. Pack hot. Pack loosely to $\frac{1}{2}$ inch from top of jar or to $\frac{1}{4}$ inch from top of can. Add $\frac{1}{2}$ level teaspoon salt to each pint. Add hot liquid in which food was cooked to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of can.	70	15	....	....	70	15	3*†

*See CAUTION at head of table, page 30.

†In using the pressure cooker above 2,000 feet elevation, add one pound of pressure for each 2,000 feet. For water bath canning, for each additional 1,000 feet altitude above 1,000 feet, increase the processing time recommended in canning tables by 20 per cent.

‡Containers larger than pint jars or No. 2 cans are not recommended.

Directions and Time Tables for Canning

Table VII. FRUIT CANNING IN HOT WATER BATH

Hot pack of fruits, or precooking a few minutes is recommended for better keeping qualities and for shrinking the fruit and producing fuller containers than with the cold pack. Place hot jars in boiling water on rack. Water should come 1 inch over tops of jars. Seal jars immediately after processing. Keep water boiling continuously the required time. For higher altitudes with water bath canning, for each additional 1,000 feet altitude above 1,000 feet, increase the processing time recommended in canning tables by 20 per cent. For half gallon jars, add 5 minutes.

Sirups: thin—1 cup sugar, 3 cups water; medium—1 cup sugar, 2 cups water; thick—1 cup sugar, 1 cup water. See pages 9-12 for canning fruits and tomatoes, and open kettle canning; and page 15 for canning in tin.

Fruit	Preparation for canning	Hot water bath (Boiling water, 212° F.)	
		Pint or quart jars	No. 2 or No. 2½ tin cans
		<i>Minutes</i>	<i>Minutes</i>
34 Apples.....	Wash, pare, core, quarter or slice into cold salt solution (4 teaspoons salt to 1 gallon water), wash, pack into hot jars standing in hot water, add boiling, medium sirup to ½ inch from top of jar, or ¼ inch from top of tin can. Fuller pack by precooking.	15	10
	Or boil 5 minutes in medium sirup, pack hot.	5	5
	Or bake as for serving, pack hot.	5	5
	Or make into apple sauce, pack hot.	5	5
Apricots.....	Treat same as peaches.	15	15
	Or wipe with damp cloth, do not peel. Halve and pit, precook in boiling medium sirup.	15	15
Blackberries Gooseberries Huckleberries Loganberries Raspberries	Sort and discard decayed berries.		
	Wash carefully, remove caps and stems. To hull gooseberries, rub them together gently in a coarse bag. Avoid tight packing, add boiling medium sirup to ½ inch from top of jar or ¼ inch from top of tin can.	20	15
	Or to each quart of berries add ½ to 1 cup sugar, boil 5 minutes, stirring gently, pack hot. Add more sugar to gooseberries if desired.	5	5
Cherries.....	Wash, stem, pack, add boiling medium sirup to ½ inch from top of jar or ¼ inch from top of tin can.	25	20
	Or remove pits, add sugar as desired, bring to boil, pack hot.	5	5
Peaches.....	Select firm, ripe peaches, immerse in boiling water 1 minute or until skins slip easily, plunge into cold water for few seconds, peel, cut into halves, remove pits, simmer 4 to 8 minutes in thin or medium sirup, pack with pitted sides	15	15

	down in overlapping layers, add boiling sirup to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can. May add one cracked pit to each quart sirup. Strain before using. Peel clingstone peaches if necessary with lye bath of 2 table-spoons lye to 1 gallon water in agate or iron. Heat, then wash thoroughly.		
Pears.....	Can pears when in good eating condition. Pare, cut into halves or quarters, core (be sure to remove all white core), drop immediately into cold salt bath (4 level teaspoons salt to 1 gallon water) wash before cooking. Cook 4 to 8 minutes in hot thin or medium sirup, pack hot, add boiling sirup to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	20	20
	Or bake, pack hot, add hot sirup and process in jars.	5	5
Prunes or plums....	Wash, pack; cover with boiling medium sirup to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of can. Pricking skins prevents bursting.	20	15
	Or add sugar as desired. Boil 3 to 5 minutes, pack hot.	5	5
Rhubarb.....	Trim, wash carefully, cut into $\frac{1}{2}$ inch lengths, pack, cover with boiling medium or thick sirup.	20	15
	Or cut into $\frac{1}{2}$ inch lengths, add 1 cup sugar for each quart rhubarb, bake in covered dish until tender, pack hot.	5	5
	Or cut into $\frac{1}{2}$ inch lengths, pack in sterilized jars, fill to overflowing with cold water, seal and store without processing. Use this method only if rhubarb is fresh and not overripe. Cook after opening jars.	—	—
Strawberries.....	Wash, stem, place in preserving kettle in alternate layers with sugar, using $\frac{3}{4}$ to 1 cup sugar to 1 quart raw berries; reserve sufficient sugar to cover last layer; let stand over night, at least 12 hours. Boil 1 minute, pack in hot jars to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of can. This method helps to prevent shrinkage, and to produce even distribution of berries in jar; in some seasons, may not be effective. May boil $\frac{1}{2}$ minute in sirup; let stand over night. Then process.	10	10
Tomatoes.....	Use firm, ripe tomatoes, wash, place in thin cloth or wire basket, dip into boiling water 1 minute or until skins slip easily, plunge into cold water for an instant, core (be sure to remove all white core), peel, trim well, pack whole or in pieces. Add 1 teaspoon salt per quart if desired. For home use fill jars with boiling juice of other tomatoes to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	45	35
	Or cut in quarters, heat to boiling and pack hot.	10	10
Tomato juice.....	Use firm, ripe tomatoes, wash well, cut into sections, crush slightly to set free juice to start the cooking, cook quickly until soft, stirring occasionally to prevent burning, put through sieve fine enough to remove seeds,* add 1 teaspoon salt to each quart if desired, bring to boil, pour into containers to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	20	20
Fruit juice†.....	Wash fruit, crush, heat slowly, to simmering point, about 185° F., strain through thick clean cloth, add $\frac{1}{4}$ cup sugar to each quart fruit juice, bring to simmering point pour into containers to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	30 at sim- mering point	30 at simmering point

*Note: It has been suggested that tomatoes be allowed to cool before straining as a means of preserving more of the vitamin C.

†Note: Before using berry juice, a good general rule is to first dilute $\frac{1}{3}$ to $\frac{1}{2}$ with cold water and add sugar to taste. Use 1 part of logan-berry juice to 6 or 7 parts of cold water and add sugar to taste.

Directions and Time Tables for Canning

Table VIII. MEATS, POULTRY, AND FISH

***CAUTION.** Hot water bath method of canning is not recommended for nonacid vegetables, meat, and fish. If use of pressure cooker is not possible, the essential steps in the hot water bath method should be followed very carefully and the full period of time allowed for processing. After emptying jar and before tasting, boil home canned meat, fish, and nonacid vegetables on same day eaten. Canned food showing any signs of spoilage should be burned, or mixed with 1 tablespoon of lye and buried. Avoid placing where animals can find it.

Pack boiling hot foods in hot jars standing in hot water. See pages 13-14 for canning meats, poultry, and fish.

Product	Preparation for canning	Pressure cooker†								Hot water bath* (Boiling water, 212° F.)†
		Pint jars		Quart jars		No. 2 cans		No. 2½ cans		
		Time	Pressure	Time	Pressure	Time	Pressure	Time	Pressure	Pint and quart jars
Chicken, with bone*‡	Use young cockerels or fat hens. Kill at least 6 hours before canning. Bleed well, pick, singe and remove pin feathers, wash, draw, cut as for serving, remove excess fat. Make broth from wing tips, neck, breast bone. Retain other bones. Boil in broth until thoroughly heated. Pack hot and loosely as follows: pack vertically drumsticks, thighs, and wings with elbows linked together. Place back and breast meat on top. May add heart and gizzard. Can livers separately. Add 1 teaspoon salt per pint. Add boiling broth to ½ inch from top of jar or ¼ inch from top of tin can.	Min.	Lb.	Min.	Lb.	Min.	Lb.	Min.	Lb.	Hr.
		90	15	100	15	90	15	90	15	4*‡

Chicken, boned*†	Prepare for cooking as described above. Boil or roast until nearly done. Remove meat from bone. Bring to boil in own broth or drippings. Pack hot and loosely. Add 1 teaspoon salt per pint. Add boiling broth to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of tin can.	100	15	110	15	100	15	100	15	4*†
Beef, veal, lamb, mutton, venison*†	Butcher at least 12 hours before canning. Can after animal heat is gone. Make broth from large bones. Clean meat with damp cloth, cut into convenient pieces. Boil in broth until thoroughly heated. Pack hot and loosely. Add 1 teaspoon salt per pint. Add boiling broth to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of can. May sear before boiling and add diluted pan drippings. For hamburger see Sausage under Pork.	110	15	130	15	110	15	120	15	4*†
Pork*†	Butcher at least 12 hours before canning. Can after animal heat is gone. Remove excess fat and prepare and pack as beef.	110	15	130	15	110	15	120	15	4*†
	To make sausage, grind meat, salt, make into pats, sear, pack hot and loosely, add diluted pan drippings to $\frac{1}{2}$ inch from top of jar or $\frac{1}{4}$ inch from top of can. Many prefer seasoning just before using.	110	15	130	15	110	15	120	15	4 $\frac{1}{2}$ *†
Rabbit*†	Use methods given for chicken. Skin.									

*See CAUTION at head of table.

†The following modification for altitude is recommended. For pressure cooker, after the first 2,000 feet of elevation add one pound pressure for each 2,000 feet. For water bath canning, for each additional 1,000 feet of altitude above 1,000 feet, increase the processing time recommended in canning tables by 20 per cent.

‡Containers larger than pint jars or No. 2 cans are not recommended.

Table VIII. MEATS, POULTRY, AND FISH (Continued)

Product	Preparation for canning	Pressure cooker†								Hot water bath* (Boiling water, 212° F.) †
		Pint jars		Quart jars		No. 2 cans		No. 2½ cans			Pint and quart jars
		Time	Pressure	Time	Pressure	Time	Pressure	Time	Pressure	
Clams**‡	Wash clams. Open by slitting with knife or steaming over boiling water, remove from shell, save juice. Wash until all sand is removed, run through food chopper. Add strained juice and boil until thoroughly heated. Pack hot and loosely to ½ inch from top of jar or ¼ inch from top of can. Add 1 teaspoon salt per pint.	Min. 125	Lb. 10	Min.	Pressure	Min. 120	Pressure 10	Min.	Pressure	Hr. 4*‡
Crabs**‡	Kill with knife, remove entrails, boil 20 minutes. Peel. Bring to boil in hot brine, using 2 level teaspoons salt to 1 quart water. Pack hot and loosely to ½ inch from top of jar or ¼ inch from top of can. If packed in tin use C-enamel cans with parchment lining.	125	10	....	....	120	10	....	....	4*‡
Oysters**‡	Same method as clams. Leave whole.	125	10	....	....	120	10	....	....	4*‡
Salmon**‡	Use only absolutely fresh fish. Remove head, tail, fins, entrails and backbone, dip into boiling water and scale or skin, wipe with clean damp cloth or wash, press out blood. Cut slices across fish and roll, pack loosely. Skin outside aids in slipping from jar. Add 1 teaspoon salt per pint, add no water. Early Chinook best for canning. Flavor is better if skin left on; if skin is removed, or fish has little fat add 2 teaspoons salad oil per pint. Exhaust tin cans.	125	10	....	....	120	10	....	....	4*‡

Smelt and trout*†	Remove head, tail, entrals, scales. Cut crosswise if necessary to fit jar, pack vertically, add 1 teaspoon salt per pint, add no water. May sear and add diluted drippings. Exhaust tin cans.	120	10	....	....	120	10	....	....	4*†
Smelt in oil	Eviscerate, remove head, and clean with water. Put into 22-25 per cent salt solution (1 lb. salt to 2 qts. water) for 20-45 minutes or until fish tissue shows evidence of hardening using twice as much brine as fish. Remove and rinse in water. Dry on slatted tray in baking oven for few hours or in hot sun for a day. Fry in cottonseed or corn oil for 1½-8 minutes or until backbone can be lifted out by the tail. Fill containers, carefully fitting fish together. Cover with oil. Seal.	30	10	....	....	30 (No. 2)	10	....	....	4*†
Tuna fish	Use only fresh fish. Remove head and entrals. Bake in pan with rack in moderate oven (300-325° F.) or a steam bath for 2-4 hours until the natural oil has been separated from the muscle. Cool to room temperature or until muscles are firm. Remove skin with knife or by hand. Separate the four long muscle sections from the backbone. Cut into desired lengths. Pack. Add 1 teaspoon of salt and 2 teaspoons salad oil per pint jar or No. 2 can. Exhaust tin cans.	125	10	....	....	120	10	....	....	4*†

*See CAUTION at head of table.

†The following modification for altitude is recommended. For pressure cooker, after the first 2,000 feet of elevation add one pound pressure for each 2,000 feet. For water bath canning, for each additional 1,000 feet of altitude above 1,000 feet, increase the processing time recommended in canning tables by 20 per cent.

‡Containers larger than pint jars or No. 2 cans are not recommended.

PUBLICATIONS AVAILABLE ON SUBJECTS RELATED TO HOME FOOD PRESERVATION

Oregon State College Publications

- Mimeograph Circular HE 784—Preserving Eggs in Water Glass Solution and Lime Water
Mimeograph Circular HE 498—Fruit Jellies, Preserves, Jams, Marmalades, Conserves and Butters.
Mimeograph Circular HE 748—Bottling Fruit Juices.
Mimeograph Circular HE 750—Homemade Pickles and Relishes
Mimeograph Circular HE 208—Tomato Recipes
Mimeograph Circular HE 753—Suggested Plan for Family Food Supply.
Extension Bulletin 461—Canned and Stored Food Budget
Extension Bulletin 525—Farm Vegetable Garden.
Extension Bulletin 457—Planting the Subsistence Vegetable Garden
Extension Mimeograph Circular 282—A Monthly Schedule of Operations in Growing Vegetables for Home Use on the General Farm
Extension Mimeograph Circular 283—Crop Requirements and Planting Directions For the Home Vegetable Garden
Extension Mimeograph Circular 339—Farm Vegetable Storage
Extension Bulletin 523—Vegetable Garden Insect Pest Control.
Mimeograph Circular HE 537—Salt Pork Recipes
Mimeograph Circular HE 295—Twenty Ways of Using Oregon Carrots.
Extension Bulletin 537—Low Cost Menus for One Month With Recipes
Mimeograph Circular HE 501—Guide for Weekly Market Order to Provide Adequate Diet at Minimum Cost
Mimeograph Circular HE 1100—Preparing and Storing Meat in Cold Storage Lockers
MC 53—Preservation of Fruits and Vegetables by Freezing

U. S. Department of Agriculture Publications

- Farmers' Bulletin 900—Homemade Fruit Butters
Farmers' Bulletin 1264—Farm Manufacture of Unfermented Apple Juice
Farmers' Bulletin 1424—Making Vinegar in the Home
Farmers' Bulletin 1233—Tomatoes for Canning
Farmers' Bulletin 1415—Beef on the Farm, Slaughtering, Cutting, Curing
Farmers' Bulletin 1186—Pork on the Farm
Farmers' Bulletin 74 L—Boning Lamb Cuts
Farmers' Bulletin 1236—Corn and its Uses as Food
Farmers' Bulletin 9 L—Making and Storing Farm Butter for Winter Use
Farmers' Bulletin 1757—Diets to Fit the Family Income
Farmers' Bulletin 1800—Homemade Jellies, Jams and Preserves
Farmers' Bulletin 879—Home Storage of Vegetables
Farmers' Bulletin 847—Potato Storage House

These publications and a list of other available bulletins on home economics subjects can be obtained free of charge from your County Extension Agent or by writing the Home Economics Extension Service, Oregon State College, Corvallis.