Home Canning of Foods For Family Use

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THIS CIRCULAR gives simple directions for canning foods at home according to the best methods known at the present time. Large crops of fruits such as strawberries, peaches, and apples are raised in Illinois and other fruits are grown in smaller quantities; the home vegetable garden is part of the plan on many farms; and meat animals, especially hogs, are raised thruout the state. These provide an abundance of food, more than is needed in season. If food is preserved safely so that the form and flavor are much like the fresh product, it will be enjoyed thruout the year and will result in a real saving. A year's supply of canned fruits, vegetables, and meats will make possible better balanced meals, which should result in better health and a consequent saving in the money spent to maintain health.

However, unless care is taken in canning to use the highest grade of raw materials and to apply the results of scientific research, good food, fuel, and work will be wasted and the family subjected to the danger of botulism, an ever-present menace. The home canner should check carefully the amount of spoilage which is occurring in her home-canned foods, should endeavor to learn the causes, and should make the necessary changes to reduce such loss to a minimum.

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Home Canning of Foods for Family Use

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THERE is no basis for prejudice for or against the use of either home-canned or commercially canned foods. Each has its place in the Illinois home. The canners of home products can benefit, however, by the years of experience and the extensive laboratory investigations that have given assurance to commercial canning. Commercially canned foods are usually prepared under better controlled conditions than are some home-canned foods, for commercial canners have had to develop adequate canning processes. They regard one percent spoilage as high and usually keep the proportion of spoiled products below one-half of one percent.

High-pressure steam is used in processing most commercially canned foods, a process comparable to cooking home-canned foods in a pressure cooker. Commercial canners have found that from the standpoint of spoilage alone, processing under pressure is the safest method of canning. The process times and temperatures used by commercial canners have been arrived at after years of experience and very extensive laboratory investigations. The home canner should be eager to use as much of this information as possible in order to reduce the amount of spoilage which takes place in home-canned foods, as well as to have all foods entirely free from possibilities of botulism poisoning.

CAUSES OF SPOILAGE

The art of canning is an attempt to free foods of microorganisms and to keep them free in sealed containers. If the home canner will fully appreciate this fact, and remember that microorganisms are everywhere, she will have greater success. When Appert first announced the method of food preservation by canning, he advised boiling or cooking, and placing in a hermetically sealed container. He thought spoilage was due to the entrance of air and that if air were kept out of the container, the foods would keep. We now know that the main reason for sealing in tight containers is to prevent the entrance of spoilage microorganisms.[1] Here we have the real reason for giving so much attention to the seal or closure on containers used in canning. The early scientists who studied the cause of spoilage of

[1]The term microorganisms includes all forms of life which cannot be seen without the aid of a microscope. The term bacteria is often used in the same manner.

canned foods could have saved much time had they made better closures.

There are three groups of microorganisms—bacteria, yeasts, and molds—which are especially important in causing spoilage of canned foods. Members of these groups are always present on the outside of fruits and vegetables.

Bacteria. This group of microorganisms causes most trouble to the home canner and to the commercial canner. Bacteria are so small that it requires a microscope magnifying about 1,000 times to make them visible to the human eye. Some 12,000 ordinary bacteria would be required to reach one inch. It is no wonder that canners did not know what was spoiling their foods until scientists found the bacteria that were responsible.

Bacteria which spoil canned foods are in general spore-formers. A spore is a tiny resistant body that appears in the bacterial cell; it may be compared to the seed of a plant. Since the spores are very resistant to heat, some of them may survive the processing of canned products, altho every effort should be made to destroy all of them. When a can of food has been stored in the fruit cellar, the spores which have survived germinate and begin to grow and form thousands of cells, all of which may have a part in spoiling the food. The rapidity of growth depends mainly on the temperature of the storage room. Bacteria multiply very rapidly when kept in a warm place. When the temperature is kept so low that the spores cannot germinate, evidence of growth of bacteria may not be apparent for a long time. In fact, in some cases they may never grow so long as the food is stored properly.

Yeasts. Yeasts are larger than bacteria, and are just as active in spoilage of preserved foods. They are active destroyers of sugar and are therefore responsible for considerable spoilage of fruits such as peaches and pears canned in sirups. They are not so resistant to heat as are bacteria. When they are the cause of spoilage, it means that too little heat was used at some step in the canning procedure or that the container was defective.

Molds. These microorganisms differ from bacteria and yeasts in that they grow with long threads. The appearance of mold growth is familiar to everyone and need not be discussed. Molds also form resistant bodies which are much like the seeds of higher plants. After they have been liberated from the plant, these bodies are carried about in air currents. When conditions are right, they germinate and reproduce the well-known mold growth.

TYPES OF SPOILAGE

Putrefaction. A very bad odor and a marked change in the appearance and consistency of food are evidence of putrefaction. Certain foods are darkened. One would not be likely to serve such a food, but instances are on record where it has been done, and where illness has resulted. When a canned food which has started to putrefy is heated, a very bad odor is given off. This is a warning that the food should be discarded. Putrefaction usually occurs in nonacid foods, such as corn, peas, and meats.

Fermentation. Fermentation occurs to a greater extent in foods such as the fruits, peaches, pears, cherries, etc., which contain considerable sugar or which have been packed in sirup. The organisms which ferment sugars are usually yeasts; consequently, when fermentation takes place, it means that the food was not thoroly cooked. A can of food which has undergone fermentation will be under considerable pressure, and when the lid is removed both gas and liquid may escape.

Flat Sour. Some foods, such as corn, string beans, and peas, are subject to flat sour, a type of spoilage accompanied by acid formation without apparent gas formation. The term originated with foods packed in tin cans. The ends of the can in the case of flat sour are not bulged, since no gas is formed, but remain flat; the presence of acid in the food gives it the sour taste. Flat-sour foods usually have a cloudy liquid. This type of spoilage is generally due to thermophilic, or heat-loving, bacteria. Consequently flat-sour spoilage may result from lack of proper cooling immediately after processing or from storing the jars in a warm place. The possibility of the development of flat-sour spoilage is further reason for taking great care in storing canned foods. Cans of food which contain the living bacteria that produce flat sour may not spoil if the cans are stored at temperatures low enough to prevent the development of the bacteria.

THE DANGER OF BOTULISM

Many outbreaks of botulism during the last few years have been traced to home-canned foods. This fact should cause the home canner to use only the safest procedures in canning. It is definitely established that many of the canned foods which have caused botulism were packed by methods which cannot be approved in the light of present knowledge. The bacterium which causes botulism grows especially well away from air; it forms a very powerful poison and very heat-resistant spores. It is widely disseminated in the soil. These facts indicate that no method of home canning should be advised which

does not take into consideration the possible presence of *Clostridium botulinum* and the consequent formation of poison if foods are not properly processed. The home canner should not risk the dangers of inadequate processing, but should profit from the bitter experiences with improperly canned foods in the last fifteen years.

The poison formed by *Clostridium botulinum* is one of the most active ones known. A very small amount will cause death. Some fatal cases have been reported where a little liquid was left on the tongue from tasting a portion of a beanpod. Even tho the mouth was cleaned as thoroly as possible, death resulted after several days. Many similar cases justify the following advice: Do not taste nonacid home-canned foods (corn, peas, string beans, meats, etc.) until after they have been thoroly heated, unless it is certain that adequate processes have been used in canning. Boiling is necessary to destroy the poison formed thru the growth of spores which may remain in inadequately processed foods.

The spores of *Clostridium botulinum* are very resistant to heat. One strain has been reported which forms spores that can resist boiling for 330 minutes at 212° F. This information should be kept in mind when choosing a method of processing in canning foods at home.

Foods in which *Clostridium botulinum* has grown generally have very pronounced characteristics which should warn the consumer. They are usually heavily impregnated with gas and have a very foul odor. When this odor is especially characteristic, it may be said to be "cheesy," altho in some instances this cheesy odor is masked by the other evidences of putrefaction. No decomposed foods should be served under any circumstances, for not only are decomposed canned foods displeasing in appearance and unpalatable but they may be very dangerous.

There are some instances on record where the food which caused botulism gave no evidence of abnormality.

DESTROYING MICROORGANISMS WITH HEAT

When heat is used for the destruction of microorganisms, canners try to use the minimum amount necessary, in order to produce as few changes in the food as possible. A can of food can be completely sterilized by cooking it at a high temperature for a long time, but it would probably be so changed in texture and in color as to be rendered unsuitable for food.

In their active growing stages, bacteria are quickly destroyed by heating at 212° F. This is not so with spores; long-continued heating is necessary to destroy them, and furthermore the spores of some bacteria are much more resistant to heat than are the spores of others.

It is also important to know that a can of food that contains few spores is much more easily sterilized than one that contains great numbers of them. Careful washing of raw materials, especially such vegetables as spinach, beets, or string beans, is therefore of special value, for in this way a large proportion of the microorganisms are removed, thus reducing the load on the sterilization process and the amount of heat needed.

Canning compounds or "canning powders" should not be used. If the food and container are heated sufficiently for the necessary length of time to destroy microorganisms causing spoilage and the container is sealed so that others cannot enter, the product will keep.

Complete Heat Penetration Important. Since bacteria will not be destroyed unless the entire contents of a can are thoroly heated, the rate of heat penetration is an important factor to consider in determining the degree of heat to apply and the length of time to apply it. More time is required for heat to penetrate to the center of a large container than of a small one. Solidly packed foods, such as sweet potatoes or roast beef which usually have little liquid, permit much slower heat penetration than canned peas or string beans in water. The matter of complete heat penetration becomes especially important in processing foods that may cause botulism.

Presence of Acid. It is common knowledge among home canners that acid foods are more easily preserved than foods that are not acid. This is probably due to the fact that spores of bacteria are more easily killed by heat when acid is present. Canners have therefore adopted the practice of discussing acid and nonacid foods as separate groups. Nonacid foods are sterilized with more difficulty and should be processed only in pressure cookers; acid foods may be successfully processed in boiling water, tho processing in a pressure cooker is a surer guarantee against spoilage. (For a list of acid and nonacid foods see time-tables, pages 17 and 18.)

In order to render nonacid foods more easily sterilized, the addition of a small amount of vinegar or lemon juice was once advised. So far as any effect on the process times and temperatures is concerned, this practice is not to be recommended. This does not apply to pickled products, such as cucumbers or beets, to which a large amount of vinegar is added.

DEVELOPMENT OF CANNING METHODS

There are two principles to remember in home canning: (1) the food and container must be heated to a temperature sufficiently high and for the necessary period of time to destroy the bacteria which

cause spoilage; (2) the container must be sealed so that air which may contain other bacteria cannot enter.

The method first used in home canning was probably that known as the "open-kettle" method. The containers as well as the food were boiled to destroy bacteria upon them; the hot food was then poured quickly into the hot container and the container sealed immediately. This method is still used quite successfully by some for a few fruits.

It was later found that if the food were cooked in the container itself, there would be less opportunity for bacteria to enter than if the food were cooked and then poured into a jar or can and sealed. This method of canning, in which the food is cooked or processed in the container, has become very popular among homemakers during the past fifteen years. At first the "cold-pack" method was used, the raw cold food being packed into the jar or can and then processed. Later a "hot-pack" method was developed. In this method the food is partially cooked before being placed in the jar. The jar is then sealed and processed.

The hot-pack method has the advantages of both the open-kettle and the cold-pack methods. Less spoilage occurs in hot-packed foods. When the hot-pack method is used, shrinkage takes place in foods such as greens before they are packed and so more food can be put into the container. Certain desirable flavors, such as that of roasted or broiled meat, may be obtained by using the hot-pack method. And most important of all, less time is required in hot packing for heat to penetrate to the center of the container.

GENERAL EQUIPMENT FOR CANNING

The equipment to be used in canning will depend upon the method of canning and processing used. There will be less work and spoilage and better products if good equipment is used.

Most of the articles used in canning are a part of the usual kitchen equipment. These include a stiff brush for cleaning fruits and vegetables, sharp knives, spoons, measuring cups, strainer or colander, bowls, kettles, and scale, if supplies are to be measured by weight. A large-mouth funnel is very convenient for filling jars or cans with hot foods, and a jar lifter, several types of which are on the market, makes it easier to put jars or cans into hot water and to remove them after processing is completed.

Glass Jars. There is a variety of types of glass jars. They differ in shape, size of openings, and means of sealing.

The *Mason* jar has a porcelain-lined metal top which must be screwed into place. If the porcelain is cracked, broken, or loosened, a new cover should be used. The practice of opening Mason jars by

thrusting a knife blade into the rubber and prying up on the cover is not advised. This slight dent in the cover admits air and makes it easy to open the jar but it also renders the cover unfit for use again as a perfect seal would be impossible.

The *modified Mason* jar has a top of glass, porcelain, or enameled metal which fits over a rubber ring or composition gasket and is held fast by a metal ring which must be screwed into place.

The *wire clamp* jar has a glass top which fits over the rubber ring and is held in place by two wire clamps. The cover is easily cleaned, and unless it is cracked or nicked may be used again and again. The wire clamps must be tight enough so that there is a click when the upper one is put into place above the cover. If it is not sufficiently tight, it may be removed and bent so that it will hold the top securely and then put back into place. New wire clamps may be purchased from the manufacturer if needed.

There is also a jar which has an *enameled metal top* with a composition gasket on the edge of the cover where it fits on the jar. This gasket softens when heated and hardens when the jar cools, forming a seal. A clamp which allows steam to escape from the jar but prevents air from entering during the cooling is put over the cover during processing. After the jar is cold and the composition hardened, this clamp may be removed. A new cover is needed each time this jar is used.

Rubber Rings. Only new rubber rings of good quality should be used. They should be tested before using. A simple test is to stretch the ring to twice its length. If good, it will return to its original size and shape. Another test is to fold the ring tightly between the fingers. If good, it will not crack.

Tin Cans. The use of tin cans by the home canner seems to be increasing. The sanitary or open-top can is generally used. The can and cover are so constructed that a double seam can be made on the closing machine which locks the cover to the side of the can. In a groove around the edge of the cover is a composition or paper gasket which helps to make the closure on the can tighter. The double seam is made by placing the can on a hand sealer. Two rolls fold and press the tin together. The seams must be properly made if the can is to be tight. Attention should be given to the seams to make certain that the hand sealer is properly adjusted. The sealer should be inspected frequently for worn parts. It may be necessary in the case of improper adjustment to seek the advice of the manufacturer. Directions accompanying the sealer should be followed closely.

Tin cans are made either plain or enameled. Enamel-lined cans

were devised to improve certain foods canned in them. One kind is especially desirable for corn (C enamel) and another (sanitary enamel) for colored (red) fruits.

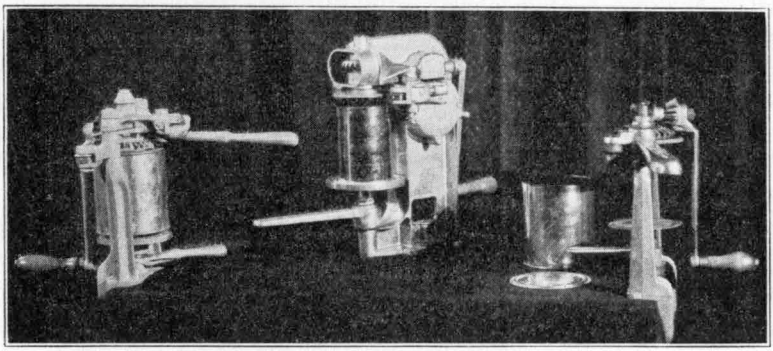

FIG. 1.—TIN-CAN SEALERS

An inexpensive type of sealer is shown on the left; it can be used for sealing only. The other two sealers have attachments for opening cans and reflanging them.

PROCESSING EQUIPMENT AND METHODS

Processing is the term used for heating the food after it has been packed in the jar or can. The aim of the home canner when she processes a can of food is to destroy all living bacteria in it. This is not always done, even tho the food remains fit for consumption. There is a difference between processing and sterilization. Processing is the application of heat to canned foods to such a degree that they remain fit for consumption; sterilization implies the destruction of all living microorganisms. Processing may or may not result in sterilization. Successful processing, however, must result in a can of food which will keep when stored under proper conditions. Processing either cold-packed or hot-packed foods may be done in any of the following ways, depending upon the products being canned.

Hot-Water Bath. Fruits and acid vegetables, such as tomatoes, may be processed quite satisfactorily by means of the hot-water bath, but this method is not recommended for nonacid vegetables and meats. Canners of this type may be purchased ready for use but they usually are assembled from things the homemaker has. The first requisite is a utensil having a tightly fitting cover, in which water may be boiled. This may be a wash boiler, large kettle, or lard can. There should be a rack on which the jars or cans containing the food to be processed may be placed.

The water in a hot-water bath never reaches a temperature above the boiling point of water (212° F. at sea level)[1] and the contents of the jar or can will not be hotter than the water around them. This temperature, unless applied for a period of such length that the color, flavor, and texture of most foods are spoiled, is not sufficient to destroy spores of certain bacteria (see botulism, page 5).

How to Use. When the water in the hot-water bath is at the boiling temperature, place the jars, which have been heated gradually in order to prevent breakage, or cans on the rack so that the water may circulate freely around them. There should be sufficient water to cover the jars or cans. Bring the water again to the boiling point, and when it is boiling vigorously, start counting the time for processing (see time-table, page 17).

Steamers Unsatisfactory for Canning. It is not advisable to buy a steamer for canning purposes. Unless the water is kept boiling rapidly and there is plenty of steam circulating about the jars or cans, the temperature may fall too low for proper processing. This results in a high percentage of spoilage, which is dangerous and wasteful.

Oven Method Not Recommended. There is considerable confusion regarding the reliability of the oven for processing. Altho the temperature of the oven may be much higher than the boiling point of water, the contents of the jars will not reach a temperature above the boiling point. If the jars or cans are completely sealed before being put into the oven, there will be some steam pressure and therefore some increase in temperature above the boiling point. However, complete sealing at this point is not advised because it may result in the breakage of jars and the spreading of the seams of tin cans, the pressure on the inside of the jar not being equalized by pressure on the outside. The rate of heat penetration in the oven is much slower than in the hot-water bath.

Owing to the difficulty in securing high temperatures and the extremely low rate of heat penetration, processing in the oven is not advised.

Steam Pressure Cooker. Canners soon learned that temperatures higher than the boiling point of water, 212° F., were desirable, and in order to secure them began to use steam under pressure.

A pressure cooker must be strongly and carefully built. For home use an aluminum cooker, which is lighter than one of iron or steel, is

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[1]The altitude in the state of Illinois ranges from 300 to 1,241 feet above sea level. This altitude is not sufficient to require any changes from the directions given for canning at sea level.

most satisfactory. Cookers may be had in several sizes, the size usually being indicated in liquid quarts. If the cooker is purchased primarily for canning, one should determine just how many jars or cans each size will hold and buy the size best suited to the purpose.

A pressure cooker should be so constructed that there is no leakage of steam, and should be so simple in operation that persons with little mechanical skill can use it.

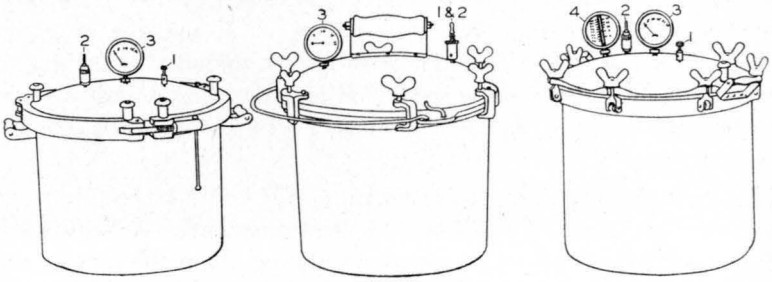

FIG. 2.—TYPES OF PRESSURE COOKERS

The above cookers have different devices for closing, exhausting air and steam, and registering pressure and temperature. The one on the left is closed with a collar and the other two with clamps. The cookers on the right and left have separate petcocks (1) and safety valves (2); the center cooker has a combination petcock and safety valve (1 & 2). The cooker on the right has a thermometer (4) in addition to the steam pressure gage (3).

Devices for closing vary on different pressure cookers. Some have a single clamp, others a collar put in place and screwed tight or a set of several clamps. Whatever the device, it should be simple to operate and make a steam-tight closing. There must be an opening for letting out the air and also a device, called a petcock, for closing this opening when the steam is to be retained. When purchasing a pressure cooker, one should learn how to take the petcock apart for cleaning.

The pressure gage is usually a small dial with a movable hand indicating pounds of pressure. The hand should move easily without sticking as the pressure rises. A safety valve, which opens to let out steam when the pressure becomes too high, is a necessary part of the cooker. The safety valve must be kept in good working order.

It is best to purchase a cooker which is provided with both a pressure gage and a thermometer.[1] By comparing the readings of both with the table on page 18, the canner may secure the temperature

[1]In order to maintain their low selling price, cookers are not usually provided with thermometers. Cookers may be provided with thermometers by having the cover drilled and threaded to receive one.

which should accompany the pressure indicated on the pressure gage, as there is a direct relationship between the pressure of steam and its temperature. Steam must be pure, however, for if it is mixed with air the temperature in the cooker will be lower than the pressure on the gage indicates. It is therefore very necessary to force all air out of the cooker before processing is started.

Directions for Using. Put enough hot water into the cooker (1 or 2 cups) so that there will then be no danger of the cooker boiling dry. Place the filled jars or cans on the rack. Carefully adjust the cover of the cooker and fasten the clamps so that the steam will escape only at the petcock.

Place the cooker over the heat with the petcock open; leave the petcock open for seven minutes after the steam begins to escape, in order to make certain that all the air has been exhausted. Then close the petcock. If all the air is not forced out, it may form an air pocket where the temperature will be much lower than expected. If a large cooker is being used in which there is plenty of water and consequently little danger of its boiling dry, the petcock may be left so that a very small amount of steam can escape. This helps to remove air and also to keep the steam moving in the cooker.

Count the process time from the time when the desired pressure or temperature is reached (see time-tables, pages 17 and 18). Keep the pressure as uniform as possible, as fluctuation in pressure means uneven cooking temperature and may be the cause of underprocessing and the extraction of liquid from the jars.

When processing is complete, remove the pressure cooker from the fire. If glass jars are used for canning, permit the pressure to fall slowly to zero and then slowly open the petcock. If the petcock is opened rapidly, loss of liquid from the jars results. If tin cans are used, slowly open the petcock when the cooker is removed from the fire without waiting for the pressure to fall to zero. Release the clamps and remove the cover of the cooker. In lifting the cover, point it in such a way that the escaping steam will not burn the face.

The steam pressure cooker may be used for processing fruits, vegetables, and meats.

STEPS IN CANNING

Selection of Foods. Whenever possible, can fruits and vegetables on the day they are gathered. This is particularly necessary for vegetables, as a delay of a few hours brings about a change in flavor and the growth of many resistant bacteria.

Choose each food when it is at its best for canning. Usually fully ripe fruit has the best flavor, but care should be taken to select that which is firm. Most vegetables are best before they are fully matured. Select fresh meat in perfect condition. It need not be tender, for long cooking at a high temperature in processing may be sufficient to render tough cuts palatable.

Preparing Fruits and Vegetables. Wash, pare, or peel fruit; remove all bruised spots, and cut into pieces the desired shape and size.

Wash all vegetables thoroly, using a stiff brush to remove dirt and bacteria in the dirt (see page 7).

Cut or break into even lengths such vegetables as asparagus or string beans.

Shell only enough peas or lima beans to fill those containers to be processed at one time. If more are shelled and kept for a later processing period, flat sour may result.

Remove husks and silks from corn, and clean it carefully before cutting from the cob.

Wash beets thoroly, leave the roots and an inch or two of the stem; parboil ten to fifteen minutes, and slip off the skins.

Pick over greens, discarding imperfect leaves and tough stems, and wash thoroly. Steam greens, or heat in covered utensil with a very small amount of water until thoroly wilted.

Preparing Meats. Trim meat, cutting off surplus fat and dark-colored portions. Be sure to remove from mutton the outer skin, which has a strong flavor. Cut meat into pieces that fit easily into the can and are suitable for serving. Wipe meat carefully with a clean damp cloth. Heat or precook foods if they are to be hot packed. By precooking meats, certain desired flavors, such as that of roast beef or of fried chicken, may be obtained. The hot pack is recommended for meat because with that method less time is required for the heat to penetrate to the center of the jar or can.

Packing Food Into Jars or Cans. An orderly arrangement of food permits more to be put into the container and makes a much more attractive pack. Do not pack the food so loosely as to leave waste space in jars or cans, but do not pack so tightly that there is no room for expansion. Provision for expansion is especially important in the case of such foods as corn. Furthermore, if foods such as corn, sweet potatoes, or meats are very tightly packed, the penetration of heat to the center will be retarded and a longer period of processing required.

Add hot sirup (or hot water if sugar is not desired) to fruits to fill the jar or can (see table of sirups, page 16). Add 1 teaspoonful of

salt to each quart of vegetable and fill container with hot water. The salt is for seasoning only and may be omitted if not desired. Add 1 teaspoonful of salt to each quart of meat for seasoning, if desired. There will be sufficient juices from the meat to keep it moist.

Preliminary Sealing. If glass jars are being used, dip rubber rings into hot water and adjust on the jar. Be sure that there is no grease or salt on the ring as it may prevent the complete sealing of the jar. Adjust cover, and partly seal. With the Mason or modified Mason jar, turn cover until almost tight, as might be done with just the thumb and little finger; with the wire clamp jar, put one wire clamp over the cover of the jar and leave the other loose; with the enameled metal top jar, put cover into place and put the clamp over the top of it (see glass jars, page 8). If food is hot-packed, the jars may be completely sealed before processing. If tin cans are being used, put cover into place, be sure that the can sealer is adjusted for the size of can being used, and seal. The hot-pack method should be used for home canning in tin cans.

Processing. Put jars or cans into utensil being used for processing and follow directions for closing (see page 13). Process for required length of time (see time-tables, pages 17 and 18).

Completing the Seal. When processing is complete, remove jars or cans from the canner. Completely seal glass jars. When tin cans are removed from the canner, plunge them into cold water. By thus stopping the cooking of the food, a better texture is obtained.

HOW TO TELL WHETHER CANNED FOODS ARE SAFE

Since canned foods are subject to spoilage, due chiefly to underprocessing or to faulty closure, those who finally prepare them for the table should use every reasonable precaution to make certain that they are fit for consumption.

To determine first whether canned food is keeping well, store it in a warm place for a week or so. If it has not been adequately processed, it will spoil. The liquid may become cloudy and gas may escape under the rubber. The contents of such jars should not be served.

When a jar is opened, the presence of a vacuum or pressure should be noted. A sound jar should have a vacuum. A vacuum is indicated by the suction of air into the can when it is first opened. If the cover on a jar is difficult to remove, it is frequently an indication of a good vacuum.

The food in a jar should possess an appearance and odor characteristic of that product. Presence of an abnormal odor or consistency

should be a warning of possible spoilage. Evidence of spoilage is sufficient cause for discarding the contents of a jar. Such food should never be tasted. To prevent any danger from *Clostridium botulinum* nonacid home-canned foods, such as corn, peas, string beans, and meats, even tho normal in appearance and odor, should be *thoroly heated* before they are tasted (see botulism, page 5).

Thoro heating as used here means raising the temperature of every part of the food to 212° F., the boiling point. This is done best by stirring and bringing the liquid portion to a boil for three to five minutes. Foods that have undergone spoilage may be heavily impregnated with gas. This gas in passing off may cause bubbles when the temperature is still considerably below the boiling point. This should not be taken as evidence that the boiling temperature has been reached, or insufficiently heated food may be tasted or served.

Spoilage of foods packed in tin cans may be determined with considerable accuracy in some cases before the can is opened. If the ends of the can are bulged, causing what is known as a swelled can, the development of microorganisms is indicated. Such a can of food should not be eaten. Since flat-sour spoilage is not evident from the outside appearance of the can, the contents should be examined after the tin container is opened, in the same way as outlined above for foods packed in glass jars.

SIRUPS FOR CANNING FRUITS

The thickness of the sirup to be used for canning fruits by any method depends upon two things: (1) the kind of fruit to be canned, and (2) the desired richness of the product. Sirups used for canning may be thin, medium, or thick. Proportions of sugar and water for preparing them are as follows:

Thin sirup	*Medium sirup*	*Thick sirup*
2 cups (1 pint) water	2 cups (1 pint) water	2 cups (1 pint) water
¾ cup sugar	1¼ cups sugar	2 cups sugar

Variations of these proportions may be used. For example, a still thicker sirup may be used for sour cherries or gooseberries, or a thinner sirup for very sweet fruits. However, anything thicker than the formula given above for thick sirup verges on preserves. Fruits may be canned in water instead of using a sirup.

To make sirup, stir the water and sugar together while heating until the sugar is thoroly dissolved; bring to the boiling point and let boil for one minute.

TIME-TABLES FOR CANNING

Time-Table for Processing Fruits and Acid Vegetables in Hot-Water Bath

Product	Cold pack, glass jars—pint or quart	Hot pack[1]	
		Glass jars—pint or quart	Tin cans—No. 2, 2½, or 3
	minutes	*minutes*	*minutes*
Apples	25	15	10
Apricots	30	20	15
Blackberries	30	20	15
Cherries	35	25	20
Gooseberries	30	20	15
Peaches	35	25	25
Pears	30	20	20
Pimentos (ripe)[2]	50	40	30
Pineapples	40	30	25
Plums	30	20	15
Raspberries	30	20	15
Rhubarb	15	5	5
Strawberries	30	20	15
Tomatoes	55	45	45
Tomato juice	..	25	20

[1]Most of the figures given here for processing were taken from Farmers' Bulletin 1471, U. S. Department of Agriculture.

[2]Pimentos should be canned in small containers, preferably ½ pint or pint jars, or No. ½ or No. 1 tin cans.

Time-Table for Processing Nonacid Vegetables in Pressure Cooker[1]

Product (Hot pack only is recommended for these vegetables)	Glass jars—quart		Glass jars—pint		Tin cans—No. 2, 2½, or 3	
	minutes	*pounds pressure*	*minutes*	*pounds pressure*	*minutes*	*pounds pressure*
Asparagus	40	10	35	10	30	10
Beans, lima	60	10	55	10	55	10
Beans, string	40	10	35	10	30	10
Beets	40	10	35	10	30	10
Corn	80	15	75	15	70 (No. 2 cans only)	15
Greens	65	15	60	15	55 (No. 2 cans only)	15
Mushrooms	35	10	25	10	25	10
Peas	55	10	45	10	45	10
Pumpkin	75	15	60	15	70	15
Spinach	65	15	60	15	55 (No. 2 cans only)	15
Squash	75	15	60	15	70	15
Sweet potatoes	120	10	95	10	95 (No. 2 cans only)	10

[1]Adapted from Farmers' Bulletin 1471, U. S. Department of Agriculture.

Time-Table for Processing Meats in Pressure Cooker

Product	Glass jars—pint or quart	Tin cans—No. 2, 2½, or 3
Meats, packed raw..	75 minutes at 15 pounds pressure	
Meats, hot-packed..	60 minutes at 15 pounds pressure	60 minutes at 15 pounds pressure

Temperatures Obtained at Different Pounds Pressure in Steam Pressure Cooker

Pounds pressure	Temperature	
	Degrees Fahrenheit	*Degrees Centigrade*
5	228	109
10	240	115
15	250	121
20	259	126
25	267	131