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## Home Scale Processing and Preservation of Fruits and Vegetables

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**home-scale**

processing and preservation  
of  
fruits and vegetables



central food technological research institute  
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of Fruits and Vegetables**



**CENTRAL FOOD TECHNOLOGICAL RESEARCH INSTITUTE  
MYSORE, INDIA**

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## FOREWORD

Fruits and vegetables are an important nutritional requirement for the people as they not only meet the quantitative needs to some extent but also supply vitamins and minerals which improve the quality of the diet. It is, therefore, necessary to make every possible effort to make them available in fresh or preserved form for human consumption throughout the year.

Although India produces only 18 million tonnes of fruits and vegetables per year as against the requirement of nearly 70 million tonnes, several of these commodities are available as seasonal surpluses during certain parts of the year and go to waste due to improper pre-packaging, handling, distribution and marketing. Efforts are being made to develop the food processing industry along modern lines, but so far this industry has been able to use only 0.3 per cent of the produce. Therefore, if losses are to be prevented and the large seasonal surpluses made available for human consumption, every effort should be made by the producers and the consumers to preserve at least a part of these surpluses for their own home consumption. If such efforts are successful, they would stimulate an increase in production, bring better returns to the agriculturist, and improve the nutritional status of the people at large.

The Institute started bringing out from time to time single leaflets on home-scale preparation of various fruit and vegetable products such as pickles, chutneys, sauces, *murabba*, and canned and bottled fruit and vegetable products. When a large number of leaflets had accumulated, they were compiled into a brochure, of which four editions were printed by 1962. Since then, the need for a complete revision was felt in order to bring it up-to-date. This has now been accomplished, and the title modified to describe the contents more aptly.

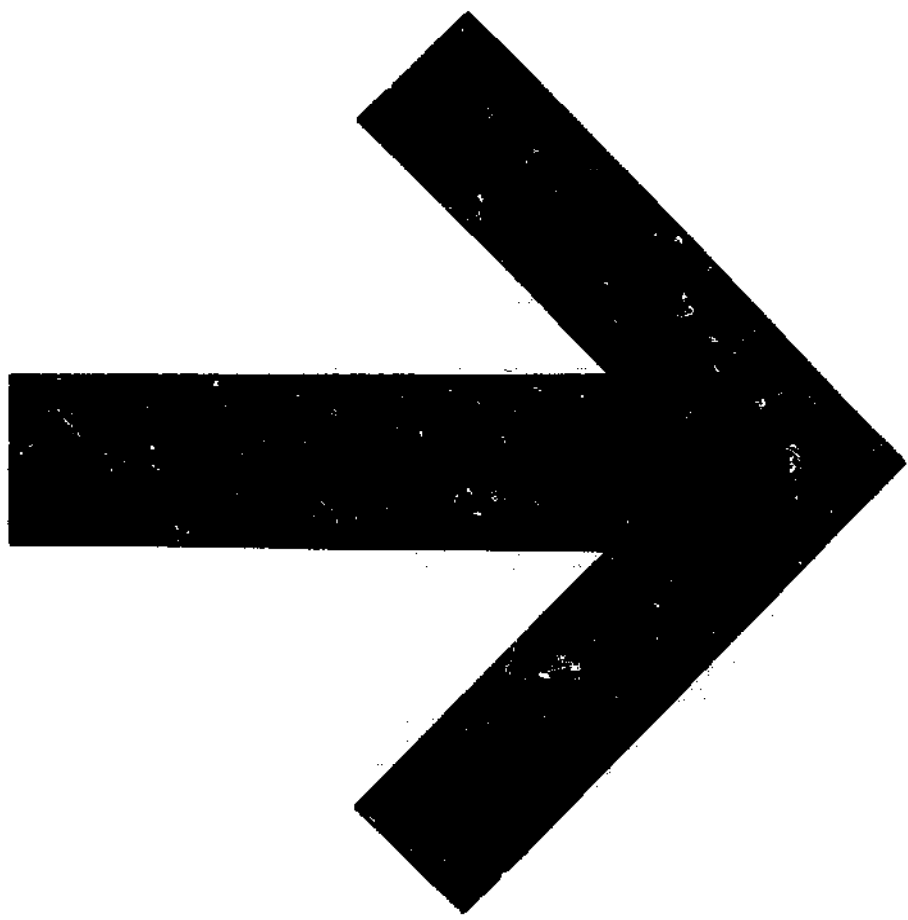
The booklet now includes information on dehydration of fruit and vegetable products which has been newly added. The advantage of this method of preservation is that it does not require elaborate containers for home-scale preservation and can be used more effectively in remote areas where the packaging material is not easily available. The new edition also gives for the first time, methods for the processing and preservation of papaya, pear, carambola, musk melon, *bilwa* fruit, plam kernel, green chillies, beans, and pulses.

An effort has been made to present information in a simple and comprehensible manner, so that an average housewife can use it without any difficulty. It can be used by home science and catering institutions as well as agricultural extension agencies.

Thanks are due to shri P. G. K. Menon, Dr. J. V. Shankar, Dr. B. L. Amla and Dr. G. S. Siddappa for revising and compiling the material and to Shri S. Kuppuswamy for providing material on dehydration of fruits and vegetables. The assistance rendered by Shri K. V. Achyuta Rao and Shri K. V. Doddaiah in making illustrations, and by Shri B. S. Narahari Rao and Shri K. A. Ranganath in scrutiny of proof is gratefully acknowledged.

C.F.T.R.I., Mysore - 2  
28th September 1967

H. A. B. PARPIA  
*Director*



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## 1. GENERAL METHODS OF FRUIT PRESERVATION

### 1.1 Canning and bottling of fruits

1.1.1 *Selection of fruit.* Select fresh, firm, fully developed, evenly matured and sound fruits. To ensure good quality in the product, use only fruits of uniform maturity and colour. If the fruits are under-ripe keep them in a ventilated place for some time so that they ripen properly.

1.1.2 *Washing.* Wash the fruits thoroughly in water, preferably in running water to remove dust, spray residues, etc. Handle them carefully to avoid bruising.

1.1.3 *Preparation of fruit.* Prepare the different fruits as indicated under each fruit. To avoid darkening of the product use a stainless steel knife for cutting.

1.1.4 *Filling and syruping.* Use cans and glass jars which have been previously heated for about 15 minutes in boiling water. In the case of glass jars immerse them in cold water and gradually heat to boiling to prevent breakage. Transfer the prepared fruit into the containers (one lb. butter size cans and pint glass jars hold 340 - 400 g.; A 2½ size cans hold 500-560 g.). Pour boiling sugar syrup to cover the fruit, leaving about 0.6 cm. of head space. Strength of syrup to be used is indicated under each fruit.

1.1.5 *Preparation of syrup.* Syrups can be classified as heavy (50 per cent sugar), medium (40 per cent sugar) and light (33 per cent sugar) depending on the requirement of a particular fruit. Use an eight ounce cup for measuring sugar and water. For heavy syrup, add one cup of sugar to one cup of water; for medium syrup, add 1 cup of sugar to 1½ cups of water; and for light syrup, add 1 cup of sugar to 2 cups of water. Dissolve the sugar in water, boil and filter through cloth.

1.1.6 *Exhausting.* Exhaust the filled can or jar (before sealing) to drive out air from the fruit tissues and to prevent discolouration as well as loss of flavour during storage. To do this, place the filled can or jar in a large kettle, or open tank, containing boiling water, so that the top of the can or jar is about 5 cm. above the level of water in the tank. Place a lid on the tank and continue to heat the water till the centre of the can or jar records a temperature of 80 - 82°C. This will take about 10 minutes.

1.1.7 *Sealing.* While still hot, remove the cans or jars one by one from water. Replace any syrup spilt from the containers with fresh boiling hot syrup. Place a clean lid on the

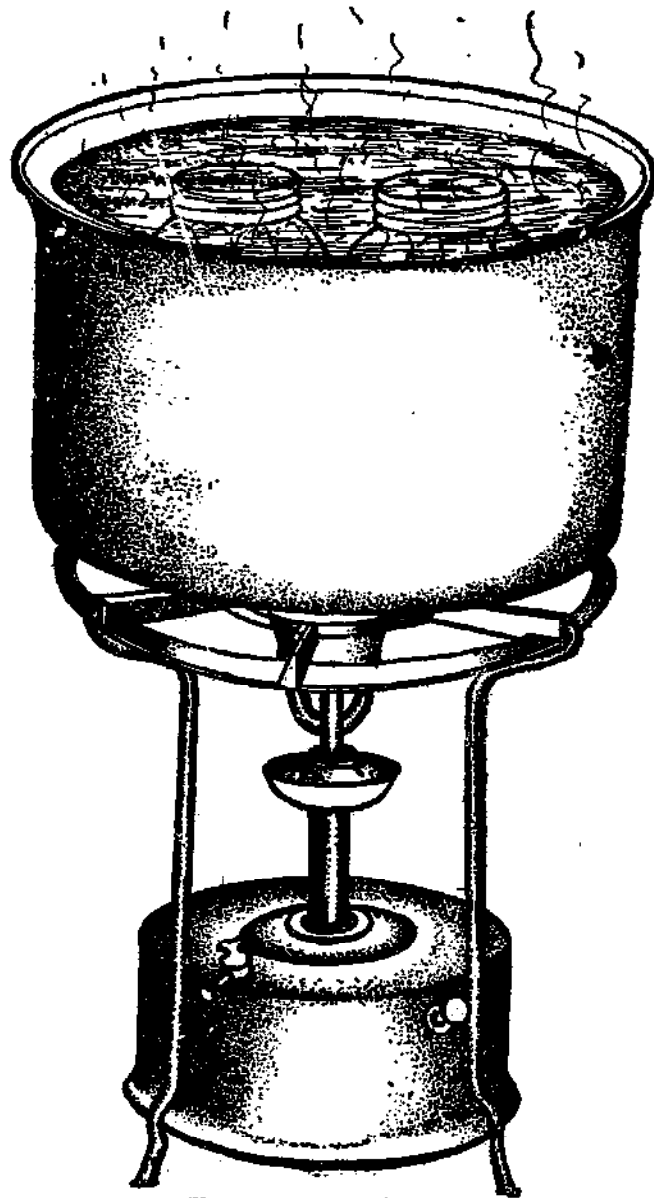


FIG. 1: Pasteurization

filled can and seal it by means of a home can sealer. Seal the jars with screw caps.

1.1.8 *Pasteurization.* Place the sealed cans or jars on a thick pad of cloth spread at the bottom of a pan containing hot water. This acts as an insulator and prevents breakage of glass jars and bumping of the containers during subsequent boiling. Keep the level of water 2.5-5 cm. above the top of the containers. Cook different fruits for different periods as indicated under the respective fruits, counting time from the moment water comes to rolling boil. This step is necessary for killing harmful micro-organisms present in the contents of the can or jar.

1.1.9 *Cooling and storage.* Cool the cans quickly preferably in running cold water, and take them out while they are still warm so that they dry quickly in the air. Place glass jars separately for cooling in air, taking care not to expose the hot jars to cool surface, water or air draught. When they are cooled, store them in a cool and dry place.

## 1.2 **Drying of Fruits**

The first stage is the preparation of fruits which involves peeling, cutting, slicing and such other operations. Next is the pre-treatment where fruits are dipped in solutions of some chemical for specific periods. The last two stages are sulphuring and drying.

Fruits like grapes and prunes are dried whole without peeling; they are, however, dipped in cold or hot lye solution of proper concentration to remove the wax and also to effect cracking of the surface. The treatment hastens the subsequent drying.

In order to maintain the colour and prevent spoilage by micro-organisms, the fruits are exposed to fumes of SO<sub>2</sub> produced by burning sulphur. Fruits are not steeped in metabisulphite solution as in the case of vegetables. Sulphuring is done in a sulphur box which is a closed chamber of non-porous material (concrete, brick, asbestos sheet or wood) capable of holding the trays containing the prepared fruit. The sulphur is burnt in a shallow tray on the floor at the back of the chamber. Ideally, the box should have the same dimensions as a home-scale drier so that it can handle the entire charge at a time. About 100-200 g. of sulphur are necessary for a home-scale drier of seven trays, 80 cm.x60 cm. dimensions and capable of taking about 25 kg. of fruit. The time of sulphuring varies from half an hour to two hours depending on the nature of the fruit. Wooden flat bottom trays must be used for sulphuring and drying.

1.2.1 *Home drier.* A home drier is ideal for drying fruits and vegetables at home. It consists of a strong box of galvanized iron sheet (90 cm.x60 cm.x90 cm) with perforated bottom. The sides and top of this box are enclosed in wooden frame work. The box is supported on an iron stand, 40 cm. high. A kerosene oil stove, charcoal hearth, or electric heater can be used as source of heat. Moisture is let off through two

TABLE 1. SCHEDULE FOR DRYING OF FRUITS

Fruits	Preparation	Pretreatment, dipping in lye, etc.	Time of sulphuring	Finishing temperature (C°)
Apple	Peel, core, trim, and cut into 3 to 5 mm. thick slices	Nil	15-30 min.	50-55
Apricot	Wash, halve, destone	"	15-25 min.	45-50
Peach	Halve, peel and pit	"	15-20 min.	45-50
Grape	Wash			
Prune	Wash. Use whole fruit	10-20 seconds and wash	10-15 min.	55-60
Litchi	Wash, remove skin	3-5 seconds and wash	.....	50-55
Banana	Wash, peel, cut into 12 mm. thick slices	Dip in 1% KMS solution for 16 hr	.....	50-55
Mango	Wash, peel, cut into 12 mm. thick slices	Nil	2 hr	55-60
Pineapple	Wash, punch, core, cut into 6 mm. thick slices	"	2 hr	45-48
Papaya	Wash, peel, cut into 6 mm. thick slices	"	2 hr	55-60
				60-63

slits 60 cm.x4 cm. with collapsible metallic flaps along the length on both sides about 10 cm. below the top. The drier can accommodate 7 trays of 80 cm.x60 cm. Care is taken to regulate the temperature and outflow of moisture from the drier by adjusting the source of heat and the slits.

#### 1.2.2 Packing and storage.

The fruits dried and finished as per directions given in Table 1 should be put into tins and sealed air-tight with solder or wax, depending upon the duration of storage.

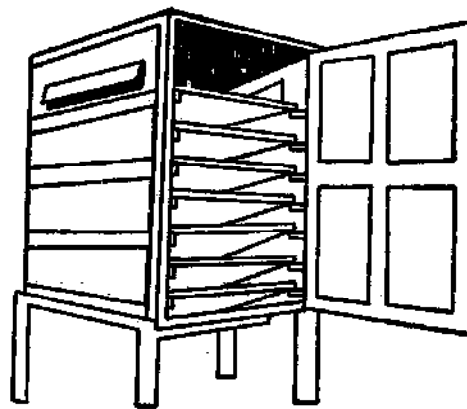


FIG. 2: Home drier

### 1.3 Preparation of jams

1.3.1 *Selection of fruit.* Select fully ripe fruit having good colour, flavour and aroma. If the fruit is firm and tough, allow it to stand for a day or two to develop sweetness and flavour. Unripe or immature fruits should not be used for this purpose. Wash the fruits thoroughly in fresh water. Remove stems and leaves, if any. Trim the bruised and blemished portions.

1.3.2 *Preparation of fruit.* Peel the fruits. Remove any stones and cores. Cut the fruit into small pieces. If the fruit is tough and hard, boil it with small quantity of water to soften it.

1.3.3 *Addition of sugar.* To the sour fruits, add an equal quantity of sugar by weight; to the sweeter varieties add only three fourths sugar by weight and also citric acid at the rate of 1.5 - 2 g./kg. of the fruit.

1.3.4 *Mixing.* Mix the ingredients thoroughly and allow the mixture to stand for  $\frac{1}{2}$  - 1 hour so that the sugar dissolves in the juice released from the fruit.

1.3.5 *Cooking.* Cook the mixture slowly, with occasional stirring and crushing, till the temperature reaches 105.5°C (at sea level), or till the cooking mass approaches the desired consistency (for every 150 m. rise in the altitude a decrease of 0.6°C should be allowed in the cooking temperature of 105.5°C). When the mass has been boiling for some time and has become sufficiently thick in consistency, dip a spoon into it and let the product run off the sides of the spoon. If, on cooling, the product falls off in the form of a sheet instead of flowing readily in a single stream, it means that the end point has been reached

and the product is ready for filling into containers. Otherwise, continue boiling till the sheet test is satisfactory.

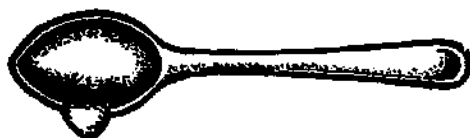


FIG. 3: Sheet test

**1.3.6 Filling and closing.** Fill the hot jam into clean dry jar or can placed on an insulating material like a wooden board or a thick pad of cloth (for preventing the breakage in the case of glass jars). Close the filled containers without delay.

**1.3.7 Cooling and storage.** Invert the container for about 5 minutes to sterilize the lid also and then allow it to cool. Store the containers in a cool and dry place.

#### **1.4 Preparation of fruit syrups**

Thick syrup can be made out of the juice of Phalsa (*Grewia asiatica*), Jaman (*Eugenia jambolana*) and pomegranate. Select fresh, fully ripe and sound fruits.

**1.4.1 Washing.** Remove any spray residues by washing the fruit with a dilute solution of hydrochloric acid (5 per cent) and wash again with water.

**1.4.2 Preparation of the fruit.** Remove the inedible portions of the fruit. Crush the fruit thoroughly with hand wearing rubber gloves.

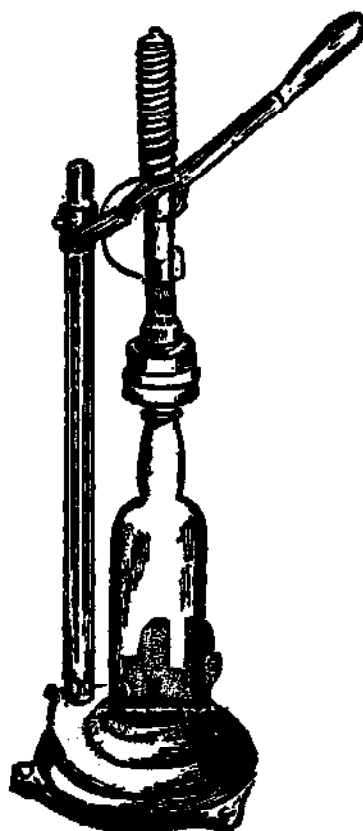


FIG. 4: Crown corks machine

1.4.3 *Extraction of juice.* Place the prepared fruit in a piece of coarse cloth, wrap well and press out the juice in a small basket press. Take one or two more extracts by adding small quantities of water and warming, if necessary. Mix the extracts.

#### *Recipe*

Juice	1 kg.
Sugar	1.5 kg.
Citric acid	16 - 20 g.

(in *jaman* and grape syrups only).

1.4.4 *Mixing and preserving.* Mix the ingredients thoroughly, warm, if necessary, and strain through coarse muslin cloth. Add sodium benzoate (preservative) at the rate of 710 mg./kg. of the finished product. The preservative can be had from chemists or chemical suppliers. It should be dissolved in a small quantity of water and mixed with the product.

1.4.5 *Bottling and storage.* Pour the finished product into bottles, which have been thoroughly washed with hot water, and leave 2.5 - 3.75 cm. of head space. Close air-tight either with crown cork seal or with ordinary cork slightly wetted and pushed in. Store the bottles in a cool, dry place.

### **1.5 Preserves and candies**

Preserves are made by cooking the entire fruit or its pieces in sugar syrup of higher concentrations. Usually for every 45 kg. of fruit, 55 kg. of sugar is used, and cooking is continued till the soluble solid content reaches 68 per cent (i.e. when the syrup drawn between fingers gives a consistency of two to three threads).

1.5.1 *Selection of the fruit.* Wash ripe, firm fruits in ample quantity of fresh water. A wash with dilute hydrochloric acid may be given to remove the spray residues in case the fruits are to be used without peeling.

1.5.2 *Processing of the fruit.* Peel, core and cut the fruits into pieces wherever necessary. Pricking should be done with stainless steel forks or bamboo prickers. In the case of *petha*, after pricking, immerse the fruit pieces in dilute lime water for some time before further processing (details under *Petha candy*).

Blanch the fruits for a few minutes in boiling water to make them soft which assists in absorption of sugar. Highly juicy fruits can be put straight without blanching into syrup. Take sugar equal to or half the weight of fruits. Spread it on the blanched fruit pieces in alternate layers. Allow to stand for 24 hours. The juice exuding out of the fruits dissolves the

sugar. Next day, drain off the syrup, add enough sugar to raise the thickness of syrup (Brix of about 60°). Add 5-10 g. of citric acid for every 1 kg. of sugar used at the start. Add the fruit pieces, boil and keep for 24 hours. On the next day, raise the syrup strength by adding the required quantity of sugar so that when drawn between the fingers the syrup gives two to three threads (68° Brix). Boil the mass again for 5 minutes. Leave the fruit in the syrup for 3-4 days. Boil the fruit along with the syrup for a few minutes and fill hot into dry, wide-mouthed jars and seal air-tight.

1.5.3 *Alternative method.* As an alternative method, cook the fruit pieces in syrup of low sugar content. Gently heat the mass to boiling. Continue boiling till the syrup thickens sufficiently to 68° Brix and this corresponds to a temperature of 105.5°C (for every 150 m. rise in altitude a decrease of 0.6°C should be effected in the cooking temperature). Cool the preserve slightly after final boiling. Fill while hot into clean, dry previously sterilized bottles. Screw air-tight.

1.5.4 *Candy.* The process is similar to that of making preserve, except that the concentration of syrup is continued till it attains a Brix value of 75 - 80° or the syrup becomes thick enough to give three to four threads when drawn between two fingers. Drain off the syrup and cut the fruit pieces to desired size and dry in sun. Transfer the product into clean, dry, wide-mouthed, glass jars.

## 1.6 Fruit toffees

Pulpy fruits like banana, mango, papaya, jack fruit, guava, etc., can be mixed with sugar, skim milk powder and fat for the preparation of fruit toffees.

1.6.1 *Preparation of the fruit pulp.* Wash the fruits thoroughly in ample quantity of fresh water and peel. Steam fruits like bananas at atmospheric pressure for about five minutes to check enzymatic browning or dip in 0.1 per cent solution of potassium metabisulphite for 5 minutes instead of steaming. Crush and pass through a stainless steel sieve.

### Recipe

Fruit pulp	5.3 kg.
Sugar	3.0 kg.
Glucose	0.5 kg.
Skim milk powder	0.8 kg.
Hydrogenated fat (vanaspati)	0.5 kg.
Add suitable essence and colour, if necessary	

1.6.2 *Cooking.* Concentrate the pulp to about 1/3 of its volume by heating in a steam jacketed kettle or in a sauce



pan over a steam bath. Mix the other ingredients given in the recipe and continue cooking, till a speck of the product put into water forms a compact solid mass and does not dissolve. Add milk powder to a small quantity of water and make into thick paste. Add this paste to the boiling mixture.

1.6.3 *Cooling and setting.* Transfer the cooked mass to a smooth, hard and level surface of a table with stainless steel top, smeared lightly with fat. Add flavouring material at this stage, if desired, and spread the product into a thin sheet of  $\frac{1}{2}$  -  $\frac{3}{4}$ cm. thickness. Allow to cool and set for two hours. Cut the solid sheet into cubes with a stainless steel knife and wrap them in butter paper.

## 2. LIME AND LEMON

Lime (*Citrus aurantifolia*) (Hindi—*Kaghzi nimbu*; Beng.—*Kagzinimbu, patinebu*; Guj.—*Khatalimbu*; Tam.—*Elumichai*; Tel.—*Nimma*; Kan.—*Limbe, nimbe*; Mal.—*Erumichinarakam*) grows wild in the warm valleys of Himalayas and is cultivated throughout India. The small fruited *Kaghzi* is the variety grown all over India. A large number of types differing in size, shape and colour of the fruits are also cultivated.

Lemon (*Citrus limon*) Hindi—*Baranibu, Fambira, pahari nimbu, paharikagzi*; Beng.—*Baranebu, goranebu*; Guj.—*Motulimba*; Mar.—*Idalimbu, thoralimbu*; Tam.—*Periya yelumichai*; Tel.—*Bijapuram*; Kan.—*Bijapura, Bijori*) is cultivated in home gardens and small orchards in Uttar Pradesh, Maharashtra, Tamil Nadu and Karnataka. *Galgai* is a well known commercial variety grown in some parts of Punjab.

### 2.1 Lime and lemon squash

Take fresh, fully ripe, sound fruits and wash them thoroughly in fresh water. Cut them into halves with a stainless steel knife.

Express the juice from the limes in a lime juice squeezer or in small basket press; for lemons use a cone type juice extractor (Mix Master). Strain the juice through coarse muslin cloth to remove seeds and coarse pulp.

#### Recipe

	Medium sugar squash	High sugar squash
Juice	2 kg.	1 kg.
Sugar	2.5 kg.	2 kg.
Water	1.5 kg.	200 g.

Add suitable quantity of edible yellow colour (permissible brand) to bring out the desired shade in the finished product.

Mix the ingredients thoroughly and strain through coarse muslin cloth. For recipe with high sugar content, mix the in-

gradients with slight warming, if necessary. Add potassium metabisulphite (preservative at the rate of 610 mg./kg. of the finished product (dissolve the potassium metabisulphite in a small quantity of water and mix it with the rest of the product). Bottle and store the product as described under fruit syrups (1.4).

### 2.2 Lime juice cordial

Extract the juice from limes as in squash and store it in glass containers, Winchester bottles or carboys after adding potassium metabisulphite at the rate of 1.5 g./kg. of the juice. Allow the juice to settle for about a month. Decant the clear juice without disturbing the sediment and strain it through fine muslin cloth.

#### Recipe

	Medium sugar cordial	High sugar cordial
Juice	1 kg.	1 kg.
Sugar	1.25 kg.	2.25 kg.
Water	1 kg.	200 g.

Mix the ingredients thoroughly, with slight warming, if necessary. Strain the product through fine muslin cloth. Add potassium metabisulphite (preservative) at the rate of 300mg./kg. of the finished product. Bottle and store the finished product as described under fruit syrups (1.4).

### 2.3 Lemon or lime barley water

Extract the juice as in squash and strain it through coarse muslin cloth.

Mix about 15 g. of barley flour with some water and make it into a thin paste. Continue to add water and stir till the quantity of water added is about 1 kg. Heat it gently to disperse the barley flour thoroughly. Cool the mixture and strain through muslin cloth.

#### Recipe

Barley extract	1 kg.
Lime or lemon juice	1 kg.
Sugar	2.5 kg.

Mix the ingredients thoroughly, with slight warming, it through fine muslin cloth. Add potassium metabisulphite at the rate of 610 mg./kg. of the finished product. Bottle and store the product as described under fruit syrups (1.4).

### 2.4 Lime and green chilli pickle: See under 23.

## 3. ORANGE

Loose skinned orange or mandarin orange (*Citrus reticulata*) commonly known as Santara is cultivated extensively in

Maharashtra, Assam, Karnataka, Madhya Pradesh, parts of Punjab and Uttar Pradesh.

Sweet orange or the tight skinned orange (*Citrus sinensis*) (Hindi, Beng., Guj. and Mar.—*Musambi, narangi, kamala nambu*; Tam.—*Sathgudi, chini*; Tel.—*Sathgudi, sini*; Kan.—*Kittile, Sathgudi*) is cultivated chiefly in Uttar Pradesh, Punjab, Maharashtra, Tamil Nadu, Aadhra Pradesh, Madhya Pradesh, Bihar and Orissa under various local names. *Blood Red Malta* is a type cultivated in Uttar Pradesh and Punjab.

### 3.1 Orange squash

Select fresh, fully ripe, sound fruits, and wash them in ample quantity of fresh water. Remove the peel of the loose skinned oranges, separate the segments and extract the juice in a screw press. Strain the juice through a coarse muslin cloth. Cut the tight skinned oranges into halves and express the juice in a cone type extractor (Mix Master).

#### Recipe

	I (30 per cent juice)	II (57 per cent juice)	III (60 per cent juice)
Juice	2 kg.	2 kg.	1 kg.
Sugar	2.5 kg.	1.5 kg.	1 kg.
Water	1.5 kg.	...	...
Citric acid	90 g.	40 g.	...
Lime, Lemon or <i>galgal</i> juice	...	...	500 ml.

Essence Peel emulsion\* of 2-4 oranges for every 100 fruits or a requisite quantity of fruit essence or oil to be used.

Colour Requisite quantity of edible orange colour (permissible brand) to give the desired shade in the product.

Mix thoroughly the ingredients for the respective recipes and strain the mixture through coarse muslin cloth. Add potassium metabisulphite (preservative) at the rate of 610 mg./kg. of finished product. Bottle and store the product as described under fruit syrups (1.4).

### 3.2 Orange marmalade

*Santaras* (loose skinned oranges), *Maltas* (tight skinned oranges) and *Khattas* (*Citrus aurantium*) (rough lemons) are

\* Make peel emulsion by crushing the peels in a mortar and pestle and squeezing the crushed pulp through a thick cloth.

In the case of recipe 1, prepare a syrup by heating the mixtures of sugar and water. Strain it through a coarse muslin cloth.

suitable. Even fruits of inferior quality having very little of juice, but otherwise sound, can be used. Use two oranges either *Malta* or *Santara* for each *Khatta*.

3.2.1 *Preparation of fruit.* After washing the fruit thoroughly in cold water, remove the skin of *Santara*; and in the case of *Malta*, peel off its thin outer portion with a steel knife retaining as much of albedo portion as possible.

Cut the peels of some oranges into fine shreds and boil them in sufficient water for about 10 minutes. Change the water 2 or 3 times.

3.2.2 *Extraction of pectin.* Crush the segments of *Santara* and the thin slices of *Malta* and cover with enough water. Cook the mass for about half an hour, with occasional crushing by means of a wooden ladle, till the extract becomes fairly thick. Strain the hot pulp extract through coarse muslin cloth. To the pomace add  $\frac{1}{3}$ - $\frac{1}{4}$  the quantity of water and take a second and third extraction, if necessary. Mix the three extracts and keep the mixture overnight in a deep vessel for sedimentation. Draw out the clear extract and discard the residual pulp.

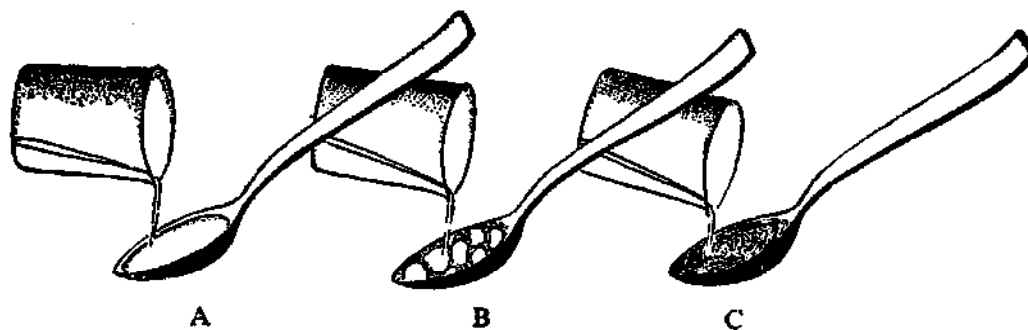


FIG. 5: Test for pectin

- A. One big clot : high pectin content
- B. Several small clots : medium pectin content
- C. Gelatinous precipitate : low pectin content

3.2.3 *Test for pectin.* To a teaspoonful of extract, add two teaspoonfuls of methylated or rectified spirit. Formation of one big clot indicates high pectin in the extract; several small clots indicate medium pectin; and a thin gelatinous precipitate shows poor pectin. If the extract is poor in pectin, concentrate it by heating till it gives test for good pectin content.

3.2.4 *Addition of sugar.* To every cup (8 oz.) of the clear extract which contains high or medium quantity of pectin add  $\frac{3}{4}$  or  $\frac{1}{2}$  cup (8 oz. cup) of sugar respectively.

3.2.5 *Cooking.* Cook the mixture to  $103^{\circ}\text{C}$ . This temperature is reached at sea level just 10 - 15 minutes before the end point. Add the boiled shreds of the orange peel. Continue

boiling till the temperature of the product reaches 105.5°C (for every 150 m. rise in altitude, a decrease of 0.6°C should be effected in the cooking temperature) or the product falls from the ladle in the form of flakes or sheets.

3.2.6 *Packing and storage.* Pour the product into clean, dry, sterilized glass jars and seal them air-tight, after cooling. Store in a cool, dry place.

## 4. TOMATO

Tomatoes (*Lycopersicum esculentum*) (Vern.—*Tamatar*) are grown throughout India. They are eaten fresh in raw as well as ripe condition. They can also be made into various products which can be preserved over long periods.

### 4.1 Tomato juice

Select fully ripe and healthy tomatoes having well developed colour and wash them thoroughly in fresh water. Remove the green and blemished portions with a stainless steel knife and discard them. Cut the sound portions into small pieces.

Collect the prepared fruit in an aluminium or stainless steel open vessel and crush thoroughly with a wooden ladle. Cook the crushed mass for about 5 minutes and mash it well while cooking. When it is sufficiently soft, strain through fine mosquito net cloth or 1 mm. mesh stainless steel sieve, by rubbing gently with the bottom end of an enamelled mug. Discard the seeds and skins.

### *Recipe*

Tomato juice 10 kg.      Common salt 100 g.      Sugar 100 g.

Pour the hot finished product into bottles which have been sterilized in boiling water for half an hour. Seal them air-tight with crown corks which have also been kept in boiling water for 2-3 minutes. Pasteurize the bottles by placing them in a vessel having a false bottom. Cover the bottles with water and boil for half an hour. Remove the bottles from boiling water, cool and finally store them in a cool, dry place.

## 4.2 Tomato ketchup

Prepare the pulp by the above method.

### Recipe

Tomato juice/pulp	3.0 kg.
Onion (chopped)	37.5 g.
Garlic (chopped)	2.5 g.
Cloves (whole)	1.0 g.
Spices (coarsely powdered cardamom, black pepper and <i>jeera</i> in equal quantities)	1.2 g.
Mace ( <i>javatri</i> ) not ground	0.25 g.
Cinnamon	1.75 g.
Red chillies (powdered)	1.25 g.
Salt	31.2 g.
Sugar *	100.0 g.
Vinegar (good quality)	150. ml.

\* This can be increased to about 150 g. to get a ketchup with a slightly sweeter taste.

To the pulp add about 1/3 of the sugar given in the recipe. Place the spices (onions, garlic, cloves, cardamom, black pepper, *jeera*, mace, cinnamon and red chillies) in a muslin bag and immerse it into the pulp. Heat the pulp till it thickens and is reduced to about 1/3 its original volume. Remove the muslin bag and squeeze it well to extract the aroma and flavour of the spices. Add vinegar, salt and the remaining sugar. Heat the mass for a few minutes so that the volume of the finished product is about 1/3 of the original pulp.

To a small quantity of the finished product, add the preservative, sodium benzoate, at the rate of 285 mg./kg. of the finished product and mix thoroughly (according to the present specifications for tomato ketchup under F.P.O., 1955, as amended from time to time, the quantity of sodium benzoate can be increased up to 750 mg./kg.).

Transfer the dissolved preservative to the rest of the product and mix thoroughly. Pour the finished product into medium size sterilized bottles, seal them air-tight with a crown seal and pasteurise in boiling water for 30 minutes. Cool the bottles in air and store in a cool, dry place.

## 4.3 Tomato chutney

Select sound, fully ripe, red tomatoes and wash them thoroughly in cold water. Dip the tomatoes in boiling water for 3 minutes and quickly cool them by immersing into cold water. This facilitates the easy removal of the skin. Remove the peel and crush the peeled tomatoes.

### Recipe

Tomatoes (peeled)	3 kg.	Ginger	15 g.
Onions (chopped)	2 kg.	Chillies	10 g.
Sugar	2 kg.	Vinegar (4 per cent acidity)	1 litre
Salt	100 g.	or glacial acetic acid	40 ml.

Place all the ingredients except the vinegar in pan and cook to a thick consistency. Add the vinegar, cook for another 10 minutes and pack the chutney while hot in wide-mouthed, sterilized and dry bottles. Seal the bottles air-tight and store in a cool, dry place.

#### 4.4 Tomato soup

Use firm and fully ripe, red tomatoes and chop them into bits. Heat for 5 to 10 minutes till the skin separates out from the pulp. Strain the pulp through mosquito net cloth to remove seeds and skin.

### Recipe

Tomato pulp	5 kg.	Flour	50 g.
Water	1.75 kg.	Garlic (chopped)	5 g.
Onions (chopped)	75 g.	Pepper (ground)	5 g.
Salt (powder)	90 g.	Cinnamon, cardamom	
Butter	90 g.	and other spices (as	
Sugar	100 g.	desired)	2.5 g. each

Heat the tomato pulp to boiling point and add butter. Add onions and garlic and simmer for 30 minutes. Add salt, sugar and pepper and simmer for further 30 minutes. Make into a thick paste; boil and strain it through cloth. Mix the strained liquid with boiling tomato juice. Some prefer to keep spices, onions, and garlic in a cloth bag and allow it to immerse in the tomato pulp and gently boil the mass for 30 to 45 minutes. If the spices are added directly to the pulp, pass entire boiled mass through a sieve or screen or pulper with fine mesh. Heat it again and fill hot into A 1 tall cans (not below 75°C). Seal the cans and process for 45 minutes at 115.5°C or 0.7 kg. per sq. cm. pressure in pressure cooker. Cool the cans and store.

#### 4.5 Canned tomatoes

Use fresh, firm, ripe and uniform-sized tomatoes. Wash them in cold water. Dip the fruits in boiling water for three minutes and cool them by immersing in cold water. Remove the core from the stem end by cutting out a conical shaped piece with a sharp pointed knife. Peel off the skin and remove the black tip at blossom end of the fruit. If necessary, cut the tomatoes into convenient pieces to facilitate passing through the top of container.

Pack tomatoes up to the top of the can. Add  $\frac{1}{2}$  teaspoonful each of common salt and sugar for one lb. butter size can and pint jar, and one teaspoonful each of salt and sugar for A2 $\frac{1}{2}$  can; fill with boiling water. Alternatively, pack tomatoes to top and fill with hot tomato juice. For seasoning add  $\frac{1}{2}$  teaspoonful each of salt and sugar for a butter size can and 1 teaspoonful each for A2 $\frac{1}{2}$  can.

Exhaust the cans or jars until the temperature at the centre reaches 82°C (time taken, 7 - 10 min.) and seal. Process the butter size cans for 35 minutes, A2 $\frac{1}{2}$  cans for 40 minutes and pint glass jar for 45 minutes in boiling water. Cool the cans in a current of cold water and the jars in air. Store them in a cool and dry place.

## 5. MANGO

Mango (*Mangifera indica*) (Hindi—*Am, amb*; Beng.—*Am, amore*; Guj.—*Ambo*; Mar.—*Ambo*; Tel.—*Mamidi*; Tam.—*Mangai*; Kan. and Mal.—*Mavu*) is the most important fruit cultivated throughout the country. There are some 44 Indian varieties of which 35 are suited for table purposes. Among the numerous varieties of mangoes grown in India, *Safaida*, *Saroli* and *Dusehri* of U. P., *Alphonso* of Ratnagiri, *Badami* of Karnataka, *Benishan* of Andhra Pradesh, *Raspuri*, *Neelum* and *Mulgoa* of Tamil Nadu and Karnataka give good canned products. *Bangalora* also gives canned product of fairly good quality. Juicy and fibrous varieties are not suitable for canning.

### 5.1 Mango pulp

Take fresh, ripe mangoes (*badami* or *raspuri*). Wash in fresh water; soften the fruit pulp by pressing between the palms; remove the stem portion and squeeze out the pulp in pans. Pass the coarse pulp through a mosquito net cloth or coarse muslin cloth to remove small pieces of fibre. Add sufficient quantity of sugar depending upon the type of fruit to the pulp to get the required taste. Mix the entire mass thoroughly and heat in a steam jacketed kettle or in a pan. Fill hot at 85 - 88°C into sterilized Z-lacquered cans of 301x309 size. Seal the cans and process for 20 minutes in boiling water. Cool the cans in running water.

### 5.2 Mango squash

Select fresh, fully ripe, tart, juicy and sound fruits. Wash in fresh water and render the mango into pulp as described under Mango pulp.



### Recipe

Pulp	1 kg.
Water	1 kg.
Sugar	1 kg.
Citric acid	30 g.
Orange yellow edible colour	Just enough to give attractive appearance to the product.

Mix the ingredients thoroughly. Avoid heating as far as possible. Strain the mixture through coarse muslin cloth. Add potassium metabisulphite (preservative) at the rate of 610 mg./kg. of the prepared product. Bottle and store the product as described under fruit syrups (1.4).

#### 5.3 Mango preserve

Select fully developed, firm and slightly under-ripe fruits (pulp pale yellow in colour) and wash them thoroughly. Discard fruits with juicy pulp.

Remove the peel with a stainless steel knife and cut the fruit into large and well shaped slices. Keep the slices in 2 - 3% brine solution or in water to prevent them from turning black.

Wrap the slices in muslin cloth and soften them by dipping in boiling water for 5 - 10 minutes. Spread the slices on clean cloth and puncture them with forks or bamboo prickers.

Take sugar equal in weight to that of mango slices. Make a syrup by boiling it with water (1:3) and a little citric acid (1.5 - 2 g./kg. of sugar used).

Add the slices to the syrup. Cover the container with the lid and heat till the temperature reaches 106 - 107°C (at sea level) or when the syrup drawn between two fingers is thick enough to give 3-4 threads. For every 150 m. rise in the altitude, reduce the temperature of cooking by 0.6°C.

Allow the product to cool and transfer it into sterilized and dry glazed porcelain or glass jars.

#### 5.4 Mango leather

Take fully ripe, juicy fruits and wash them. Discard over-ripe and rotten fruits so as to avoid unpleasant flavour in the product. Extract the pulp (see 5.1) and strain it through fine mosquito net cloth or muslin cloth to remove the coarse particles.

Spread the pulp in thin layers on copper or brass trays (84 cm.x60 cm.) the inner surface of which is tinned in order to prevent corrosion. Smear the inside of the trays with butter to avoid sticking of the product. Cover the trays with fine net cloth and place them in the sun. When the first layer of the

juice dries, put another layer upon it. Repeat this process till 0.6-1.25 cm. thick layer of the dried pulp is obtained. This, more or less, has the texture of leather.

Expose the product to sulphur fumes (obtained by burning a small quantity of sulphur at the bottom of a closed box) which helps in retaining the attractive colour of the product for a considerable period. Cut the mango leather into small pieces, wrap them in butter paper and pack them in glass jars for storage.

### 5.5 Mango chutney (sweet)

Select unripe, firm and fully developed fruits having yellow pulp and wash them in cold water. Peel off the green skin with a stainless steel knife. Grate the peeled fruit into fine slices; these slices can be stored for 5-6 months in 6 per cent brine in closed containers.

For preparing mango chutney in the off-season these slices can be used.

#### *Recipe*

Slices (grated)	1 kg.	Ginger	15 g.
Sugar	1 kg.	Onions (chopped)	60 g.
Salt	50 g.	Garlic (chopped)	15 g.
Spices (cardamom, cinnamon, etc.)	30 g.	Vinegar (good quality)	180 g.
Red chillies	15 g.		

Cook the slices in a little quantity of water to render them soft. Add sugar and salt to them in the proportion given in the recipe. Allow the mixture to sweat so that the sugar and salt dissolve in the juice exuding from the fruit.

After the sugar and salt dissolve, keep the mixture on the stove. Tie the spices (given in the recipe) in a muslin bag. Keep the bag dipped in the mixture, continue heating with occasional stirring, till the mixture thickens sufficiently. Remove the muslin bag and squeeze it into the mixture. Add vinegar at this stage and continue heating till a product of the jam consistency is got.

Cool the product slightly and pour it into clean, sterilised, wide mouthed bottles. Allow it to cool in the air and close air-tight. The product can also be poured into clean glazed jars and covered.

### 5.6 Mango pickle in oil

Take healthy, under-ripe, fully developed mangoes, preferably of tart variety and wash them in cold water. Cut the fruits into longitudinal slices with a stainless steel knife.

Immerse the slices in 2-3 per cent brine to prevent them from becoming black.

#### Recipe

Sliced fruit	1 kg.	Turmeric (powdered)	30 g.
Common salt (powdered)	250 g.	Red chillies (powdered)	"
Fenugreek ( <i>metha</i> ) (coarsely ground)	125 g.	Black pepper	"
Nigella ( <i>Kalaunji</i> ) (coarsely ground)	30 g.	Fennel or aniseed ( <i>saunf</i> )	"

Rape seed oil (moisture free) sufficient to keep the surface covered.

Mix the mango slices with the requisite quantity of powdered common salt. Transfer the entire mass to a glass or glazed jar and shake well; leave it in the sun for 4-5 days until the fruit slices sweat and the green surface of the skin turns pale yellow in colour. Mix all the ingredients with solid slices and smear with a little oil free from moisture. Transfer the pickle into clean, dry glass or glazed jars and press the mass thoroughly so that no air pocket is left inside. Add moisture-free oil sufficient to leave a small layer at the top. Store the product for 2-3 weeks before use. During this period examine the pickle after every 2-3 days and add more oil, if necessary.

#### 5.7 Canning of mangoes

Select firm, ripe fruits and wash them; peel with a stainless steel knife. Cut their pulp into 6-8 longitudinal slices. Fill 500-550 g. or 340-400 g. of the slices into A 2½ or butter size plain cans respectively. Pour hot sugar syrup of 50° Brix containing 0.5 per cent citric acid. Leave about 0.6 cm. head space in the container after covering the slices with the syrup. Exhaust the cans until their central portion attains a temperature of 80°C (time taken is about 7 minutes). Seal them immediately and process in boiling water (for 15 min. in the case of A 2½ cans and 1 pint jars; 12 min. for butter size cans). Cool the cans under water and store. The canned product keeps well for over 1½ years. It can be used as such, or with other fresh or canned fruits.

5.8 Drying of ripe mango slices *see* under Drying of fruits (1.2).

#### 5.9 Dehydration of green mango slices

Select under-ripe but fully developed, tart varieties of mango, free from blemishes and rots. Wash, peel with stainless

steel knife and cut into longitudinal slices, about 0.6 cm. thick.

Immerse 100 kg. of slices in 60 kg. of 10 per cent brine; cover and leave aside for curing for about a week. Then drain off the slices to another vessel, add 150 g. potassium metabisulphite (KMS) (to give an effective concentration of 0.25 per cent KMS in the brine) and leave the cured slices overnight in the sulphited brine. Spread the drained slices next morning on trays and dry either in the sun or in the home-scale drier (see 1.2); the finishing temperature in the drier should not exceed 60°C.

If the green mango is dried as unpeeled slices, it can be used for pickling after reconstitution.

## 6. CASHEW APPLE

Cashew (*Anacardium occidentale*) (Hindi, Guj. and Mar.--*Kaju*; Beng.—*Halji, badam, kaju*; Tel.—*Jidimamidi, mokkamamidi, muntamamidi*; Tam.—*Tidine, kallarma, kottaimundiri, sigidima*; Kan.—*Geru*; Mal.—*Kappalaseru kashumavu*) is naturalised and cultivated in India especially in the coastal areas. Cashew apple refers to the fleshy portion to which the nut is attached. It is a by-product of the cashewnut industry. Cashew apple is fairly juicy and sweet but has not become popular on account of its astringent taste. With improved processing techniques several palatable and nutritious products like juice, syrup, jam and candy can be prepared from this fruit.

For making all these products, take fresh, fully ripe and sound fruits and wash with fresh water. Avoid contact with iron at all stages of processing to avoid discolouration.

### 6.1 Cashew apple juice

Place the washed fruits in a perforated crate of aluminium or stainless steel on a false bottom in a pressure cooker. Cook the fruit at 0.35 - 0.7 kg. steam pressure for 5 - 10 minutes depending on the degree of ripeness of the fruit. Dip the fruit in running water for cooling. This treatment removes the astringent taste and softens the fruit.

Extract the juice in a worm type juice extractor or in a basket press. To obtain the best results, first extract the juice in the worm type juice extractor and press out the juice from the residue in a basket press. Strain the juice through coarse muslin cloth.

Add gelatine to the strained juice at the rate of 430 mg./kg. Stir thoroughly and set aside for 15 minutes. Strain the

clear juice through muslin cloth and add sugar at the rate of 60 g./kg. of the juice. This yields a sweet drink having the characteristic aroma and flavour of the cashew apple.

Heat the juice to boil and fill it hot at 90 - 95°C into sterilized bottles. Close them with crown corks. Heat the bottles in water at 85 - 90°C for 30 minutes and then allow them to cool gradually to room temperature.

The finished product may also be preserved by adding preservatives. Add to the finished product sodium benzoate (preservative) at the rate of 1 g./kg. Pour the juice into sterilized bottles. Cork air-tight with crown cork or with clean and wetted corks. Store the bottle in a cool, dry place.

### **6.2 Cashew apple syrup**

Extract the juice and strain it through coarse muslin cloth.

To every kg. of the juice, add 60 g. of lime juice and a little of gelatine so that the suspended matter settles down. Allow the juice to stand for 15 minutes and strain it through thick cloth (long cloth is suitable) or 120 mesh stainless steel sieve. Add sugar at the rate of 670 g. for every litre of the juice.

Mix the ingredients thoroughly and strain through coarse muslin cloth. Bottle and preserve the product (either by heat treatment or by preservatives) as in cashew apple juice. Dilute the resulting syrup 3-4 times its volume with plain water for use as fresh drink.

### **6.3 Cashew apple jam**

Immerse the fruit in 2.0 per cent common salt solution under the weight of an aluminium, enamelled or wooden disc. Remove the fruit from the salt solution after 3 days and wash it free from salt. Hold the washed fruit in a perforated crate made of aluminium or stainless steel; cook it for 10 - 15 minutes at 0.7 - 1.05 kg. steam pressure depending on the condition of the fruit. With a stainless steel knife, trim off the undesirable portions, particularly the blackish portions to which the nuts were attached and crush the fruit with the help of a wooden ladle.

Add 1 kg. of cane sugar to every 1 kg. of crushed fruit and cook the mixture to a temperature of 105.5°C (at sea level) or till the consistency of the finished product is sufficiently close to the normal consistency of other fruit jams (for every 150 m. rise in the altitude, decrease of 0.6°C should be effected in the cooking temperature of 105.5°C). Add a pinch of citric acid towards the end of cooking process.

Put the boiling hot jam into clean, dry, sterilized jars or cans. After allowing the jam to cool in the jars for 2-3 hours, pour a layer of molten paraffin wax over its surface and roll it along the sides so as to form a layer between the sides and the jam. Cap or seal as the case may be, and store the product.

#### 6.4 Cashew apple candy

Immerse the washed fruit in 2.0 per cent common salt solution and raise the concentration of salt by 2.0 per cent every day so that in 4 days' time it reaches 10 per cent. At this stage add potassium metabisulphite (625 mg./kg.) and keep the fruit in this solution for 2-3 days more. Wash the fruits thoroughly in water, put them in a perforated crate made of aluminium or stainless steel and blanch in boiling water for 5 minutes; follow it up by cooking in a pressure cooker for 5 minutes at 0.35 kg. pressure. Cool the fruit by rinsing in water; prick it all round with sharp bamboo prickers or stainless steel forks.

Prepare sugar syrup of 30° Brix by dissolving 300 g. sugar in 700 ml. of water; add 0.1 per cent citric acid to it and boil for about 10 minutes. Pour the hot syrup over the fruit placed in an enamelled aluminium or stainless steel vessel so that the fruits are completely submerged. Keep the fruit immersed in the syrup by placing over it a flat cover and a weight. Cover the container with lid and keep it aside for about 24 hours. Next day, drain out the syrup from the fruit, find its Brix and weigh out the sugar to be added to it to raise the Brix to 35°. Boil the drained syrup for 5-7 minutes and add the sugar; bring to boil again and pour it back over the fruit. Repeat the heating and steeping processes as above, adding enough sugar every day to raise the concentration of the drained syrup by 5° Brix till it reaches 60° Brix. Repeat the process every alternate day till the final syrup strength is 70° Brix. Leave the fruit in the final syrup for 5-6 days for complete absorption of sugar, determining the Brix of the syrup every day and heating it to boiling, if necessary.

Strain the fruit on a coarse sieve and finally dry the finished product to make a candy. Pack it in dry screw-capped glass jars and close them air-tight. Store the filled jars in a cool, dry place.

### 7. SAPOTA

Sapota (*Achras sapota*) (Hindi, Mar.—*Chiku*) is grown largely in Maharashtra and Tamil Nadu particularly near the

coasts. Sapota fruits can be utilized for canning as well as for making squash and jam.

Select ripe fruits, soft to touch, and having sweet flavour. Wash them in fresh water. Peel the fruits with a stainless steel knife and cut them into segments after removing the seeds. The segments can be used for canning and for making squash and jam.

### 7.1 Sapota squash

Pass the fruit segments through a meat mincer and obtain a uniform pulp. Wrap the pulp in thick cloth and press out the juice with gloved hands or a small basket press.

#### *Recipe*

Pulp	5 kg.
Sugar	5 kg.
Water	5 kg.
Citric acid	200 g.

Mix these ingredients and beat the mixture thoroughly into a uniform syrupy mass. Strain it through coarse muslin cloth.

Add potassium metabisulphite at the rate of 600 mg./kg. of the product or sodium benzoate at the rate of 710 mg./kg. or pasteurize the product at 80 - 82°C for 25 minutes for proper preservation. If the product is packed in A 2½ cans, processing at 80 - 82°C should be done for 25 minutes. For every 300 m. rise in the altitude of the place, the processing time should be increased by 2 minutes.

Cool the cans in running cold water. Squash preserved in bottles with preservatives may be stored in a cool, dry place. Product keeps well for more than 6 months.

### 7.2 Sapota jam

#### *Recipe*

Pulp	2 kg.
Sugar	1.5 kg.
Water	250 g.
Citric acid	60 g.

Mix the ingredients and cook the mixture exactly as given under preparation of jams (1.3.5). If the fruit does not give a well set jam as it occasionally happens in fully ripe fruits, add a small quantity of powdered pectin to obtain a good product. Fill the hot jam into clean dry jar or can. To prevent breaking of glass jars during filling, place them on a wooden block or a thick pad of cloth.

### 7.3 Canning of sapota segments

Place about 280 g. of fruit segments in a plain butter size can, or 500-550 g. in A 2½ size can. Fill the interspace in the

can with boiling sugar syrup (5 cups of sugar mixed with 4 cups of water and 56 g. of citric acid to prepare the syrup of 55° Brix and heated to boiling) leaving 1.25 cm. head space. Exhaust till the temperature at the centre of the cans reaches 80°C (time taken is about 7 minutes) and seal. The product in butter size cans should be cooked for 20 minutes; and that in A 2½ size cans for 25 minutes. Cool the cans immediately under running water to room temperature. Store in a cool, dry place. Canned sapota is a delicious product having the original flavour of the fruit.

## 8. APPLE

Apple (*Malus sylvestris*) (Hindi—*Sev*; Beng.—*Seb*; Kan.-*Sebu*) is grown in Kashmir valley, Himachal Pradesh, Kulu valley, Kumaon, Bangalore and some hills of Tamil Nadu.

### 8.1 Apple juice

Select fully developed fruits with good flavour and aroma and wash them in fresh water. Grate the fruits in stainless steel or tinned graters. Wrap the grated fruit in thick cloth and press out the juice in a small basket press worked by hand. Collect the juice in an enamelled or stainless steel bucket.

Strain the juice through coarse muslin cloth and heat it rapidly to a temperature of 82 - 85°C in aluminium or stainless steel pan.

Pour the hot juice at once into clean and hot, sterilized bottles (heated in boiling water for 10 - 15 minutes) till it over - flows. Immediately seal air - tight with crown cork (also previously boiled for 2-3 minutes). The temperature of the juice, while filling and sealing, should not be in any case below 82°C.

Place the bottles horizontally on the false bottom of a pan containing water at 80°C and maintain the temperature for half an hour. Remove the bottles and cool. Store them in a cool, dry place.

### 8.2 Apple cider

Select fully developed fruits and wash them thoroughly in cold water. *Baldwin* or *Yellow Newton Pippin* varieties are ideal for this purpose because of their high tannin content. Express the juice and strain it through coarse muslin cloth.

Collect the fresh juice in a glass carboy or Winchester bottle. Add potassium metabisulphite at the rate of 215 mg./kg.



Add sugar to raise the Brix to 22°. Add some quantity of pure wine yeast to start fermentation. Keep the mouth of the carboy plugged with cotton wool and maintain the temperature between 18 and 21°C. If the fermentation becomes slow, add 0.02 - 0.05 per cent of ammonium hydrogen phosphate to supplement the food for yeast.

Fermentation is complete when the Brix density of the juice is 0 or 1 per cent. Allow the fermented juice (or the cider as it is called) to stand for settling the sediment (sedimentation is brought about more effectively by yeast). Repeat this process (racking) a number of times till a clear liquid is obtained. Filter the clear liquid through a number of layers of fine cloth. Keep the cider for ageing in an oakwood barrel, or steep oakwood shavings in it. Pasteurize the mature cider at 66°C, cool and filter. Carbonate the clear filtered cider under 0.7 - 1.05 kg. pressure of the carbon dioxide in pressure resistant bottles. Pasteurize the bottles at 60°C for 30 minutes by keeping them on a false bottom to avoid breakage.

### 8.3 Apple preserve

In the method described here *Ambri* variety of apples has been used. Wash the fruits in fresh water and peel them by hand with stainless steel knife. Keep the fruit immersed in a solution of 2 per cent common salt and 0.05 per cent potassium metabisulphite to avoid discolouration. Remove the fruits, wash thoroughly and steep overnight in 3 per cent solution of calcium lactate and 1 per cent potassium metabisulphite or 1 per cent calcium chloride and 0.1 per cent potassium metabisulphite. Drain off the liquid and blanch the fruit in boiling water for 10 - 15 minutes. Rinse in tap water. Cool them, wash in tap water and prick thoroughly with stainless steel forks.

Prepare syrup of 25° Brix by dissolving 1 kg. sugar in 3 kg. of water and by heating. Add it to the fruits and cook gently on low heat till the temperature of the syrup reaches 100.5°C. Keep overnight and cook next day to a temperature of 102°C. On the third day cook to a temperature of 103°C and on the fifth day to 104°C. When the Brix of the syrup reaches 50°, add 0.05 per cent of citric acid on the basis of syrup. On the 7th day, cook the preserve to the finishing temperature of 105.5 - 107.0°C. Keep the preserve for 4 - 5 days and check the Brix of the syrup. If there is any fall, cook again to 105.5 - 107.0°C. After the Brix remains constant, pack the preserve finally into clean, dry bottles.

## 9. BANANA

Banana (Hindi—*Kela*; Beng.—*Keli*, *Kachkala*; Guj.—*Kela*; Mar.—*Kadali*, *kel*; Tel.—*Aratti*, *anti*; Tam.—*Vazhai*, Kan.—*Bale*; Mal.—*Vazha*) is one of the most important fruits cultivated in all parts of India. A large number of varieties are grown in the country. The most satisfactory conditions for the cultivation of banana exist along the coastal region of the country.

**9.1 Drying of ripe banana** *see* under Drying of fruits (1.2).

### 9.2 Banana chips

Choose raw, sound, bananas of any variety with the minimum sugar content. Peel the fruit with a stainless steel knife (ordinary steel knife causes black stains on the slices) and cut it into slices. Keep the peeled fruit and the slices in a solution of 0.1 per cent citric or tartaric acid, 0.05 per cent hydrochloric acid, or 0.1 per cent potassium metabisulphite to avoid browning.

Remove the slices from the solution. Wash them in cold water, drain and spread on flat bottom trays (2.5-5 kg. per sq.m. of tray surface). Trays made of dealwood strips or bamboo strips are suitable. Transfer the trays to a box where the fruit slices are exposed for one hour to fumes of sulphur dioxide. Burn about 3 g. of sulphur for one charge of ten trays. Sulphuring is not necessary for products meant for immediate use.

Dry the sulphured slices either in the sun or in a home drier. Maintain the temperature in the drier at 60 - 63°C and stop drying when the slices become brittle.

The dried slices can be fried in a suitable cooking medium and eaten like potato chips. They can also be ground into flour in grinders. Banana flour has been found suitable to replace a part of wheat flour (the proportions depending on the individual taste) in preparations where wheat flour is used. Vermicelli of good quality and also cakes can be made out of banana flour.

## 10. PINEAPPLE

Pineapple (*Ananas comosus*) is cultivated in Assam, W. Bengal, Kerala and Karnataka. There are 90 varieties which fall into three groups—*Queen*, *Cayenne* and *Spanish*. *Queen* and

*Kew* varieties (also of *Cayenne* group) are popular in India.

### 10.1 Pineapple juice

Pineapple juice is usually prepared as a by-product in the canning industry and is a delicious beverage. Entire fruits or even scrapings and cores can be used for the extraction of the juice. The juice can be consumed as such or with plain soda.

After washing, remove the crown of the fruits by giving a sharp twist; remove the peel with a stainless steel knife. With a sharp V-shaped stainless steel knife, remove the eyes. Discard the damaged portions. Cut the sound portions into small pieces; pass them through a mincer or chop them finely with a sharp stainless steel knife. Wrap the prepared fruit in thick cloth and press out the juice in a small basket press or worm type juice extractor. Strain the juice through coarse muslin cloth. The juice obtained is generally tart and becomes palatable after adding sugar. Add sugar according to taste (60 g./kg.) and strain the juice again through coarse muslin cloth.

Heat the prepared juice rapidly in an aluminium or stainless steel pan on direct fire to a temperature of 82 - 85°C. Pour the hot juice into plain cans leaving 0.6 cm. head space; seal the cans immediately. Alternatively pour the juice into previously sterilized, warm bottles to overflowing and seal air-tight with crown corks.

Process the cans (milk size) in boiling water and the bottles in water at 80 - 82°C for 25 minutes at sea level. At higher altitudes increase the processing time by 2 minutes for every 300 m. rise in altitude.

Cool the cans immediately in running water; allow the bottles to cool gradually. Store the cooled products in a cool, dry place.

### 10.2 Pineapple squash

Extract the juice as in pineapple juice.

#### *Recipe*

	I	II
Juice	5.0 kg.	5.0 kg.
Sugar	8.3 kg.	12.2 kg.
Citric acid	275.0 g.	375.0 g.
Water	6.275 kg.	2.23 kg.
Pineapple essence	125.0 g.	162.5 g.
Potassium metabisulphite	12.25 g.	12.25 g.
Yellow colour	Sufficient quantity	Sufficient quantity

Mix the ingredients, juice, sugar, citric acid and water; stir thoroughly. Strain through thick muslin cloth. Add essence and colour if required and again stir. Dissolve the preservative in a little quantity of water and add to the filtered squash. Mix thoroughly and fill in previously sterilized bottles leaving a headspace of 2.5 cm., cork and store in a dry, cool place.

### 10.3 Canned pineapple

Pineapple from West Coast has been found to be suitable for canning. Ripe and juicy fruit with characteristic colour and aroma should be selected and washed in fresh water.

Remove the crown, peel, eyes and the core of the fruits (cores removed with a corer) and cut into transverse slices of 1.25 cm. thickness with a stainless steel knife. Prepare the sugar syrup by mixing 1 cup of sugar with 1 cup of water and bring it to boil. Place the pineapple rings (5 - 6) in butter size plain cans. Fill the interspace with syrup leaving 1.25 cm. head space.

Exhaust the cans until the temperature at the centre of the can contents attains 80°C (time taken is about 7 minutes) and seal. Process the cans in boiling water for 20 and 25 minutes in the case of butter size and A2½ cans respectively. Cool the cans quickly and store.

### 10.4 Pineapple jam

After removing the crown, peel and the eyes, cut the sound portions of the fruit into small pieces. Crush them thoroughly and obtain a uniform mass. Add an equal quantity of sugar by weight to the prepared fruit; allow it to stand for ½-1 hour. Cook the mixture slowly with vigorous stirring till the temperature reaches 105.5°C (at sea level) or till the mass approaches the jam consistency. Fill the jam into sterilized dry jars; cool them and screw tightly. Store in a cool, dry place.

## 11. JACK FRUIT

Jack fruit (*Artocarpus integrifolia*) (Hindi—*Kathal*, Beng.—*Kanthal*; Mar.—*Phanas*; Tel.—*Panasa*; Tam.—*Pilapalam*; Kan.—*Halasu*; Mal.—*Chakka*) is grown abundantly throughout the warmer parts of the country especially in W. Bengal, Bihar and West Coast. There are two common varieties: *Kapa* and *Benka*. The former has sweet, fleshy pericarp and the latter, which is considered inferior, has thin, mucila-

ginous and sour pericarp. Several variations occur within these two varieties.

### 11.1 Jack fruit nectar

Select ripe fruits having succulent bulbs. Cut the fruit into eight or sixteen pieces, first across and then length-wise. Remove the gummy core by means of a sharp knife to free the bulbs. Smear a little cooking oil on the hand to prevent stickiness. Separate the bulbs from the rind and the surrounding carpels. Trim off the top and bottom of the bulbs; remove the seeds and their thin covering. Cut the bulbs into halves, quarters or slices.

(a) *Fruit pulp.* Soften the cut pieces of the bulbs by heating them slowly in about half their weight of water and stirring with a wooden ladle. Mash the softened pieces into a fine pulp by crushing them thoroughly. Rub the pulp through a fine sieve to remove any large pieces.

(b) *Sugar syrup.* Prepare sugar syrup of 60° Brix by dissolving 1.5 kg. of sugar in 1 kg. of water and heating. Remove any scum and filter the syrup.

#### Recipe

Pulp	5 kg.
Sugar	11.25 kg.
Water	7.5 kg
Citric acid	235 g.

Blend the different ingredients and strain the product through muslin cloth.

To preserve the product for use over a long period, add potassium metabisulphite at the rate of 600 mg./kg. of the prepared nectar. For the recipe given, 14.5g. of the preservative will be sufficient. It should be dissolved in a small quantity of water and then the solution mixed well with the product.

Fill the nectar in medium or full size, dry and sterilized bottles leaving a head space of about 5 cm. Close the bottles air-tight with crown corks. In the case of ordinary corks, dip the mouth of the corked bottle in molten paraffin wax to give a good seal. Keep the bottles in a cool, dry place.

Jack fruit nectar is a palatable beverage with pleasant taste and aroma and keeps well. Before use, dilute it with 3-4 volumes of water. It may be taken as such or after carbonation.

### 11.2 Jack fruit jelly

Jack fruit contains 70-75 per cent of waste material comprising the outer prickly rind and the inner perigones

(underdeveloped bulbs, etc.). This waste material has been found to contain about 2 per cent pectin of high quality. A clear, light yellow jelly with good taste and aroma can be prepared from it.

After removing the bulbs from the fruit, use the remaining outer rind, the inner soft portions, the trimmings from the bulbs, etc., for the extraction of pectin. Reject the central core.

Boil the prepared material with an equal weight of water and 0.3 per cent of citric acid for 30 minutes. Drain off the extract. Reboil the residue with half the quantity of water for 15 minutes and drain again. Mix the two extracts and set aside for settling. Decant the clear extract to prepare the jelly.

*Test for pectin.* To a teaspoonful of extract add two teaspoonsful of methylated or rectified spirit. Formation of one big clot indicates high pectin in the extract; many small clots indicate medium pectin content; and a thin gelatinous precipitate indicates poor pectin. If the extract is poor in pectin, concentrate till it gives test for good pectin.

Add 1 kg. of sugar and 6 g. of citric acid per litre of the clear extract. Cook the mixture till the temperature of the boiling mass is 105.5°C at sea level or till it gives a *Sheeting test*. For every 150 m. rise in altitude, the boiling point of water falls by 0.6°C and a corresponding decrease may be effected in the cooking temperature.

*Sheet test.* Dip a spoon into the product and allow it to fall down from the sides of the spoon. If on cooling, the product falls in the form of sheets and not in a steady stream, then the product is ready.

Pour the finished product into clean and sterilized glass jars placed on wooden board for preventing them from breaking. Seal the jars air-tight. Store in a cool, dry place.

### 11.3 Canned jack fruit

Select ripe fruits having crisp and yellow bulbs with good flavour. Prepare the fruit as in Jack fruit nectar.

Dissolve sugar in an equal weight of water and add citric acid at the rate of 5 g./kg. of the syrup. This gives 50° Brix syrup of 0.5 per cent acidity. Filter the syrup.

Fill 500 - 550 g. or 340 - 400 g. of the prepared fruit into plain A2½ or butter size cans respectively. Pour hot syrup (80 - 88°C) over the fruit leaving about 0.6 cm. head space. Exhaust the cans until the temperature at the centre reaches 82°C and seal (the time taken ranges from 7 to 10 minutes). Place the sealed cans in boiling water and process for 30

minutes. Cool the cans immediately in cold water and store in a cool, dry place.

The canned jack fruit can be used as such or with other fruits for making salads.

#### 11.4 Jack fruit pickles

Take small, tender and green jack fruits in which the seeds and the pithy portions have not become hard. Wash them thoroughly and trim their stalk ends. Peel the thick, outer rind with a knife and cut the fruit into 1.25—1.8 cm. thick transverse slices. Smear a little cooking oil on the hand to prevent stickiness while handling the fruit.

Fill the slices into a clean glazed stone jar and add 8 per cent salt solution. Keep the pieces immersed in brine by placing a wooden weight on top of them. On the following day, add more common salt so as to raise the strength of the brine to about 10 per cent. Repeat this process daily till the concentration of salt in brine reaches about 15 per cent. Keep the pieces in this strong brine for 8 - 10 days to ensure complete curing. During this process, the slices become fairly soft and clean.

The cured slices, after being washed in water, form the base for the preparation of a variety of pickles, of which sweet oil pickle and spiced vinegar pickle are important. This preliminary salt curing is essential particularly for vinegar pickle, plain or spiced, where the slices have to maintain an attractive appearance in a clear, vinegar medium.

##### 11.4.1 Sweet oil pickle

###### Recipe

Brined slices	10 kg.	Ginger, chopped	15 g.
Salt	625 g.	Onion, chopped	310 g.
Chilli powder	190 g.	Mustard seed	30 g.
Jeera	30 g.	Garlic	30 g.
Clove	30 g.	Vinegar	1.25 litres
Cardamom	15 g.	Sugar	1.25 kg.
Cinnamon	30 g.		

Oil (sufficient to cover the pickle in the container).

Fry the chopped ginger, onion, garlic and mustard seeds in a little oil until they turn brown. Add this and the rest of the spices to the fruit pieces, put in a glazed jar. Mix well and place the jar in the sun for 3 - 4 days, with occasional stirring. Cover the mouth of the jar with muslin cloth to prevent the house flies. Add sugar and vinegar, mix well and keep the jar again in the sun for another 3 - 4 days when the

pickle will be ready. Fill it into glass or glazed earthenware jars and pour sufficient oil to cover the pickle. This helps in improving the keeping quality of the pickle.

#### 11.4.2 Spiced vinegar pickle

Prepare the spiced vinegar according to the recipe:

##### Recipe

Sugar	1.5 kg.
Vinegar	2 litres
Water	0.75 litre
Clove, headless	} 1 g. each
Cinnamon, whole	
Coriander seed	
Ginger root, ground	
Mace, broken	
Mustard seed, broken	

Tie the spices loosely in a muslin bag and place it in a vessel containing the vinegar, water and sugar. Cook gently over a low fire for 3-4 hours to get the spice extract of 50° Brix and acidity not less than 3 per cent. If desired, more spices may be used according to taste. Allow the vinegar extract to cool gradually and remove the cloth bag. Use equal quantities of the salt-cured fruit slices and the spiced vinegar for preparing pickle.

#### 11.4.3 Plain vinegar pickle

In this case, use plain vinegar only, without adding sugar or spices. It is, however, necessary to replace the first vinegar with fresh vinegar as the vinegar first added becomes diluted. The pieces look attractive in the vinegar solution.

Fill the pickle into condiment jars, preferably with non-metallic lids. Store the jars in a cool, dry place.

## 12. GUAVA

Guava (*Psidium guava*) (Hindi—*Amrud*, *safed safari*; Beng.—*Goachhi*, *peyara*; Guj.—*Famrukh*, *peru*; Mar.—*Jamba*; Tel.—*Jama*, *goya*; Tam.—*Koyya*, *Segappugoyya*, *Sengoyya*, *Sirugoyya*; Kan.—*S:be*; Mal.—*Koyya*, *malakkapera*) is a common fruit cultivated in India, especially in Uttar Pradesh, Bihar, Gujarat, Maharashtra, Andhra Pradesh and Tamil Nadu.

#### 12.1 Guava jelly

Select, sound and rather tart fruits and wash them thoroughly in cold water. Avoid soft fruits as far as possible because



they do not give good jelly. Cut the washed fruit with a stainless steel knife into small pieces. Cover the pieces with water and add citric acid at the rate of 1.5 - 2 g./kg. of the fruit.

Boil the mass, crushing it occasionally with a ladle, for about half an hour or till it shows stickiness. Strain the mass through a coarse cloth to separate the extract. Take one more extract in a similar way. Strain the extracts and mix them. Keep the mixed extract in a deep container. Carefully decant the extract.

*Test for pectin:* To a teaspoonful of extract, add two teaspoonsful of methylated or rectified spirit. Formation of one big clot indicates high pectin in the extract; formation of many clots indicates medium pectin; and thin gelatinous precipitate indicates poor pectin. If the material is poor in pectin, concentrate till it gives test for high pectin.

To every cup (8 oz. cup) of extract which contains high or medium quality of pectin, add 1/2 or 3/4 cup (8 oz. cup) of sugar respectively.

Cook the mixture till it boils (105.5°C at sea level) or till it gives the Sheeting Test (see 11.2). For every 150m. rise in altitude, the boiling point of water falls by 0.6°C and a corresponding decrease may be effected in cooking temperature.

Pour the finished product into clean, dry, sterilized glass jars kept on a wooden board for preventing breakage. Allow the product to cool and seal the jars air-tight. Store in a cool, dry place.

## 12.2 Guava cheese

Select sound, fully ripe, but firm fruits of good quality and wash them. Use only the sound portions of the fruit and cut them into small pieces. Add an equal quantity of water and boil till the fruit pieces become quite soft. Strain the pulp through fine mosquito net cloth to separate the seeds and the rough skins.

### *Recipe*

Pulp	1 kg.
Sugar	1.5 kg.
Butter	125 g.
Citric acid	2 g.
Salt	1 teaspoonful

Colour (red, edible) sufficient to give an attractive deep fruit colour to the product

Mix the pulp, sugar and butter, and heat till the mass becomes sufficiently thick. Just before finishing, add the remain-

ning ingredients previously dissolved in a small quantity of water.

Smear a china plate with butter and spread the finished product over it to form a layer about 0.6 cm. thick. Allow the product to cool and set. Cut it into pieces of attractive shape. Wrap the pieces in butter paper and store in clean, dry glass containers using paraffin wax to seal well.

### 13. GRAPE

Grape (*Vitis vinifera*) (Hindi—*Angur*, *draksh*; Beng.—*Angurphal*; Mar. and Tel.—*Draksha*; Guj.—*Draksh*; Tam.—*Kodimundirigai*, *gostanidraksh*, *kottani*, *madhurasam*, *mundirigai*, *simudai*; Kan.—*Drakshi*; Mal.—*Gostani*, *madhurasam*, *mridvika*, *saruphala*, *swadvi*).

#### 13.1 Grape juice

Select good quality grapes. Remove the stems and discard underripe and decayed fruits.

Wash them thoroughly in water. Heat in a pan with a little of water (about 1 cup to 4.5 kg. of grapes) until the fruits become soft. When fruit is softened, it will easily crush between spoon and pan and will not slip out when some pressure is applied. Strain the pulpy mass through coarse muslin cloth. If necessary, the juice is filtered through cloth again. Add sugar at the rate of 50 g. per litre of juice, to adjust the taste in the case of slightly sour varieties of grapes.

Fill the juice into large containers and keep in a refrigerator for 8-10 days. This facilitates the tartrates and argols to settle down. Decant the juice and filter through cloth.

Heat the juice to 88°C; fill into bottles, seal and pasteurize at 85°C (140 ml. for 15 min.; 560 ml. for 20 min. and 1.125 litre for 30 min.). During pasteurization, keep the bottle on a false bottom to prevent breakage. Cool the bottles to room temperature and store.

The juice can be preserved by adding 1 g. of sodium benzoate per kg. of juice. The juice can also be bottled or canned without removal of tartrates. When ready to use, carefully decant the juice without disturbing the sediment.

#### 13.2 Grape syrup

Extract the juice as described under grape juice.

##### Recipe

Juice 1 kg.

Sugar	1.5 kg.
Citric acid	20 - 25 g.

Mix the ingredients thoroughly, heat if necessary to dissolve the sugar and strain through coarse muslin cloth. Add 700 mg. of sodium benzoate (preservative) per kg. of product. Dissolve the preservative in small quantity of water and add to the finished product.

Fill the syrup into sterilised bottles leaving space of 2.5-4 cm; cork air - tight. Store the bottles in a cool, dry place.

Dilute the syrup with 6 - 7 times its volume of plain or aerated water for use as fresh drink.

## 14. PAPAYA

Papaya (*Carica papaya*) (Hindi—*Papita*; Beng.—*pappaiya*; Guj.—*Papia*; Mar.—*Papaya*; Tel.—*Boppai*; Tam.—*Pappali*, *parangiyamunakku*; Kan.—*Parangi hannu*; Mal.—*Kappalam*, *karmmosa*; Oriya—*Papaya*, *omrito bhonda*) is grown almost throughout the country but especially in South India, Maharashtra, Gujarat, Uttar Pradesh, Assam and Bihar. *Washington*, *Honey Dew*, *South African* or *Madagascar*, *Australian*, *New Zealand*, *Java blue*, *Singapore*, *Ceylonese*, *Bangalore*, *Gujarati*, *Saharanpur*, etc., are the popular varieties of papaya cultivated in India.

The raw fruit is used in South India for making curries, soups, etc., either alone or combined with other vegetables. The cooked papaya tastes like the cooked product of cucumber. The mature fruit can be suitably processed to give different products like pickles, jellies and candies.

### 14.1 Papaya pickle

Peel and slice the green papaya. Cover it with boiling water for three minutes. Strain the water and sprinkle common salt on the blanched slices. Allow the fruits to dry up to some extent. Place the prepared papaya slices in the jar. Cover with vinegar. Add two teaspoons of husked mustard for every kg. of fruit slices. Add turmeric in suitable quantities and close the jar air - tight. The slices cure in about 2 - 3 weeks and give good pickle.

### 14.2 Papaya jelly

Select fully mature but somewhat raw fruit; thoroughly clean in water; remove the peel and seeds and cut into pieces. Add water at the rate of 2.5 kg. for every kg. of fruit and about two teaspoons of citric acid. Add an equal quantity

(1 kg.) of ripe papaya. Heat the mixture for 30 minutes to extract pectin. Cool the extract and allow to settle for about 2 hours. Carefully decant the clear extract or filter it through thick cloth. Test the extract for pectin content with a few drops of methyl alcohol. The formation of a single clot indicates high pectin. The presence of a number of clots shows moderate pectin content. If a gelatinous precipitate forms, then it has low pectin content. Concentrate extract by heating till it gives test for high pectin content.

Mix the extract with equal quantity of sugar by volume, if it is rich in pectin,  $\frac{3}{4}$ th the quantity of sugar is sufficient if it has moderate pectin content. Cook the material till it falls in the form of sheets or flakes when let down from a spoon. Alternatively, cooking may be done up to  $105.5^{\circ}\text{C}$ . Pour the product into sterilized and dry glass jars and cool. Cover with a layer of molten wax and close the lid air - tight.

#### **14.3 Papaya preserve**

Use fully nature and unripe fruits. Peel and remove the seeds. Cut the flesh into pieces of 7.5 cm.  $\times$  7.5 cm. and prick them with stainless steel fork. Immerse the fruit pieces in dilute lime water (15 g. of lime in one litre of water) for about 3 - 4 hours. Wash the pieces 3 - 4 times with fresh lots of water and boil in sugar syrup of  $40^{\circ}$  Brix. Keep overnight. Next day, drain out the syrup and add enough sugar to raise its Brix to  $50^{\circ}$ . Repeat the process every day till the Brix of residual syrup reaches  $70 - 75^{\circ}$  (with 50 per cent invert sugar). Drain off the syrup. Cut the fruit pieces further to the desired shape.

Pack the product in sterilized wide mouthed bottles or tin cans and add to them the residual syrup to fill the interspace. Seal the mouth of the bottles.

#### **14.4 Canned papaya**

Select fully developed, ripe but firm fruits with good aroma. Wash them in cold water and cut length - wise into slices of 2.5 - 4 cm. width. Remove the peel and seeds. Cut the flesh cross - wise into pieces of 2.5 - 4 cm. length or into cubes. Pack the fruit pieces into plain cans (285 g. into A1 cans and 540 g. into A2 $\frac{1}{2}$  cans respectively). Add sugar syrup of  $33^{\circ}$  Brix (prepared by mixing one cup of sugar with 2 cups of water and half a teaspoonful of citric acid) leaving a head space of 6 mm. Exhaust the cans in boiling water at  $88^{\circ}\text{C}$  for 5 minutes. Close the cans immediately and process at  $100^{\circ}\text{C}$  for 12 and 18 minutes respectively. Cool the product in running water and store at room temperature.

#### 14.5 Canned papaya cocktail

Papaya fruits can also be canned with fruits like mango, grapes apple, etc., in the same manner.

#### 14.6 Papaya nectar

Nectar is a thin pulp of the fruit suitably blended with sugar and citric acid to obtain a product of 15 - 20° Brix and mild acid taste.

Cut the fully ripe fruit into slices and peel with a stainless steel knife and crush the pieces into pulp and pass through a fine sieve to remove the fibrous materials. The yield of pulp from raw stock (viz., ripe fruit) is about 50 per cent.

##### *Recipe*

Pulp	10 kg.
Water	15 - 20 kg.
Sugar	4 kg.
Citric acid	125 - 175 g.

Gradually mix the pulp with water. Add the sugar and citric acid. Mix thoroughly. Strain the product through muslin cloth. Heat the prepared nectar to 85 - 88°C and fill into previously sterilized plain or lacquered cans. Seal the cans, invert them for a minute and cool them in running cold water to about 38°C. Cool the product subsequently under atmospheric conditions. Equipment used should be of non-corrosive metal.

#### 14.7 Canning of ripe pulp

After washing, peeling and deseeding of the ripe fruits, crush them into pulp. Render it fine by passing through a stainless steel sieve. Add 2.5 g. of citric acid and 50 g. of sugar to every kg. of pulp for improving its taste. Fill the pulp into plain jam size tin cans leaving a head space of 6 mm. Exhaust the cans in boiling water at 85 - 88°C till the temperature reaches 80°C at the centre of the can. Seal the can and process in boiling water for 20 minutes. If citric acid is not added, process the cans for 35 minutes at 0.7 kg./sq. cm. steam pressure or 115.6°C. The canned product keeps for more than a year at 24 - 30°C.

#### 14.8 Papaya slabs

For each kg. of papaya pulp (prepared for canning), add 50-75 g. of sugar, 500 mg. of citric acid and 3 g. of potassium metabisulphite. Mix thoroughly and spread the product in layers of 1 cm. thickness on aluminium or stainless steel trays smeared with fat. Dry them in home drier at 55 - 60°C. The dried product which has leathery consistency can be cut or

rolled into pieces of convenient size. Wrap the pieces in polyfilm sheets and pack them in friction top tins. The dried product keeps well for about eight months at room temperature 24 - 30°C.

**14.9 Papaya toffee** *see* Fruit Toffees (1.6).

## 15. CARAMBOLA

Carambola (*Averrhoa carambola*) (Vern.—*Kamrakh*) is grown throughout India. When ripe, the fruit has rich amber colour and acidic taste. It is used in stews, curries, puddings and tarts. It can also be used in the preparation of juice, squash, jam, jelly, etc.

### 15.1 Carambola squash

After thorough washing, express the juice from the ripe sour fruit in a screw type juice extractor. Add sufficient sugar (1 kg./kg. of juice) to the juice to raise its Brix from 7° to 55°. Add one heaped teaspoonful of citric acid per kg. of the squash. Add 0.6 g. of potassium metabisulphite to one kg. of squash and fill into dry, previously sterilised bottles. Alternatively, fill the squash into 340 ml. (12 oz.) bottles and sterilize for 30 minutes in boiling water. Cool and store.

Both the squashes possess light yellow colour and provide, on dilution with water, highly acceptable product. The squash preserved with potassium metabisulphite has better colour during long storage at room temperature (24 - 30°C).

### 15.2 Carambola jam

Cut the cleaned fruit crosswise into small slices and boil them with  $\frac{3}{4}$  their weight of sugar to thick consistency till they attain a final Brix of 68° or it answers the flake test or cold plate test.

*Flake test.* Dip clean, wooden spoon into the jam, remove and turn horizontally in the hand until the adhering jam is slightly cooled. Allow the jam to fall or drop from the edge. If the jam drops in the form of flakes which break off in a clean, sharp manner, stop cooking the jam further.

*Cold plate test.* Cool a teaspoon of jam on a plate. If the surface sets and crinkles when pushed with the finger, stop cooking the jam further.

Cool the product for a few minutes and fill, while still hot, into dry, previously sterilized bottles. The jam is of fair quality only and does not possess any characteristic taste.

### 15.3 Carambola jelly

Boil the fruit slices gently for 15 - 20 minutes with equal weight of water and collect the extract. Boil the slices again with half their weight of water; separate the extract. Mix the two extracts. Add half its weight (mixed extract) of sugar and boil till the product falls in the form of a sheet when let down from a spoon. The jelly obtained, however, has syrupy consistency. In the case of extract from sweet variety, add a small quantity of citric acid (0.3 - 0.5 per cent of the weight of the extract) to improve the taste of jelly. The finished product has a light amber colour and is of good quality.

### 15.4 Carambola preserve and candy

After cleaning, prick the whole fruits with stainless steel forks. Prepare sugar syrup (33° Brix) by dissolving 1 cup of sugar in 2 cups (8 ounce cups) of water. Boil and filter through thick muslin cloth. Add sugar syrup to the fruits (1 kg./kg.) and boil for about 15 minutes. Keep the fruits in the syrup for a day. Drain off the syrup and increase its strength (about 38° Brix) by adding more sugar and heating. Repeat the process every day till the strength of syrup is increased to 72° Brix or the syrup is thick enough to give 2 - 3 threads when drawn between two fingers.

In the final preserve the fruit is soft inside and the sugar will have been absorbed uniformly. The outer skin, however, still remains tough.

For making candy, take out the fruit from syrup, drain and dry in the shade. The product obtained is generally of good quality. The sour variety of fruit is better suited for making preserve and candy.

## 16. LOQUAT

Loquat (*Eriobotrya japonica*) (Hindi—*Lokat*; Tam.—*Ilakotta, lokkota*; Kan.—*Lakkote*) has been long naturalized in India. It is grown nearly throughout the country upto elevation of 1,500 m. Its commercial cultivation in India is confined mostly to the sub-tropical parts of Uttar Pradesh, Delhi and Punjab. It is grown to a small extent in Assam, Tarnil Nadu, Maharashtra and Karnataka.

### 16.1 Loquat jam

After washing, remove the thin coat and the seeds with a stainless steel knife; cut the fruit into small pieces and

mash them thoroughly to obtain a uniform mass. Add to the fruit mass an equal quantity of sugar if the fruits are acidic; if they are slightly sweet add  $\frac{1}{2}$  quantity of sugar. Mix the mass well and allow it stand for 30 - 40 minutes. Cooking, filling, closing and storage should be done as described under preparation of jams (1.3).

### 16.2 Loquat jelly

The same material prepared for making jam can be used for jelly making. To the fruit pieces, add water just sufficient to cover. Boil the mass for 30 minutes or more with occasional crushing till the extract becomes fairly sticky. Filter the extract through coarse cloth and allow the extract to settle.

Carry out the test for pectin and the subsequent steps of addition of sugar, cooking, filling and storage as described under guava jelly (12.1).

### 16.3 Canned loquats

Select fresh, fully developed and sound fruits with good flavour and sweet taste. Wash them in fresh water and remove the thin coat carefully with a stainless steel knife. Deseed the fruit and cut into halves. Fill them into containers which can be cans or screw type jars (the lids having rubber lining). Pour boiling hot syrup (2 cups of sugar mixed with 3 cups of water and a pinch of citric acid added) into the containers leaving a head space of 1.25 cm. Exhaust the can or bottle till the central portion attains a temperature of 71 - 77°C which takes 10 - 12 minutes. Remove the cans and seal. Pasteurize the cans or bottles in boiling water for 25-30 minutes and cool. Store in a cool and dry place. The canned fruit is used with other fresh or canned fruits or milk cream as a sweet dish.

## 17. PEAR

Several varieties of pears (*Pyrus communis*) are grown in India of which *LeConte*, *Kieffer*, *Williams*, *Bagugosha*, *Nashpati* (hard country pear), *Nakh*, *Winter*, *Mellis*, *Beurre Hardy*, *Basque*, *Christmas* and *Sweet* are more important. *Bagugosha* is grown in Kashmir and Punjab. *Nashpati* is also grown in Punjab. *Williams* is grown on a small scale in Kulu valley and this variety has been found to be suitable for canning.

Hard pears are grown in Tamil Nadu and the neigh-



bouring areas. They have white, rather hard, grainy, sweet flesh and green skin having black spots. They can be used in the preparation of following products.

#### 17.1 Canned pears

Wash the fruits, peel them, cut lengthwise into four pieces and remove the core. Immerse the pieces in a 2 per cent solution of common salt to check browning. Take out the pieces and fill 310 g. of them into clean, butter size can. Add 225 g. of hot sugar syrup of 40° Brix containing 0.3 per cent citric acid (for making syrup add 2 cups of sugar to 3 cups of water, boil and filter. Add about a teaspoonful of citric acid). Exhaust the cans at a temperature of 78 - 80°C for about ten minutes. Seal the cans and cook for about 30 minutes in boiling water. Remove the cans, cool them and store in a cool, dry place.

#### 17.2 Pear preserve

Wash the fruits, and remove their stem and calyx ends. Peel the fruits with a stainless steel knife and keep them in a 2 per cent solution of common salt to prevent browning. Boil them in water for 5 minutes to soften their texture. Remove and prick with stainless steel fork, or bamboo prickers to facilitate proper penetration of sugar. Boil in sugar syrup of 40° Brix containing 0.2 per cent citric acid. Allow to stand overnight. Drain off the syrup next day. Raise its strength by about 10° Brix by adding the required quantity of sugar and boil. Repeat the process every day till the final Brix reaches 70° i.e., when drawn between fingers, the syrup gives 2-3 threads. Cool slightly and pour while hot into previously sterilized, dry bottles and screw tightly.

The finished product has attractive amber colour and possesses characteristic aroma of fruit. The canned product keeps well for a year.

#### 17.3 Pear chutney

Mince the fruit pulp and prepare the chutney following the recipe and procedure given under chutney (5.5). The product has good consistency and sweet taste.

### 18. MUSK MELON

Musk melon (*Cucumis melo*) (Hindi, Guj. Mar. and Kan.—*Kharbuja*; Beng.—*Kharmuj*; Tel.—*Kharbuja dosa*, *putzakova*; Tam.—*Mulampazham*) is a common fruit in this country avai-

lable in plenty during summer season. It can be canned alone or with other fruits to yield delicious products.

### 18.1 Canning

Select firm, ripe fruits and wash them in fresh water. Peel them with a stainless steel knife, wash in water and cut into small pieces. Papaya, banana, grape, mango and pineapple can be used with this fruit for canning. Prepare these fruits for canning in the usual way.

If the musk melon is to be canned alone, fill about 227 g. into previously sterilized plain 1 lb. Jam size cans and add 128 g. of syrup of 40° Brix (prepare sugar syrup of 40° Brix by adding 2 cups of sugar to 3 cups of water, boil and filter through cloth), and 0.5 per cent citric acid. Keep the cans in a vessel containing boiling water till the temperature at the centre of cans reaches 77°C. Seal the cans and process them for 30 minutes in boiling water. Cool them under running cold water and store in a cool, dry place at room temperature. The product possesses flavour of melon and keeps well for about 7 months at room temperature (24 - 30°C).

While canning melon with other fruits take them in the following proportions:

Melon + <i>Raspuri</i> mango	(4:6, 6:4)
Melon + Pineapple	(4:6, 6:4)
Melon + Grape	(4:6, 6:4)
Melon + <i>Raspuri</i> mango + Pineapple	(4:2:4)
Melon + Papaya + Pineapple	(4:2:4)
Melon + Papaya + Grape	(4:2:4)
Melon + Banana + Pineapple	(4:2:4)
Melon + Banana (4:6) (Use 0.5% citric acid in syrup)	

Weigh the fruits separately in the respective proportions and fill 227 g. of mixed fruits into cans and add 128 g. syrup. Adopt similar procedure for canning as in the previous case.

## 19. BILWA FRUIT

Bilwa (*Aegle marmelos*) (Hindi, Beng. and Mar.—*Bel*; Guj.—*Bil*; Tel.—*Moredu*; Tam. and Mal.—*Vilam*; Kan.—*Bilpatre*) is widely grown in India and the preserve made from its fruit has been famous for its therapeutic properties.

### 19.1 Bilwa preserve

Select tender, *bilwa* fruits with the shell intact; cut them transversely into eight pieces and soften them by boiling in

water. Prick the fruit pieces with stainless steel forks. Meanwhile prepare sugar syrup (33° Brix) by dissolving 1 cup of sugar in 2 cups of water. Boil and filter through thick muslin cloth. Boil the softened slices for 4 - 5 minutes in the syrup and allow to stand overnight. Drain the syrup. Add enough sugar to raise the Brix by about 10°. Transfer the fruit pieces to the syrup, boil for 4 - 5 minutes and keep overnight. Repeat the process every day till the Brix of the syrup reaches 72°. The final product can be preserved in clean, previously sterilized bottles.

## 20. PALMYRAH PALM KERNEL

Palmyrah palm (*Borassus flabellifer*) (Hindi—*Tal*; Beng.—*Tal*; Guj. and Mar.—*Tad*; Tel.—*Tali chettu*; Tam.—*Panai*; Kan.—*Tatinungu*; Mal.—*Pana*) is found in the drier parts of India particularly in the coastal areas. The tree is usually tapped for its sweet refreshing sap - *nira* or for converting it into *plam gur*.

The tender fruits which contain soft, sweet, gelatinous pulp with a little liquid in them are relished in summer. The pulp gradually hardens into a bony kernel. Tender kernels can be used in canning and preparation of candies.

### 20.1 Preparation of kernel

Remove the stalk end of the fruits or cut in the longitudinal plane and split open. Remove the kernels and scrape out their thin covering with a knife. The peeled kernels can be kept for 2 - 3 hours without any noticeable change in the colour and texture and utilised for making different products.

### 20.2 Canned kernel

First prepare sugar syrup (50° Brix containing 0.5 per cent citric acid) as follows: to every 5 cups of sugar add 5 cups of water and 1½ teaspoonsful of citric acid, dissolve and boil. Filter the syrup through thick muslin cloth.

Remove the thin outer coat from tender kernels and cut them into pieces. Over-ripe and hard kernels do not soften sufficiently even after processing and do not yield good canned products.

Fill about 227 g. of the kernel in plain cans of 1 lb. jam size. Add 142 g. of boiling sugar syrup. Exhaust the cans for 7-8 minutes in water at 85-88°C, seal them and process for 40 minutes in boiling water. Cool them quickly in cold water. The canned product is of very good quality and stores well at room temperature (24 - 30°C) for about a year.

### 20.3 Plum kernel candy

Select comparatively hard kernels and peel them. Prick them with stainless steel forks. Prepare sugar syrup (33° Brix) as follows: to every cup of sugar, add 2 cups of water, dissolve the sugar in water and add about  $\frac{1}{8}$  teaspoonful citric acid and boil for 2 minutes and filter. Steep the kernels in syrup. Continue the candying process in the conventional way till the final syrup attains a Brix of 70°. The final product is, however, hard.

## 21. GENERAL METHODS OF VEGETABLE PRESERVATION

### 21.1 Canning and bottling of vegetables in brine

Select mature, sound and tender vegetables, wash them free of impurities with fresh water. Remove the inedible and damaged portions.

21.1. 1 *Preparation.* Prepare the vegetables as given in the Table 2. Grade them according to maturity and size as best as possible. Wrap the prepared vegetable in a piece of muslin cloth and dip in boiling water for 2 - 5 minutes. The time of blanching depends upon the type of vegetable and its maturity. Blanching is done to inactivate the enzymes, to drive out the air from the tissues, etc. Remove the muslin bag from the boiling water and dip it in cold water immediately. The water for blanching should be changed when it begins to froth.

Usually 2 per cent brine is used. It is prepared by dissolving 2 g. of common salt in about 98 ml. of water and filtering.

21.1. 2 *Filling and brining.* Fill the blanched vegetable into tin cans or glass jars. Arrange the vegetable pieces in such a way that the container holds the given weight of vegetable.

For A 2½ size cans the fill-in weight should be	540-570 g.
For butter cans	340-400 g.
For pint glass jars	280-310 g.

Fill the interspace in the can with 2 per cent hot and clear brine leaving a head space of 0.6-1 cm. Small quantities of sugar and citric acid are added to the brine while canning peas and cauliflower.

21.1. 3 *Exhausting.* Place the filled cans in a boiling water bath with a false bottom (a frame work of wood or wire or a thick pad of cloth placed at its bottom); continue heating for 6-10 minutes till the centre of the can records a temperature

of 75 - 82°C. The time of exhaust will vary with the nature of the pack.

21.1. 4 *Sealing.* Immediately after exhausting, seal the cans with a can sealer. In the case of glass jars, the lids must have a rubber ring between the mouth of the jar and the top to achieve air - tight pack.

21.1. 5 *Processing.* Vegetables in the sealed containers are processed i.e., heated at 116°C corresponding to 0.7 kg./sq. cm. pressure in a pressure cooker for 30 - 60 minutes (Table 2). The processing time depends upon the size of the container, the kind of vegetable, its stage of maturity and the density of

TABLE 2. CANNING SCHEDULE FOR NON-ACID VEGETABLES

Vegetable	Preparation before canning	Processing time (min.) at 116°C or 0.7 kg. per sq. cm. steam pressure			
		Type of can	No. 2 can	No. 2½ can	Glass jars (pint)
Beans (lima)	Shell, grade, boil for 10 - 15 min., pack loosely	Plain	30	30	35
Beans (string)	Wash, snap, boil for 5 min., pack mature beans	"	25	30	30
Beets	Wash, retain 2.5 cm. stems, boil for 15 min., slip skins, pack	Lacque-red	30	30	35
Brussels sprouts	Wash, boil for 15 min., add salt, pack	Plain	25	30	30
Carrots	Wash, scrape, boil for 5 min., pack	"	30	30	35
Cauliflower	Soak in cold brine, boil for 3 min., pack	"	25	25	30
Cabbage	Wash, boil for 10 min., and salt pack	"	40	45	45
Parsnips	Wash, scrub, boil for 15 min., pack	Plain	30	30	35
Peas	Shell, grade, boil for 3 - 5 min., pack loosely	"	40	45	45
Potatoes white	Peel, blanch for 3 min. in boiling water and pack	"	35	40	40
Pumpkin or squash	Wash, cut into pieces, cook until tender, mash, pack	Lacque-red	70	95	75
Spinach or all greens	Steam in covered vessel for 15 min. or until wilted, use the smallest possible amount of water, pack loosely	Plain	50	55	55
Turnip	Peel, slice, blanch and pack	"	30	30	35

the pack. For every 150 m. rise in altitude the boiling point of water decreases by 0.6°C and hence a corresponding increase of 2 minutes for every 300 m. rise in altitude should be effected in the processing time given in the schedule.

21.1. 6 *Cooling and storage.* Place the cans immediately under running cold water and let the glass jars cool in the air. Store the product in a cool, dry place.

## 21.2 Canning of curried vegetables

21.2. 1 *Preparation.* Prepare the vegetable as for use in the home kitchen, *e. g.*, shell the peas; remove hard leaves of cauliflower and cut the flower head into flowerets of suitable size; remove the outer hard leaves of cabbage and cut into shreds of 0.6 - 1 cm. thickness; peel the root vegetables and cut them into slices of suitable thickness, etc. Grade them according to size, quality, where practicable. Prepare the gravy as follows.

For one dozen A 2½ cans of curried vegetables weigh the following ingredients:

Mustard (whole)	20 g.
Coriander (powder)	20 g.
Red chillies (powder)	15-20 g.
Caraway seed	20 g.
Turmeric (powder)	40-50 g.
Common salt (powder)	90 g.
Vegetable fat (hydrogenated oil)	400 g.
Water	Sufficient to make up gravy for 12 cans.

Heat the fat in a pan and fry mustard in it till the seeds crack. Add the other spices and continue frying for a few more minutes. Add the required quantity of water, stir thoroughly and bring the entire mass to boil.

21.2. 2 *Filling.* Fill the prepared raw vegetables in A2½ size cans. Add hot gravy in proportions given below for some typical packs.

Combination of vegetables	Wt. of vegetables (g.)	Wt. of gravy spices liquid (g.)	Processing	
			Temp. (°C)	Time (min.)
Potatoes-cauliflower	480-500	300-320	116	60
Potatoes-cauliflower-tomatoes	500	240	"	"
Potatoes-tomatoes	680	110	"	"
Potatoes-peas	425	370	"	75
Potatoes-peas-cauliflower	450	340	"	"

For other combinations, almost similar proportions may be used. If, however, a product with less amount of liquid portion is required, the proportion of vegetables may be increased and that of gravy decreased.

21.2. 3 *Exhausting, sealing, processing, cooling and storage.* Except that the cooking time is 60 - 75 minutes depending upon the size, and type of containers, kind and maturity of vegetables, quantity of fat in the final product, etc. the other steps are exactly the same as in Canning and Bottling of Vegetables (21.1).

### 21.3 Drying of vegetables

The main step in the dehydration of vegetables are: preparation (washing, peeling and slicing), blanching, sulphiting and drying. Blanching may be carried out either in boiling water or in steam, but in the case of green vegetables like green peas, split field beans, spinach and fenugreek leaves, blanching in boiling water containing 0.1 per cent magnesium oxide, 0.1 per cent sodium carbonate and 0.5 per cent potassium metabisulphite (KMS) is recommended to ensure maximum retention of the natural green colour in the dehydrated vegetable. In other cases, sulphiting may be carried out immediately after blanching by steeping in half the weight of KMS solution of appropriate (0.10-0.25 per cent) concentration. While beet-root is not sulphited, onions and garlic are neither blanched nor sulphited. For drying, generally about 5 - 10 kg. of material are loaded per sq. m. of the area in trays.

TABLE 3. DRYING SCHEDULE FOR VEGETABLES

Vegetable	Preparation	Pre-treatment	Maximum drying temperature (°C) in home drier
Potatoes	Peel and cut into 1 cm. thick slices	Blanch in boiling water or steam for 3-4 minutes and sulphite in 0.125% potassium metabisulphite (KMS) solution for 10 minutes using 0.5 kg. of solution per kg. of slices	65
Carrots	"	Blanch in boiling water or steam for 3-4 minutes and sulphite in 0.25% KMS solution for 100 minutes using 0.5 kg. of solution per kg. of slices	60

Vegetable	Preparation	Pre-treatment	Maximum drying temperature (°C) in home drier
Cabbage	Remove outer leaves and cores and cut into 4 to 8 mm. thick Shreds.	Blanch as above for 5-6 minutes and sulphite as above	55
Cauliflower	Remove stalks, covering leaves, and stems, break apart flowers and cut into 10-12 mm. thick pieces	Blanch as above and sulphite in 0.125% KMS solution using 0.5 kg. of solution per kg. of material	50
Onions	Remove tops and tails, peel and cut into 4 to 8 mm. thick shreds	Nil	55
Garlic	Peel the cloves, and cut into 6 mm. thick shreds	Nil	55
Okra (sliced)	Remove both ends with stainless steel knives and cut into 6 mm. thick slices	Blanch in boiling water for 4-5 minutes and sulphite in 0.25% KMS solution for 10 minutes using 0.5 kg. of solution per kg. of slices	60
Okra (small-sized 50-75 mm. length, whole)	Remove stalks with stainless steel knife and slit longitudinally along the ridges	Blanch in boiling water for 6-7 minutes	60
Bitter gourd	Remove both ends with stainless steel knife and cut into 6 mm. thick slices	Blanch in boiling water for 8 minutes	60



Vegetable	Preparation	Pre-treatment	Maximum drying temperature (°C) in home drier
Pumpkin	Cut into 50-75 mm. wide longitudinal strips, peel, remove the seeds and soft portions in contact with the seeds, prick uniformly using a stainless steel fork and cut into 6 mm. cubes	Blanch in steam for 10 minutes	65
Beetroot	Peel and cut into 10 mm. thick slices	Blanch in steam for 10 minutes	60
Green peas	Remove Pod and prick with a small nail or pin	Blanch for 3-4 minutes in boiling water containing 0.5% KMS, 0.1% magnesium oxide and 0.1% sodium bicarbonate	60
Split field beans	De-skin and split whole field bean (Dolichos) seeds by boiling in 1% sodium carbonate solution for 5-7 minutes and rubbing off the skin under a spray of water	Blanch as above for 2 minutes	60
Spinach	Sort, wash thoroughly and cut into 10-12 mm. portions using a stainless steel knife	..	60
Fenugreek leaves	Sort, wash thoroughly and remove stalks and stems	..	60

*Packing and storage.* The vegetables dried and finished as per directions given in the Table 3 should be put into confectionery tins and sealed air-tight with solder or wax, depending upon the duration of storage.

## 22. SWEET TURNIP

### 22.1 Pickle

There are three types of turnips - red, white and yellow. Select tender, sound and evenly matured turnips free from fibres. Chop off the leaves. Wash the turnips thoroughly in fresh water and remove their thick outer peel. Cut them into 0.6 - 1.25 cm. thick, round slices.

#### Recipe

Turnip slices	10 kg.
Red chillies	250 g.
Black pepper	125 g.
Mustard	500 g.
Spices (caraway and cinnamon)	62 g.
Dried dates ( <i>choara</i> )	250 g.
Tamarind ( <i>imli</i> )	250 g.
Ginger (fresh, chopped)	250 g.
Onion (fresh, chopped)	1 kg.
Garlic (fresh, chopped)	125 g.
Salt (powdered)	1 kg.
Vinegar (1 bottle)	800 ml.
Gur (jaggery)	625 g.
Rape seed oil ( <i>sarson oil</i> )	1 litre

Fry the chopped ginger, onion and garlic in a small quantity of oil. Prepare a thick extract of the tamarind pulp. Cut the dried dates into small pieces. Mix all the ingredients except *gur* and rape seed oil with the turnip slices. Fill the mass in a glass or glazed container. Place it in the sun for 3 - 4 days till the characteristic pickle flavour is developed. Add a clarified thick syrup of jaggery to the pickle and leave in the sun for another 2 - 3 days. Add rape seed oil (previously heated and cooled) and keep the pickle in the sun for another 3 - 4 days till the slices have become sufficiently soft and palatable and the flavour and aroma of the pickle sufficiently enriched.

## 23. GREEN CHILLI

### 23.1 Green chilli and lime pickle

Select sound, fully mature and juicy limes having deep yellow skin and green chillies of good size. If the limes are greenish in colour, allow them to develop deep yellow colour before use. Wash the limes and chillies thoroughly in running cold water. Remove the stalks of green chillies without injuring their caps. Cut the limes into halves or quarters depending upon their size.

For every kg. of limes and green chillies used, weigh out about 250 g. of powdered salt and transfer to a clean sterilized wide mouthed glass or glazed jar. Squeeze out some juice from limes over the salt. Transfer the partially squeezed limes to the salt. Make deep longitudinal slits in the green chillies and add them to the same jar. Stir the mass well to effect thorough mixing. If the juice of the limes is insufficient to cover the mass, add cool, boiled water acidified with citric acid (4 - 5 per cent) so that the limes and the chillies are covered by the liquid.

Keep the mass in the sun for a week with occasional shaking, for softening the material. This is indicated by the skin of the lemons turning light brown and the green colour of the chillies also turning to brown. This pickle at this stage is ready for use. Keep off moisture from the pickle to prevent it from getting mouldy and spoiled.

### 23.2 Canned green chillies

Select, tender green chillies and snip off their stalks with a knife taking care to retain the calyx. Blanch the chillies for 2 - 3 minutes in boiling water. Rinse them in cold water and fill into sterilized cans; cover with hot 2 per cent brine (171 g. chillies and 157 g. brine per 1 lb. jam size can). Add 50 mg. citric acid to every 100 g. of product. Exhaust the cans for 6-7 minutes in hot water at 85 - 88°C. Seal and process for 30 minutes in boiling water. Cool quickly and store in a cool and dry place.

## 24. CARROT

### 24.1 Spiced carrot juice

Select sound, well matured and sweet carrots of the deep pink variety. Wash them thoroughly in water by scrubbing with hands. Remove the hairy parts. Chop off the two ends; scrape the carrot to remove the inedible portions completely. Grate the prepared material on a grater.

#### *Recipe*

Grated carrots	10 kg.
Common salt	325 g.
Mustard (powdered)	30 g.
High quality vinegar	625 g.
Red chillies (powdered)	3 teaspoons.

Mix the ingredients thoroughly and pack the mass in earthenware pitchers to the brim. Cover them with lids. Apply paraffin wax all round the lids leaving a small opening on one side to let off the gases produced inside the pitchers; store in

a cool, dry place for about a month. Press out the juice by hand wearing rubber gloves and strain through coarse muslin cloth.

Allow the strained juice to stand in closed and deep containers for a couple of days. When the sediment separates from the clear juice, decant it and filter through fine muslin cloth. Add sodium benzoate (300 mg./kg. of the beverage) and mix thoroughly.

Fill the clear juice into bottles previously sterilized in boiling water for 10 - 15 minutes. Cork tightly or crown seal the bottles. Store in a cool, dry place. Before use, dilute the beverage 2 - 3 times with water.

#### 24.2 Carrot preserve

Select fresh, sound and tender carrots of uniform size and colour. Wash them thoroughly in water by scrubbing with hands to remove the mud and other foreign materials sticking on them. Remove the hairy parts, chop off the two ends and scrape the skin with stainless steel knives. Cut the peeled carrots into uniform slices of 5-8 cm. long.

Prick the slices with stainless steel forks thoroughly. Place the pricked carrots in sufficient boiling water to cover them and cook gently until they become just soft. Too much of cooking will spoil the shape and texture; little of cooking will result in slow penetration of sugar, dark colour and toughness. Drain off the water and spread the pieces on a clean white cloth for removing some moisture.

Prepare sugar syrup by dissolving 2 cups (8 oz. cup) of sugar in 3 cups of water, heat to boil and filter through thick muslin cloth. The quantity of syrup required should be equal to  $2\frac{1}{2}$  times by weight of the quantity of the prepared carrots.

Add the pieces to the boiling syrup and continue heating. When the syrup volume is reduced to half of the original, add one teaspoonful (5 - 6 g.) of citric acid for every 1 kg. of carrots; continue heating till the temperature reaches 106°C at sea level, or the syrup becomes thick enough to give 2 - 3 threads when drawn between the two fingers. Keep the mass for 48 hours. Boil again and fill into clean dry glass or glazed containers. Close the containers and store.

### 25. GINGER

Ginger (*Zingiber officinale*) (Hindi—*Ada*, *adrak*; Beng.—*ada*; Mar.—*Adu*; Tel.—*Sonti*; Tam. and Mal.—*Inji*; Kan.—*Shunti*) is the under ground stem or the rhizome grown in South India. Ginger is used as flavouring for confectionery, ginger beer, chutneys and other culinary preparations.

## 25.1 Candy

Select tender, fibreless and large rootlets or fingers, and wash them in cold water. Peel their skins with a sharp stainless steel knife and cut them into pieces of desired shape and size.

Soften the ginger by: (i) boiling it in 0.5 per cent solution of citric acid (quantity of the solution being sufficient to cover the ginger) in a covered aluminium, stainless steel or heavily tinned brass or copper vessel for a period of six hours or (ii) by cooking in 0.5 per cent solution of citric acid at 0.7 kg. per sq. cm. steam pressure in pressure cooker for one hour. Citric acid is used to bleach or whiten the colour during softening.

Remove the ginger and wash it well with cold water. When sufficiently cooled, prick the softened pieces with stainless steel, or wooden prickers. Wash again. The ginger pieces are now ready for impregnation with sugar syrup.

Prepare 30° Brix syrup by dissolving 3 parts of sugar in 7 parts of water. Boil and filter the syrup through thick muslin cloth. Use about 1 kg. of syrup for 1 kg. of the prepared ginger.

Boil the prepared ginger in the 30° Brix syrup for 15 minutes and allow it to stand overnight, taking care that the ginger is completely covered by the syrup. After about 24 hours, drain off the syrup and increase its concentration to about 35° Brix by adding more sugar and heating, if necessary. Boil the ginger with the syrup for 15-20 minutes and keep it again overnight taking care to have the ginger fully covered by the syrup. Repeat this every day till the concentration of the syrup is about 60° Brix. At this stage, add a small quantity (about 0.1 per cent of the total weight of the syrup) of citric acid or tartaric acid, or 5 per cent by weight of invert sugar or corn syrup. Carry out the process of absorption by increasing the strength of the syrup by 5° Brix each day, till it reaches 75° Brix. The preserve is then ready to be packed.

Set aside the prepared preserve for 2-3 months for thorough penetration of sugar into the ginger. Then boil it for about 5 minutes. While still hot, drain off the syrup and roll the pieces on finely ground sugar. Place the pieces on a wooden tray and dry them in shade or at 50°C in a drier till they are no longer sticky.

The syrup left over after candying can be used again for preparing more ginger preserve or used as a syrup for flavouring aerated waters.

## 26. CANNING AND BOTTLING OF PROCESSED PEAS

Pea (*Pisum sativum*) (Hindi and Beng.—*Matar*; Guj. and Mar.—*Watana*; Tel.—*Patanlu*; Tam. and Mal.—*Pattani*; Kan.—*Batani*) is extensively cultivated as a field and garden crop in India. The crop is very popular because of its sweet pods which are used in fresh condition in various preparations.

Select dried peas of uniform size and quality. Reject all grains attacked by insects. Soak sound grains in 3 times the quantity of water for 15 - 18 hours. Reject the hard grains which have not absorbed any water. Wash the soaked peas thoroughly to remove extraneous matter.

Wrap the soaked grains in a piece of muslin cloth and then dip in boiling water for 5 minutes so that the grains are soft enough to be pressed by hand. Remove the muslin bag from the boiling water when it begins to froth.

Fill the blanched peas into sterilized cans or glass jars in this way: 450 g. for A 2½ size can; 240 g. for pint glass jars; and 220 g. for butter size can. Fill the interspace with hot and clear solution containing 2 per cent common salt, 4 per cent sugar and a little mint flavour and requisite quantity of edible green colour. Leave a head space of 0.6 - 1 cm. Exhaust the cans until the centre of the can attains a temperature of 82°C (time taken is 7 - 10 min.) and seal.

For pasteurization, the sealed cans are processed at 115° C (0.7 kg. steam pressure) in a pressure cooker for 40 minutes in the case of A 2½ cans and glass jars and 30 minutes for butter cans. For every 300 m. rise in altitude, increase the processing time by two minutes. Cool the cans in running water and jars in air.

## 27. CANNING OF BAKED BEANS AND SOME PULSES IN TOMATO SAUCE

Several pulses like Bengal gram (*Cicer arietinum*), black gram (*Phaseolus mungo*), cowgram or lobia (*Vigna catieng*), horsegram (*Dolichos biflorus*) and French bean (*Phaseolus vulgaris*) widely used in India can be canned in tomato sauce.

### 27.1 Preparation of tomato sauce

Wash fresh tomatoes of proper ripeness and good colour and cut them into pieces. Heat for 10 minutes in their own juice in a stainless steel pan. Pass the heated material through a screw extractor to separate the skin and seeds. Use the pulp obtained for the sauce.

### **Recipe**

Tomato pulp (6 per cent solids)	29.5 kg.
Cardamom, pepper and jeera in equal quantities	8.5 g.
Cinnamon	10 g.
Cloves (only stalks)	8.5 g.
Mace (not ground)	5.7 g.
Salt	0.7 kg.
Onions (chopped)	155 g.
Garlic (ground)	18 g.
Sugar	2.2 kg.
White vinegar	580 ml.
Red chilli powder	15 g.

Add  $\frac{1}{3}$  the quantity of sugar given in the recipe. Place the spices in a muslin bag and immerse it into the pulp. Cook the pulp till it is reduced to half the original volume. Remove the muslin bag and squeeze it into the pulp. Add vinegar, salt and remaining sugar. Heat the mass for a few minutes so that the volume of the finished product is half of the original pulp.

Fill the finished sauce into clean, sterilized A 2½ size plain cans, seal them and process for 45 minutes in boiling water and store for subsequent use. For use with beans, dilute the sauce with half its weight of water and add corn starch (1 per cent by weight of the diluted sauce) to improve the consistency of canned product.

#### **27.2 Pretreatment of beans**

Soak the beans in water for 6-8 hours. Change water twice to prevent souring. Blanch the beans in 1 per cent sodium bicarbonate solution for 15-20 minutes. Wash in cold water to remove the residual bicarbonate taste. Bake the blanched beans in steam at 1.05 kg./sq. cm. pressure in a pressure cooker. The beans turn brownish in colour and become soft. Some beans also break up and impart a melting texture to the canned product.

#### **27.3 Canning of beans in sauce**

Fill 190 g. of baked beans directly into plain 1 lb. jam size cans and cover with 170 g. of hot tomato sauce. Exhaust for 7 minutes at 85-88°C (temperature at the centre of the can will be 74-77°C), seal and process for 75 minutes at 0.7 kg./sq.cm. pressure. Cool in running cold water and store for further use. The canned product keeps well in storage for about 5 months.

#### 27.4 Canning of pulses in sauce

Soak the pulses in water for 4-6 hours and blanch for five minutes in boiling water. After blanching, bake French beans and *lobia* for 10 minutes at 0.7 kg./sq.cm. pressure. Fill the blanched or baked material into 1 lb. jam size cans and cover with hot tomato sauce (190 g. pulse and 170 g. sauce per can). Exhaust the cans for seven minutes at 85-88°C. Seal the cans and process for 75 minutes at 0.7 kg./sq.cm. pressure. Cool in running water and store.

### 28. PETHA

#### 28.1 Candy

Select sound, fully ripe *Petha* with tough texture. Cut it into slices and remove the seeds and inner soft pulp. Remove the outer hard surface with a stainless steel knife; cut the peeled slices into, cubes or pieces of any desired shape and size.

Prick the cubes or pieces of *petha* with a stainless steel fork or bamboo pricker; keep them completely immersed in fresh lime water (prepared from 60 g. of quick lime to 1 litre of water, vigorously stirring allowing it to settle and finally decanting and filtering) for 3-4 hours, depending upon the softness of the *petha*; the softer the *petha*, the longer is the period for which it is to be left. Drain off the lime water and wash the fruit pieces thoroughly in fresh water.

Soften the *petha* pieces by placing them in boiling water for about 15-30 minutes so as to make them take up sugar from the syrup. Drain off the water and spread the pieces on a clean white sheet for removing some moisture.

Prepare sugar syrup by dissolving 2 parts of sugar in 3 parts of water, heating to boil; remove the scum and finally filter it through thick cloth to get a clear syrup. The quantity of syrup prepared should be equal to three times the quantity of the prepared fruit.

Add the fruit pieces to the boiling syrup and continue heating till the temperature reaches 107°C (at sea level) or the syrup becomes thick enough to give 2 to 3 threads when drawn between the two fingers. Allow the whole mass to stand overnight; drain off the syrup through a stainless steel sieve. Add essence if desired and store it in a clean dry glass or glazed container.

### 29. BAMBOO

Bamboos are found in the forests of Assam, Bengal, Bihar, Madhya Pradesh, Orissa, Tamil Nadu, Kerala and Karnataka



Bamboo shoots (tender) are used as an article of food by the poorer classes of people especially during famine.

For making edible products, use stunted or mis-shaped shoots which are not likely to produce bamboos of good quality. Select tender bamboo shoots 45 - 60 cm. long. Remove the sheaths or outer covering leaves with a sharp knife. Cut the tender portions into rings or pieces of suitable size. Thinly scrape off any green portion on the pieces (leafy portions towards the growing tip may be used for making chutney.)

Boil the rings or pieces of shoots in water 2 - 3 times for half an hour each time, to remove the bitterness. Change the water every time. Prick the boiled pieces with a stainless steel needle or fork. The bamboo pieces prepared in this way be used for candies, chutneys and for canning.

### **29.1 Bamboo candy**

Prepare syrup of 30° Brix by mixing 3 parts of sugar with 7 parts of water and straining. Use about 1.75 kg. of syrup per kg. of bamboo pieces.

Cover the pricked rings or pieces of shoots with the syrup and boil for a few minutes. Allow them to stand in the syrup for 24 hours. If available determine the concentration of sugar in the syrup by means of a Brix hydrometer. The Brix will be slightly less than 30° due to the absorption of sugar by bamboo shoots.

Drain the syrup and increase its concentration by about 10° Brix by adding more sugar. Bring the syrup to boil and pour it back on the shoots. Repeat this every day until the concentration of the syrup reaches about 60° Brix. At this stage, add a small quantity of citric or tartaric acid (about 0.1 per cent of the total weight of syrup). Increase the strength of the syrup by 5° Brix each day till it reaches 75° Brix. Keep the product in the syrup for about a week.

Boil the shoots along with the syrup for about 5 minutes. While still hot, drain the syrup and roll the pieces in finely ground sugar. Add any flavour, if needed. Place the pieces on a wooden tray and dry them in shade. Pack in dry containers and seal air-tight. Store in a cool and dry place. If desired, individual pieces may be wrapped in cellophane paper.

### **29.2 Bamboo chutney (sweet)**

The bamboo pieces prepared for candy making may be mixed with the tender leafy portion and utilized for chutney. After removing the bitterness, mince them in a meat mincer or chop them finely with a sharp knife.

### Recipe

Minced or chopped tender shoots	2 kg.
Sugar	2 kg.
Salt	95 g.
Cardamom, cinnamon and cumin in equal quantities	60 g.
Red chillies, finely ground	30 g.
Onions, finely chopped	30 g.
Garlic, finely chopped	30 g.
Vinegar (good quality)	95 ml.

Add sugar, salt and a little water to the minced bamboo shoots and warm in an aluminium pan till sugar and salt have gone into solution. Tie the spices loosely in a thick muslin bag and leave the bag in the pan. Continue cooking till the material has softened and acquired the consistency of a jam. At this stage, remove the bag from the pan and press its contents. Add vinegar, and boil again to the desired consistency.

Cool the product a little, pack it into clean, dry wide-mouthed jars and seal them air-tight. Store in a cool, dry place.

#### 29.3 Canning of bamboo in syrup

Prepare 40° Brix syrup containing 1 per cent citric acid by mixing 2 kg. of sugar, 5 g. of citric acid and 3 kg. of water and filtering the mixture. Bring the syrup to boil and pour into the cans filled with bamboo pieces, leaving 0.6 cm. head space.

Place the cans in boiling water so that the space at the top of the can is 2.5-3.75 cm. above the level of water. Heat the cans for 5-6 minutes or until the temperature in the centre of the can is about 93°C. Remove the cans from the bath and seal them immediately with a can sealer.

Process the sealed cans in a pressure cooker at 0.7 kg. pressure or at 116°C as follows.

1 lb. jam size can	40 minutes
1 lb. butter size can	50 minutes
No. 2½ cans	50 minutes

After processing, cool the cans in running cold water, wipe them dry and store them in a cool, dry place.

#### 29.4 Canning of bamboo in brine

Fill the prepared pieces into plain cans, keeping about 1 cm. head space. Prepare 2.0 per cent common salt solution by using 20 g. of refined table salt per litre of water. Bring the solution to boil, strain it through cloth, and pour hot into the cans, leaving 0.6 cm. head space.

The rest of the stages are the same that are followed for the canning of bamboos in syrup.

### 29.5 Canning of bamboo in curried vegetables

Prepare the bamboo pieces in the usual way. Prepare the other vegetables also in the usual way prescribed for them (see under 21). For preparing the liquid medium for the vegetables use ingredients in the proportion given below for 48 cans:

Mustard (whole)	85 g.
Coriander (powder)	85 g.
Red chillies (powder)	55-85 g.
Caraway seeds	85 g.
Water	As necessary
Turmeric (powder)	170-200 g.
Common salt	370 g.
Vegetable fat (hydrogenated oil)	1.6 kg.

Heat the required quantity of fat in a pan till a few grains of mustard, when added to it, produce a crackling sound. Then, add the entire quantity of mustard grains and fry for a few minutes. Add the other spices and fry. Add the requisite quantity of water, stir thoroughly and bring to boil.

Fill plain A 2½ cans with the prepared material in any of the combinations mentioned below, leaving 0.3 cm. head space. Add the hot liquid medium.

<i>Combination of vegetables</i>	<i>Wt. of vegetables (g)</i>	<i>Wt. of liquid medium (g)</i>
Bamboo - cauliflower	480-500	300-310
Bamboo - tomato	680	110
Bamboo - peas	425	370

Place the filled cans immediately in a boiling water bath for 5 - 6 minutes, or until the temperature at the centre of the can reaches 82 - 88°C. Remove the cans from the bath, seal them immediately with a can sealer.

Process the sealed cans in a pressure cooker at 0.7 kg. pressure or at 116°C for 70 - 75 minutes depending on the kind and maturity of the vegetables and the quantity of fat in the final product. After processing, cool the cans in running cold water, wipe them dry and store in a cool, dry place.

## GLOSSARY

1. APRICOTS (*Prunus armeniaca*)  
Hindi—*Chila, khubaini, priyalu*.
2. BEANS (*Dolichos lab lab var. typicus*)  
Hindi—*Sem*; Beng—*Shim*; Guj—*Val*; Mar—*Pavta*; Tel.—*Chikkudu*; Tam.—*Avarai*; Kan.—*Chapparada avare*; Mal.—*Avara*.
3. BEETS (*Beta vulgaris*)  
Hindi—*Chukandari*; Beng.—*Bitpalang*; Kan.—*Beetroot gadde*.
4. BLACK PEPPER (*Piper nigrum*)  
Hindi—*Golmirch, kalimirchi*; Beng.—*Golmirch, kalamorich, muricha*  
Guj.—*Kalomirch, miri*; Mar.—*Kalmirich, mire*; Tel.—*Mari-chamu, miriyamu*; Tam.—*Aguttam, arisa, irambivam kalliani, marisam, milaga, sevviam, sur, uchiram*; Kan.—*Menasu*; Mal.—*Kolakam, kurumulaka, maricham, uchiram*; Oriya—*Golomirich moricho*.
5. CABBAGE (*Brassica oleracea var. capitata*)  
Hindi—*Band gobi*; Beng.—*Palang*; Kan.—*Kosugedde*.
6. CARAWAY (*Carum carvi*)  
Hindi—*Zira, shtajira*; Beng.—*Jira*; Guj.—*Shajtra*; Mar.—*Shahajtra*;  
Tel.—*Shimaisapu*; Tam.—*Kekkuvirai, simaishembu*.
7. CARDAMOM (*Elettaria cardamomum*)  
Hindi—*Ilayechi*; Beng.—*Elaich*; Guj.—*Yelachi, itachi*, Mar.—*Vellode*;  
Tel.—*Elaki*; Tam.—*Elakkai*; Kan.—*Elakki*; Mal.—*Elakkaya*; Oriya—*Elo, olaicho*.
8. CARROT (*Daucus carota var. sativa*)  
Hindi, Beng. and Guj.—*Gajar*; Mar.—*Gazara*; Tel.—*Gajjaragedda, pitakanda*;  
Tam.—*Gajjara kilangu, karettu, kizhangu*; Kan.—*Gajjari*.
9. CAULIFLOWER (*Brassica oleracea var. botrytis*)  
Hindi—*Phul gobi*; Tel.—*Kosugadda*; Tam.—*Kovippu*; Kan.—*Hookosu, kobigadde*.  
Punjab—*Gilas, olohi*,
10. CHERRIES (*Prunus cerasus*)  
Punjab—*Gilas, Olohi*,
11. CINNAMON (*Cinnamomum zeylanicum*)  
Hindi, Beng., Guj. and Mar.—*Dalchni*; Tel.—*Lavangapatta*;  
Tam.—*Ilavangapattai, karvuua*; Kan.—*Dalchini*; Mal.—*Cherizilaivannam, erikkolam, ilavangam*.
12. CLOVE (*Eugenia caryophyllata*)  
Hindi—*Laung, long*; Beng., Guj. and Mar.—*Lavang*; Tel.—*Karavappu*;  
Tam.—*Kirambu, lavangam*; Kan.—*Lavanga*.

13. CORIANDER (*Coriandrum sativum*)  
Hindi—*Dhania, dhanya*; Beng.—*Dhane*; Guj.—*Dhanya, kothmir*;  
Mar.—*Dhanya, kothmur*; Tel.—*Danyalu, kotimuri*; Tam.—*Kotamali*; Kan.—*Kottambari*; Mal.—*Kothumpalari*.
14. DATE (*Phoenix dactylifera*)  
Hindi, Beng., and Guj.—*Khajur*; Mar. and Kan.—*Kharjur*; Tel.—*Kharjuramu*; Tam.—*Karchuram*; Mal.—*Ittapalam*; Oriya—*Khorjjuri*.
15. FIGS (*Ficus carica*)  
Hindi, Beng., Guj. and Mar.—*Anjir*; Tel.—*Anjuru*; Tam.—*Simaiyatti, tenatti*; Kan.—*Anjura*; Mal.—*Simayatti*; Oriya—*Pusphoshunyo*.
16. FENUGREEK (*Trigonella foenum-graecum*)  
Hindi, Beng. and Guj.—*Methi*; Tel.—*Mentula*; Tam.—*Ventayam*  
Kan.—*Menthya*; Mal.—*Venthiam, uluva*.
17. FENNEL (*Foeniculum vulgare*)  
Hindi—*Bari saunf*; Beng.—*Mauri, panmuhori*; Guj.—*Variari, varyali*; Mar.—*Badishep*; Tel.—*Peddajilakaram*; Tam.—*Perunjiragam sohikirai*; Kan.—*Badi soppu*.
18. GARLIC (*Allium sativum*)  
—*Velliappundu*; Kan.—*Bellulli*; Mal.—*Vellulli*.
19. GINELLY (*Guizotia abyssynica*)  
Hindi—*Kalatil, ramtil, surgiya*; Beng.—*Ramtil, sirguja*; Guj.—*Kalatil, ramtel*; Mar.—*Khursani, karale*; Tel.—*Verrinuvvulu*;  
Tam.—*Payallu, uchellu*; Kan.—*Huchhellu, guruellu*.
20. GRAPE FRUIT (*Citrus paradisi*)  
Hindi—*Chokotra*; Beng.—*Batavinebu, chokotra*; Guj.—*Obakotru*;  
Mar.—*Panis, papanasa*; Tel.—*Pampalamasam*; Tam.—*Pambalimasu*; Kan.—*Chakkotne*; Mal.—*Bombirinarakam, pamparamsam*
21. JEERA (*Cuminum Cymium*)  
Hindi—*Zira*; Beng.—*Jira*; Guj.—*Jira*; Mar.—*Jiregire*; Tel.—*Jilakarra, jiraka*; Tam.—*Shiragam*; Kan.—*Jirge*; Mal.—*Jiraka*.
22. LITCHI (*Litchi chinensis*)  
Hindi—*Lichi*; Tam.—*Ilich*; Kan.—*Litchi*; Oriya—*Lishi*.
23. LIMA BEAN (*Phaseolus lunatus*)  
Beng.—*Cimra*.
24. MACE (*Myristica fragrans*)  
Mace refers to the aril of the fruits.  
Tel. and Kan.—*Jajipatri*; Oriya—*Jaitri, joyotri*.
25. NIGELLA (*Nigella sativa*)  
Hindi—*Kalajira*; Beng.—*Kalajira, mungrela*; Guj.—*Kalanjjiram*  
Tel.—*Nellajeera kaira*; Tam.—*Karunjiragam*; Kan.—*Karijjirage*;  
Mal.—*Karunjirakam*.

26. OKRA (*Hibiscus esculentus*)  
Hindi—*Bhindi*; Beng.—*Dheras*; Guj.—*Binda*; Mar.—*Bhendi*;  
Tel.—*Venda*; Tam.—*Vendai*; Kan.—*Bende*; Mal.—*Venda*.
27. ONION (*Allium cepa*)  
Hindi—*Piyaz*; Beng.—*Pyanj*; Guj.—*Dungari*; Mar.—*Kanda*; Tel.—*Nirulli ulligaddalu*; Tam.—*Vengayam*; Kan.—*Nirulli*; Mal.—*Chuvannaulli*.
28. PETHA (*Benincasa hispida*)  
Hindi—*Petha*; Beng.—*Chalkumra, kumra*; Guj.—*Bhurukola*; Mar.—*Kohala*; Tel.—*Budidegummadi*; Tam.—*Pushanikkai*; Kan.—*Budakumbalakayi*; Mal.—*Kumpalanga, Kumpalam*
29. POTATO (*Solanum tuberosum*)  
Hindi—*Alu*; Beng.—*Golalu, belathi aloo*; Guj.—*Papeta*; Mar.—*Batata*; Tel.—*Urlagadde*; Tam.—*Urlakalanga*; Kan.—*Aloogadde*.
30. PUMPKIN (*Cucurbita pepo*)  
Hindi—*Kadimah, konda sitaphal*; Beng.—*Kadimah, konda kumra*;  
Guj.—*Dudia*; Mar.—*Kohala*; Kan.—*Kumbala*; Mal.—*Panikakharu*.
31. RED CHILLI (*Capsicum annum*)  
Hindi—*Lalmirch*; Beng.—*Lalmorich*; Guj.—*Lalmirich*; Tel.—*Sudmirapakaya*; Tam.—*Usimalagay*; Kan.—*Menasinakayi*;  
Mal.—*Chalie todachina, mulaku*.
32. SARSON (*Brassica campestris var. sarson*)  
Hindi—*Sarson*; Beng.—*Sarisa*.
33. SPINACH (*Spinacia oleracea*)  
Hindi—*Isanag, pinnis, sagpalak*; Beng.—*Palang, pinnis*; Tel.—*Dumpabachhali, matturbacchali*; Tam.—*Vasaiyilaikkirai*.
34. CORN (*Zea mays*)  
Hindi—*Bhutta, makai*; Beng.—*Bhutta, janar*; Guj.—*Makkari*;  
Mar.—*Maka*; Tel.—*Makkazonalu*; Tam.—*Mukkasholam*;  
Kan.—*Musikinajola*; Oriya—*Buta, maka*.
35. SWEET POTATO (*Ipomoea batatas*)  
Hindi—*Mitha alu, shakarkand*; Beng.—*Lalalu, ranga alu*; Guj.—*Kannagi, sakaria*; Mar.—*Ratalu*; Tel.—*Chelagadda*; Tam.—*Sakkaravelleikilangu*; Kan.—*Genasu*; Mal.—*Chakkare kilangu*;  
Oriya—*Kanda*.
36. TURMERIC (*Curcuma longa*)  
Hindi and Beng.—*Haldi*; Guj.—*Haladu*; Mar.—*Halade*; Tel.—*Pasupu*; Tam.—*Manjal*; Kan.—*Arishina*; Mal.—*Manjal, marinalu*.
37. TURNIP (*Brassica rapa*)  
Hindi—*Salgam*; Mar.—*Shiras, salgham*.

## EQUIPMENT AND OTHER ARTICLES

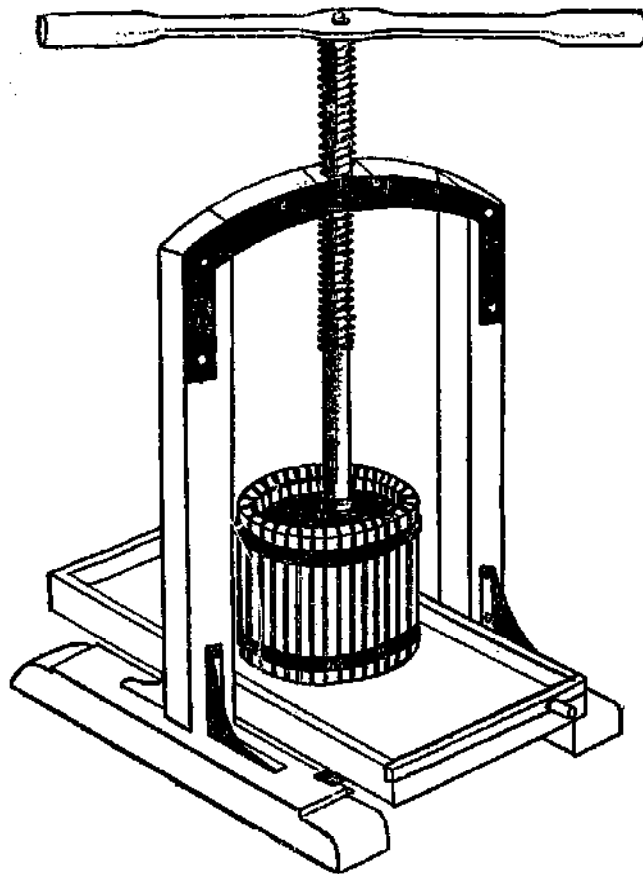
Equipment	Type/Size	Address
1. MB domestic hand can sealer complete with tools, spares to close A2½ size, butter size, 1 lb. jam and A1 tall open top sanitary cans	...	M/s Metal Box Co. of India Ltd., Hide Road, Kidderpore, Calcutta. Other makes can be had from M/s Gladwyn & Co., 251, D. Naoroji Road, Bombay and M/s. Gardners Corporation, P. B. No. 299, New Delhi.
2. Pressure cookers complete with accessories	15 quarts & 25 quarts	M/s Gardners Corporation, P. B. No. 299, New Delhi.
3. Screw type juice extractors (non-corrodible metal)	Husqurana No. 7 Sweden or any other make	M/s Gordhandas Desai Pvt. Ltd., Kermani Buildings, Sir P. M. Road, Bombay - 1. M/s Food Kings, 65/11, Pohtak Road, Karol Bagh, New Delhi.
4. Wooden basket press		M/s Hirala & Sons, Sadar Bazaar, Delhi 6
5. Crown corking machine (hand operated, portable)	...	M/s Gardners Corporation, New Delhi. M/s Thankujee & Co, Behind Novelty Cinema, Delhi.
6. Hand capsuling machine (bench model) and capsules	...	M/s Gardners Corporation, New Delhi M/s Larsen & Toubro Ltd., Dougall Road, P. B. No. 278, Ballard Estate, Bombay. M/s Alu Capsules Ltd., Bombay. M/s Gardners Corporation, New Delhi

Equipment	Type/Size	Address
7. Cabinet drier with 6 spare trays	3'x2½'x3'	M/s Gardners Corporation, New Delhi
8. Wooden lime squeezers	¾" dia-cavity 1" dia-cavity 1¼" dia-cavity Prabhat No. 2	M/s Karam Singh, Karod Bagh, New Delhi 6 or local market. Local market
9. Kerosene oil stoves	4" & 6" blades	M/s Raylon Metal Works, Kondivitta Village, off Andheri - Kurla Road, Andheri, Bombay - 59 "
10. Stainless steel knives: : cutting peeling coring pitting	(8" & 10" blades) ¾", 3½" & 3¾" dia. 7", 1" & 1¼" dia. 60°, 45° & 30° 12" & 14" size 14"	
11. Pineapple cutting knives " punchers " coreers " eyeremovers		
12. Enamel basins buckets mugs		Local market
13. Stainless steel or aluminium patillas with lids	Lipped & plain 10", 12" & 14" (20 gauge)	M/s Devidayal Metal Industries Ltd., Reay Road, Darukhaua, Bombay 10 or Local market
14. Stainless steel or monel metal sieves with wooden frames	61" square (20 & 30 meshes)	M/s Raylon Metal Workes, Bombay
15. Stainless steel teaspoons, tablespoons and forks		Local market

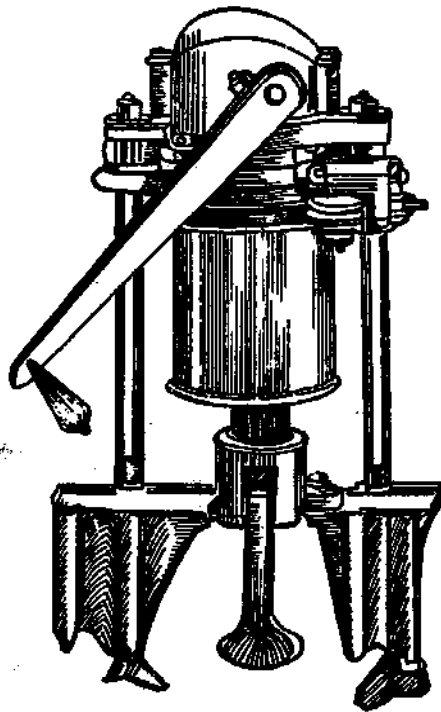


<i>Equipment</i>	<i>Type/Size</i>	<i>Address</i>
16. Wooden ladles	2' long	Local market
17. Stainless steel cooking spoons		Local market
18. Metal graters		Local market
19. Pan balance	to weigh 10kg.	M/s Avery & Co. Ltd., 16 Dougall Road, Ballard Estate, Bombay - 1.
20. Pocket refractometers	0-45 and 45-85	M/s Andhra Scientific Works, 4, Blackers Road, Mount Road, Madras - 2.
21. Brix hydrometers	0-30°, 30°-60°, 60-90° 0-110°C	M/s Adair Dutt & Co. India Ltd., Madras M/s Andhra Scientific Works, Madras - 2.
22. Thermometers		"
23. Vacuum gauge		"
24. Jelmeter		"
25. Salometer		"
26. Mortar and pestle		M/s Gardners Corporation, New Delhi
27. Hot can lifting tongs		Local market
28. Preparation tables	6' x 3' x 3'	"
29. Work benches ,stools, etc.		"
30. Miscellaneous (tools, etc.)		"
31. Filter cloth, towels, aprons, dusters, brushes, rubber gloves, measuring cylinder (glass), etc. (sufficient for the season)		"
32. Sugar, salt, spices, kerosene oil, spirit etc. (sufficient for the season)		"

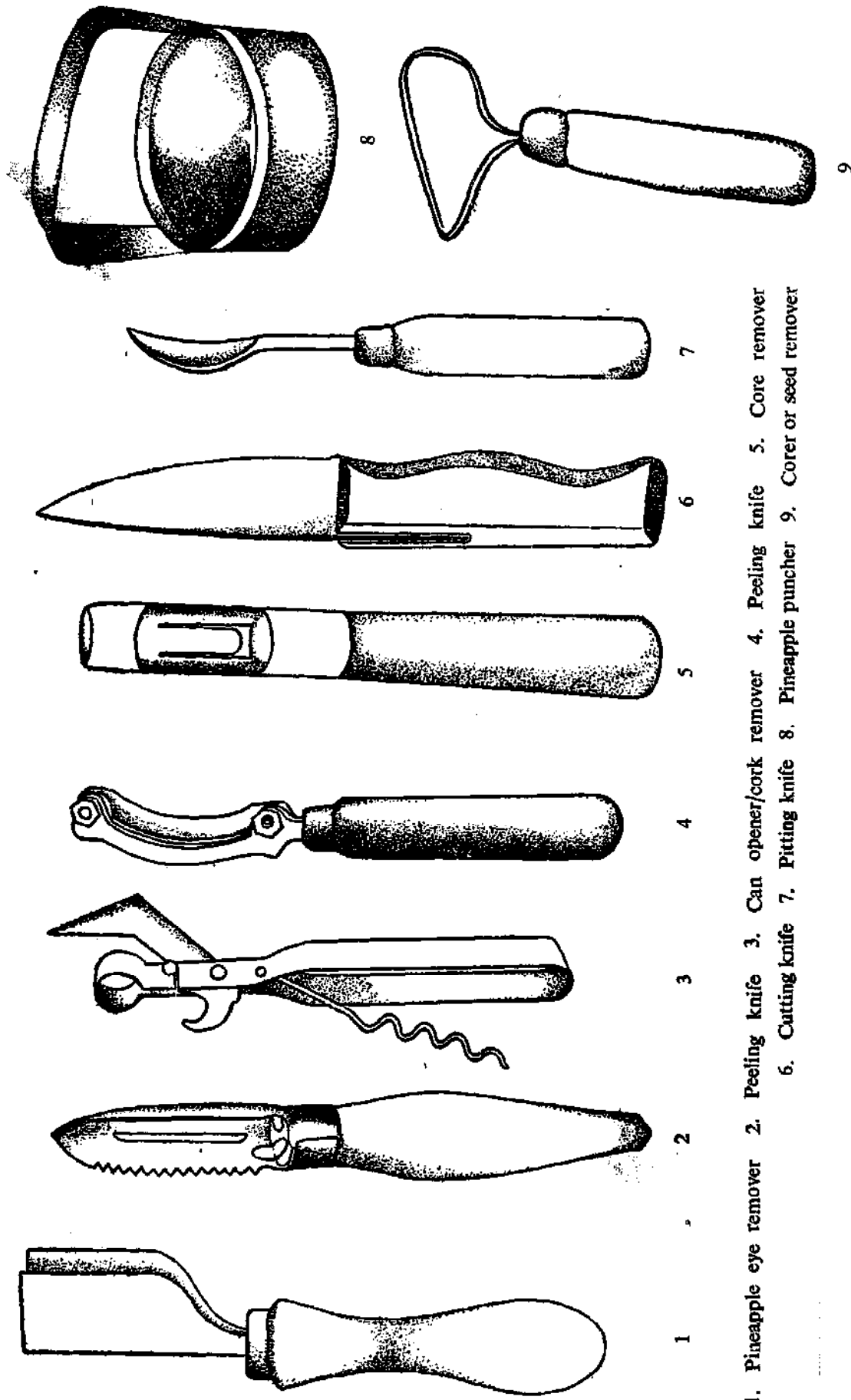
Equipment	Type/Size	Address
33. Citric acid, preservatives, colours, and essences (sufficient for the season)		<p>M/s Akbarally Mohamedally &amp; Co., 316, Abdul Rehman Street, Bombay - 3.</p> <p>M/s General Import Co. (India), Keshav Baug, 102, Princess Street, Bombay - 2.</p> <p>M/s R. C. Mehta &amp; Co., Mimraj Bldg., Babu Genu Road, Bombay - 2.</p>
34. Sanitary tin containers (different sizes) sufficient for the season)		<p>M/s Metal Box Co. of India Ltd., Calcutta</p> <p>M/s Poysha Industrial Co. Pvt. Ltd., Sewri, Bombay.</p>
35. Empty glass bottles and glass jars		<p>M/s Hindustan National Glass Mfg. Co. Ltd., 2, Wellesley Place, Calcutta</p> <p>M/s Taj Glass Works, Hyderabad</p> <p>M/s Ogale Glass Works, Ogalewadi</p> <p>M/s Hiralal &amp; Co., 159, Chakla Street, Bombay</p>
36. Crown corks		M/s Metal Box Co. of India Ltd., Calcutta
37. Corks		Local market



Wooden basket press



Can sealer



1. Pineapple eye remover 2. Peeling knife 3. Can opener/cork remover 4. Peeling knife 5. Core remover  
6. Cutting knife 7. Pitting knife 8. Pineapple puncher 9. Corer or seed remover