



HAWAII FOOD PROCESSORS

H A N D B O O K



**CIRCULAR 55
HAWAII AGRICULTURAL EXPERIMENT STATION
UNIVERSITY OF HAWAII — JUNE 1959**

TABLE OF CONTENTS

	PAGE
FRUITS AND FRUIT PRODUCTS	7
<i>Fruits</i>	7
Avocado Spread, Frozen	7
Banana, Canned	7
Australian Tropical Fruit Cocktail, Canned	8
Australian Tropical Fruit Salad, Canned	8
Hawaiian Tropical Fruit Salad, Canned	9
Guava Spread, Frozen	10
Lychee in Syrup, Frozen	10
Lychee, Canned	10
Mango, Canned	11
Papaya, Canned	11
Papaya in Syrup, Frozen	12
Passion Fruit Pulp, Canned	12
 <i>Fruit Juices, Nectars, Nectar Bases, and Purees</i>	 12
Guava Nectar Base, Frozen	12
Guava Nectar, Canned	13
Guava Puree, Frozen	13
Papaya Nectar, Canned	13
Papaya Nectar Base, Frozen	14
Papaya-Banana Nectar, Canned	14
Papaya Puree, Frozen	14
Papaya-Passion Fruit Nectar, Canned	15
Papaya-Pineapple Nectar, Canned	15
Passion Fruit-Acerola Cherry Nectar, Canned	16
Passion Fruit-Pineapple Nectar, Canned	16
Passion Fruit Juice, Frozen	17
Passion Fruit Nectar, Canned	17
Passion Fruit Nectar Base, Canned	17
Passion Fruit Nectar Base, Frozen	18
 <i>Jams, Jellies, and Syrups</i>	 18
Coconut Syrup	18
Guava Jam	18
Guava Jelly	19
Passion Fruit Jelly	19
Papaya-Pineapple Jam	20
Passion Fruit-Papaya Jam	20
Passion Fruit-Pineapple Jam	21

TABLE OF CONTENTS (Continued)

	PAGE
VEGETABLES AND VEGETABLE PRODUCTS . . . . .	. 22
Poi, Acidified, Canned . . . . .	. 22
Poi, Fresh, Canned . . . . .	. 22
Poi, Sour, Canned . . . . .	. 22
Taro Leaf, Canned . . . . .	. 23
Strained Taro Leaf, Canned . . . . .	. 23
MEATS, MEAT PRODUCTS, AND FISH . . . . .	. 24
Frankfurters, Canned . . . . .	. 24
Kau Yuk (Chinese Pot Roast Pork), Canned . . . . .	. 25
Sweet-Sour Spareribs, Canned . . . . .	. 25
Tuna Chicken, Processed . . . . .	. 26
Tuna Ham, Processed . . . . .	. 26
Laulau, Canned . . . . .	. 26
MISCELLANEOUS . . . . .	. 27
Birds' Nest Soup, Canned . . . . .	. 27
Chocolate Taro Beverage, Canned . . . . .	. 28
Shredded Coconut, Canned . . . . .	. 28
Haupia, Canned . . . . .	. 29
Fried Rice, Canned . . . . .	. 29
REFERENCES . . . . .	. 30

FOREWORD

This publication constitutes a revision and extension of the *Food Processors' Handbook for Hawaiian Fruits and Vegetables* issued in the form of Progress Notes by the Agricultural Experiment Station of the University of Hawaii in May, 1952. The original edition provided valuable guidance to the food industry of the Territory of Hawaii. Recent advances in the science of food technology together with the patent need for increased diversification in production are the basic reasons for alterations and additions. These changes were forecast in the prefatory remarks to the first edition in which the authors state, "As our work progresses changes and alterations may be necessary in the formulations, methods, and equipment requirements. Supplements will be issued from time to time to show any new recommendations and to keep the procedures up to date." This revised edition may therefore be taken to denote substantial progress in the research work of the Food Processing Laboratory since 1952.

The retention of the section dealing with general processing was not considered necessary in view of availability of excellent textbooks in which unit processes and food equipment are described in detail. For the same reason explanatory information relating to specific processing procedures has been deleted. Canned and frozen products have been grouped under fruits, vegetables, and meats and fish, rather than according to the method of preservation but this arrangement is purely one of personal preference. An endeavor has been made to insure conformity of presentation of all products insofar as this treatment was possible. A brief list of references of the more prominent publications in the field of food technology has been included.

Quantities of materials used in formulation have been expressed as parts but, since they total one hundred in most cases, they may also be regarded as percentages. Processors are reminded that Territorial and Federal food regulations prevail irrespective of statements made in this Handbook.

It is strongly recommended that heat sensitive, high acid products be sterilized in a spin cooker. Details of its construction and performance are available from this laboratory.

Process times recommended for retorted products commence when the retort attains temperature. After the expiration of the stipulated time the cans are cooled immediately.

There are certain aspects of the processing of foodstuffs which are not amenable to unqualified statement; e.g., times and temperatures are rarely stated for the commercial sterilization of products which vary in viscosity in accordance with standards established by different manufacturers. For information on such matters and on the various technological problems that arise from time to time, it is suggested that application for advice be made to the Food Processing Laboratory.

THE AUTHORS

L. J. LYNCH was Visiting Food Technologist and Acting Director of the Food Processing Laboratory at the University of Hawaii, 1957–1958. He is now Officer-in-Charge, Canning Section, Division of Food Preservation and Transport, C.S.I.R.O., Sydney, Australia.

ANNIE TOM CHANG was Junior Food Technologist at the Food Processing Laboratory, 1956–1958.

JOANA C. N. LUM is an Analyst at the Food Processing Laboratory.

DR. G. DONALD SHERMAN, Senior Soil Scientist at the Hawaii Agricultural Experiment Station, Head of the College of Agriculture Department of Agronomy and Soil Science, and Senior Professor of Agriculture, University of Hawaii, is Director of the Food Processing Laboratory.

P. E. SEALE was Acting Director of the Food Processing Laboratory at the University of Hawaii, 1958–1959. He is now Chief Chemist, Queensland Tropical Fruit Products, Brisbane, Australia.

ACKNOWLEDGMENTS

The funds and facilities which made the preparation of this Handbook possible were supplied through a grant to the University of Hawaii by the Economic Planning and Coordination Authority, Territory of Hawaii.

Hawaii Food Processors Handbook of Fruits, Vegetables, Meats, and Fish

*By L. J. Lynch, Annie Tom Chang, Joana C. N. Lum,
G. Donald Sherman, and P. E. Seale*

FRUITS AND FRUIT PRODUCTS

Fruits

FROZEN AVOCADO SPREAD

Formulation:	Avocado puree	93.0 parts
	Lime or lemon juice	4.6 parts
	Salt	1.9 parts
	Onion powder	0.3 part
	Ascorbic acid	0.2 part
Preparation:	Select avocados of high fat content, low fiber, and good color. Pass flesh through a pulping machine equipped with a 0.027-in. (or finer) screen. Sufficient lemon or lime juice should be added to reduce the spread to less than pH 4.5.	
Fill:	Fill into jars, paper pails, or other suitable containers.	
Process:	Freeze immediately and store at 0°F.	

CANNED BANANA

Formulation:	Cavendish or Chinese banana
	Syrup 30° Brix containing 0.5 percent citric acid and 0.2 percent calcium chloride
Preparation:	Select fruit of early eating stage just beginning to fleck, hand peel, and cut into ¾-in. to 1-in. pieces.
Fill:	Fill 12 oz. into a No. 2 enamel can. Add syrup close to the boiling point to give a final headspace when cold of 6/16 in. and exhaust to a center temperature of 160°F., close without vacuum <i>or</i> add syrup to 5/16-in. headspace and close at 15-in. vacuum.
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to 195°F. and cool immediately.

CANNED AUSTRALIAN TROPICAL FRUIT COCKTAIL

- Formulation:**
- | | |
|-----------------------|----------------------------|
| Pineapple | Smooth leaf Cayenne |
| Papaya | Solo |
| Banana | Cavendish |
| Passion fruit | Yellow |
| Syrup 40° Brix | |
- Preparation:** Select firm fully ripe pineapples, papayas, and passion fruit. Select bananas just beginning to fleck at the early eating stage. Wash fruit. Peel and core the pineapples. Peel the bananas and papayas, and deseed the papayas. Remove the pulp from the passion fruit. Dice the pineapples and papayas into 7/16-in. cubes and cut the bananas into 3/16-in. slices.
- Fill:** Fill into a No. 2 plain can:
- | | |
|--------------------|---------|
| Pineapple | 7.0 oz. |
| Papaya | 5.0 oz. |
| Banana | 1.0 oz. |
| Passion fruit pulp | 0.7 oz. |
- Add syrup close to the boiling point to give a headspace when cool of 6/16 in. Exhaust to a center temperature of 160°F. and close without vacuum. *Or* add syrup to 5/16-in. headspace and close at 15-in. vacuum.
- Thermal process:** Process in an agitating cooker to 195°F. and cool immediately *or* heat in boiling water about 10 min. to a center temperature of 195°F. and cool immediately.

CANNED AUSTRALIAN TROPICAL FRUIT SALAD

- Formulation:**
- | | |
|--|----------------------------|
| Pineapple | Smooth leaf Cayenne |
| Papaya | Solo |
| Banana | Cavendish |
| Passion fruit | Yellow |
| Syrup 40° Brix containing 0.2 percent citric acid | |
- Preparation:** Select firm fully ripe pineapples, papayas, and passion fruit. Select bananas just beginning to fleck at the early eating stage. Wash fruit. Peel and core the pineapples. Peel the bananas and papayas, and deseed the papayas. Remove the pulp from the passion fruit. Dice the pineapples, papayas, and bananas into ½-in. to ¾-in. cubes.

- Fill:** Fill into a No. 2 plain can:
- | | |
|--------------------|---------|
| Pineapple | 5.6 oz. |
| Papaya | 5.6 oz. |
| Banana | 2.1 oz. |
| Passion fruit pulp | 0.7 oz. |
- Add syrup close to the boiling point to give a headspace when cool of 6/16 in. Exhaust to a center temperature of 160°F. and close without vacuum. Or add syrup to 5/16-in. headspace and close at 15-in. vacuum.
- Thermal process:** Process in an agitating cooker to 195°F. and cool immediately or heat in boiling water about 10 min. to a center temperature of 195°F. and cool immediately.

CANNED HAWAIIAN TROPICAL FRUIT SALAD

- Formulation:**
- | | |
|----------------------|----------------------------|
| Pineapple | Smooth leaf Cayenne |
| Papaya | Solo |
| Banana | Cavendish |
| Lychee | Brewster, Kwai Mi |
| Passion fruit | Yellow |
- Syrup 40° Brix containing 0.2 percent citric acid**
- Preparation:** Select firm fully ripe pineapples, papayas, lychees, and passion fruit. Select bananas just beginning to fleck at the early eating stage. Wash fruit. Peel and core the pineapples. Peel and deseed the papayas and lychees, cutting the lychees into half. Peel the bananas. Remove the pulp from the passion fruit and strain out the seeds. Dice pineapples, papayas, and bananas into ½-in. to ¾-in. cubes.
- Fill:** Fill into a No. 2 plain can:
- | | |
|---------------------|---------|
| Pineapple | 5.5 oz. |
| Papaya | 5.5 oz. |
| Banana | 1.0 oz. |
| Lychee | 1.3 oz. |
| Passion fruit juice | 0.7 oz. |
- Add syrup close to the boiling point to give a headspace when cool of 6/16 in. Exhaust to a center temperature of 160°F. and close without vacuum. Or add syrup to 5/16-in. headspace and close at 15-in. vacuum.
- Thermal process:** Process in an agitating cooker to 195°F. and cool immediately or heat in boiling water about 10 min. to a center temperature of 195°F. and cool immediately.

FROZEN GUAVA SPREAD

Formulation:	Guava puree	46.54 parts
	Sugar	52.96 parts
	Pectin, 150 grade	0.50 part
Preparation:	Select only ripe whole fruit. Wash thoroughly and pass fruit successively through pulpers fitted with 0.033-in. and 0.014-in. screens. The pH of puree should be adjusted to 3.00 ± 0.05 with citric acid. Thoroughly stir the pectin mixed with 8 times its weight of sugar into 10 percent of the puree without incorporation of air. Add to this with continuous stirring 50 percent of the original weight of puree. Mix the balance of the puree with remaining sugar. Combine the two lots and stir until sugar is completely dissolved.	
Fill:	Fill into suitable containers and let stand until the product has set, usually overnight.	
Process:	Seal container, quick freeze, and store at 0°F.	

FROZEN LYCHEE IN SYRUP

Formulation:	Lychee	
	Syrup 40° Brix	
Preparation:	Select whole fully ripe firm fruit. Wash fruit, peel, and deseed.	
Fill:	Fill into enamel cans or other suitable containers and cover with syrup to ½-in. headspace.	
Process:	Close cans at 15-in. vacuum, quick freeze, and store at 0°F.	

CANNED LYCHEE

Formulation:	Lychee	75 parts
	Syrup 40° Brix containing 0.2 percent citric acid for varieties other than Brewster, <i>or</i>	
	Syrup 40° Brix containing 0.1 percent citric acid for Brewster	25 parts

- Preparation: Select only firm whole ripe fruit. Remove peels and seeds.
- Fill: Fill 16.5 oz. fruit into a No. 2 enamel can with 5.5 oz. syrup. Close at 15-in. vacuum *or* exhaust in steam to a center temperature of 160°F. and close without vacuum.
- Thermal process: Heat in an agitating cooker to 195°F. (about 2 min.) and cool immediately *or* cook in boiling water about 12 min. to a center temperature of 195°F.

CANNED MANGO

- Formulation: **Mapulehu (Joe Welch) or Haden mango
Syrup 40° Brix containing 0.25 percent citric acid**
- Preparation: Select firm fully ripe fruit. Wash, peel, and slice off the cheeks, dice into ¾-in. or 1-in. cubes.
- Fill: Fill 13.5 oz. into a No. 2 can. Add syrup close to the boiling point to give a headspace when cool of 6/16 in. Exhaust to a center temperature of 160°F. and close without vacuum. *Or* add syrup to 5/16-in. headspace and close at 15-in. vacuum.
- Thermal process: Process in an agitating cooker to 195°F. and cool immediately *or* heat in boiling water about 10 min. to a center temperature of 195°F. and cool immediately.

CANNED PAPAYA

- Formulation: **Papaya
Syrup 40° Brix containing 0.75 percent citric acid**
- Preparation: Select firm fully ripe papayas. Wash, peel, halve, and deseed the fruit. Dice into ¾-in. or 1-in. cubes.
- Fill: Fill 13.5 oz. fruit into a No. 2 enamel can. Add syrup close to the boiling point to give a headspace when cool of 6/16 in. Exhaust to a center temperature of 160°F. and close without vacuum. *Or* add syrup to 5/16-in. headspace and close at 15-in. vacuum.
- Thermal process: Process in an agitating cooker to 195°F. and cool immediately *or* heat in boiling water about 10 min. to a center temperature of 195°F. and cool immediately.

FROZEN PAPAYA IN SYRUP

Formulation:	Diced papaya	60.00 parts
	Syrup 40° Brix	39.82 parts
	Citric acid	0.18 part
Preparation:	Select whole mature firm fruit. Peel, halve, deseed, and cut into 1-in. dice.	
Fill:	Pack into enamel cans or other suitable containers and add syrup to ½-in. headspace.	
Process:	Close cans at 15-in. vacuum, quick freeze, and store at 0°F.	

CANNED PASSION FRUIT PULP

Formulation:	Passion fruit pulp	87.5 parts
	Sugar	12.5 parts
Preparation:	Select only ripe whole fruit. Wash thoroughly, halve, and remove pulp mechanically. Dissolve sugar in pulp with minimum incorporation of air into the product.	
Fill:	Fill pulp into enamel cans to 5/16-in. headspace. Close at 20-in. vacuum <i>or</i> exhaust in steam to a center temperature of 160°F. and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool <i>or</i> cook in boiling water about 12 min. to a center temperature of 195°F. and cool in water.	

Fruit Juices, Nectars, Nectar Bases, and Purees

FROZEN GUAVA NECTAR BASE

Formulation:	Guava puree	67.5 parts
	Sugar	32.5 parts
Preparation:	Select only ripe whole fruit. Wash thoroughly and pass fruit successively through pulper equipped with 0.033-in. and 0.020-in. screens. Dissolve sugar thoroughly in puree with minimum incorporation of air into the product.	
Fill:	Fill into enamel cans or other suitable containers to ½-in. headspace.	
Process:	Close cans at 15-in. vacuum, quick freeze, and store at 0°F. Dilute 2½ times for use as a beverage.	

CANNED GUAVA NECTAR

Formulation:	Guava puree	20.0 parts
	Sugar	9.6 parts
	Water	70.4 parts
Preparation:	Select only ripe whole fruit. Wash thoroughly and pass successively through pulpers fitted with 0.033-in. and 0.020-in. screens. Dissolve sugar in water thoroughly and mix with puree.	
Fill:	Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to 195°F. and cool in water.	

FROZEN GUAVA PUREE

Preparation:	Select only ripe whole fruit. Wash thoroughly and pass fruit successively through pulpers fitted with 0.033-in. and 0.020-in. screens.	
Fill:	Fill into enamel cans or other suitable containers to ½-in. headspace.	
Process:	Close cans at 15-in. vacuum, quick freeze, and store at 0°F.	

CANNED PAPAYA NECTAR

Formulation:	Papaya pulp	35.2 parts
	Sugar	8.5 parts
	Citric acid	0.5 part
	Water	55.8 parts
Preparation:	Select only ripe whole fruit. Wash, peel, halve, deseed, and pass through a pulper fitted with a 0.020-in. screen. Dissolve sugar and acid in water and mix with pulp.	
Fill:	Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in a steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to 195°F. and cool in water.	

FROZEN PAPAYA NECTAR BASE

Formulation:	Puree	83.33 parts
	Sugar	16.25 parts
	Citric acid	0.42 part
Preparation:	Select only ripe whole fruit. Wash, peel, halve, deseed, and pass through a pulper fitted with a 0.020-in. screen. Heat the papaya puree to 180°F. in a steam jacketed pan. Dissolve sugar and acid in puree.	
Fill:	Fill hot into enamel cans or other suitable containers to 4/16-in. headspace and close <i>or</i> allow to cool, fill to ½-in. headspace, and close.	
Process:	Cool in water, quick freeze, and store at 0°F.	

CANNED PAPAYA-BANANA NECTAR

Formulation:	Papaya puree	33.22 parts
	Banana puree	1.75 parts
	Sugar	6.47 parts
	Citric acid	0.17 part
	Water	58.39 parts
Preparation:	Select only ripe whole fruit. Wash, peel, halve, and deseed papayas, and pass through a pulper fitted with a 0.020-in. screen. Wash and peel bananas, blanch in boiling water for 5 min., and pass through a pulper fitted with a 0.020-in. screen. Dissolve citric acid in water. Mix all ingredients thoroughly.	
Fill:	Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in a steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to 195°F. and cool in water.	

FROZEN PAPAYA PUREE

Preparation:	Select only ripe whole fruit. Wash fruit, peel, halve, remove seeds, and pass through a pulper equipped with a 0.020-in. screen. Heat puree to 195°F. in a flash pasteurizer <i>or</i> to 185°F. in a steam jacketed kettle.	
Fill:	Fill hot into enameled cans with ¾-in. headspace.	
Process:	Cool cans in water, quick freeze, and store at 0°F.	

CANNED PAPAYA-PASSION FRUIT NECTAR

Formulation:	Papaya puree	26.6 parts
	Passion fruit juice	11.7 parts
	Sugar	11.7 parts
	Water	50.0 parts
Preparation:	Select only ripe whole fruit. Wash passion fruit thoroughly and remove pulp mechanically. Run fruit through a pulper fitted with a 0.033-in. screen. Wash, peel, halve, and deseed papayas. Pass through a pulper fitted with a 0.020-in. screen. Dissolve sugar in water and mix with papaya puree and passion fruit juice.	
Fill:	Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in a steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to 195°F. and cool in water.	

CANNED PAPAYA-PINEAPPLE NECTAR

Formulation:	Papaya puree	32.55 parts
	Pineapple juice	9.30 parts
	Sugar	7.75 parts
	Citric acid	0.40 part
	Water	50.00 parts
Preparation:	Select only ripe whole fruit. Wash, peel, halve, and deseed papayas and pass through a pulper fitted with a 0.020-in. screen. Pineapple juice is obtained by passing by-product material from fruit cannery lines through a screw press, heating to coagulate protein, and centrifuging to standardize content of insoluble solids. Thoroughly dissolve sugar and citric acid in water and stir in the papaya puree and the pineapple juice.	
Fill:	Fill into plain cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in a steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to a center temperature of 195°F. and cool in water.	

CANNED PASSION FRUIT-ACEROLA CHERRY NECTAR

Formulation:	Passion fruit juice	13.60 parts
	Acerola cherry pulp	2.50 parts
	Sugar	8.90 parts
	Water	75.00 parts
Preparation:	Select ripe whole passion fruit. Wash fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Select firm ripe whole acerola cherries, wash, and pass through pulper fitted with a 0.020-in. screen. Dissolve sugar in water and mix in passion fruit and acerola cherry pulp.	
Fill:	Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to 195°F. and cool in water.	

CANNED PASSION FRUIT-PINEAPPLE NECTAR

Formulation:	Passion fruit juice	11.3 parts
	Pineapple juice	11.3 parts
	Sugar	9.9 parts
	Water	67.5 parts
Preparation:	Select only ripe whole fruit. Wash passion fruit thoroughly and remove pulp mechanically. Run fruit through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Pineapple juice is obtained by passing by-product material from fruit cannery lines through a screw press, heating to coagulate protein, and centrifuging to standardize content of insoluble solids. Thoroughly dissolve sugar in water and stir in the passion fruit juice and pineapple juice.	
Fill:	Fill into plain cans to 5/16-in. headspace and close at 15-in. vacuum <i>or</i> heat in a steam jacketed kettle to 160°F., fill hot, and close without vacuum.	
Thermal process:	Heat in an agitating cooker to 195°F. and cool immediately <i>or</i> heat in boiling water to a center temperature of 195°F. and cool in water.	

FROZEN PASSION FRUIT JUICE

- Preparation: Select only ripe whole fruit. Wash fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen.
- Fill: Fill to ½-in. headspace into enamel cans or into other suitable containers.
- Process: Close cans at 15-in. vacuum, quick freeze, and store at 0°F.

CANNED PASSION FRUIT NECTAR

- Formulation:

Passion fruit juice	15 parts
Sugar	10 parts
Water	75 parts
- Preparation: Select only ripe whole fruit. Wash fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen. Dissolve sugar in water thoroughly and mix with passion fruit juice.
- Fill: Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum *or* heat in steam jacketed kettle to 160°F., fill hot, and close without vacuum.
- Thermal process: Heat in an agitating cooker to 195°F. and cool immediately *or* heat in boiling water to 195°F. and cool in water.

CANNED PASSION FRUIT NECTAR BASE

- Formulation:

Passion fruit juice	60 parts
Sugar	40 parts
- Preparation: Select only ripe whole fruit. Wash fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Thoroughly dissolve sugar in passion fruit juice.
- Fill: Fill into enamel cans to 5/16-in. headspace and close at 15-in. vacuum.
- Process: Heat in a spin cooker for 2 min. to 195°F. and spin cool immediately.

FROZEN PASSION FRUIT NECTAR BASE

Formulation:	Passion fruit juice	60 parts
	Sugar	40 parts
Preparation:	Select ripe whole fruit. Wash thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Dissolve sugar thoroughly in juice with a minimum incorporation of air.	
Fill:	Fill into enamel cans or other suitable containers to ½-in. headspace.	
Process:	Close cans at 15-in. vacuum, quick freeze, and store at 0°F. Dilute 4 times for use as a beverage.	

Jams, Jellies, and Syrups

COCONUT SYRUP

Formulation:	Coconut milk	50 parts
	Corn syrup 43° Baume	50 parts
Preparation:	Select fully mature coconuts. Remove meat from shell and peel brown skin from meat. Grate or grind meat and express milk in a hydraulic press or a screw press. Mix milk and corn syrup thoroughly and boil moderately in a steam jacketed kettle to 222°F. (75 percent soluble solids). Pass syrup through a homogenizer at 3,000 psi and deaerate.	
Fill:	Fill into appropriate containers to exclude headspace and close without vacuum.	

GUAVA JAM

Formulation:	Guava puree	45 to 50 parts
	Sugar	55 to 50 parts
	Pectin, rapid set 150 grade	0.45 part
Preparation:	Select only ripe whole guavas, wash thoroughly, and pass through a pulper fitted with a 0.030-in. screen. Heat puree in a steam jacketed kettle to 160°F. Stir	

in pectin mixed with 5 times its weight of dry sugar and bring to a brisk boil. Add balance of sugar, bring to boil, and boil moderately to 222°F.

Fill: Fill hot into suitable containers without headspace.

Process: Close at a minimum temperature of 180°F., invert for 2 min. to sterilize cover, and cool in water.

GUAVA JELLY

Formulation:

Guava jelly stock	45 to 50 parts
Sugar	55 to 50 parts
Pectin, rapid set 150 grade	0.42 part

Preparation: Select only whole ripe fruit. Wash thoroughly and pass successively through pulpers fitted with 0.030-in. and 0.014-in. screens. Heat juice in a steam jacketed kettle to 160°F. Stir in pectin mixed with 5 times its weight of sugar and bring to a brisk boil. Add balance of sugar, bring to boil, and boil moderately to 222°F.

Fill: Fill hot into suitable containers without headspace.

Process: Close at a minimum temperature of 180°F., invert for 2 min. to sterilize cover, and cool in water.

PASSION FRUIT JELLY

Formulation:

Passion fruit juice	40 parts
Sugar	60 parts
Pectin, rapid set 150 grade	0.57 part

Preparation: Select only ripe whole fruit. Wash fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Heat juice in a steam jacketed kettle to 160°F. Stir in pectin mixed with 5 times its weight of dry sugar and bring to a brisk boil. Add balance of sugar, bring to boil, and boil moderately to 222°-223°F.

Fill: Fill hot into suitable containers without headspace.

Process: Close at a minimum temperature of 180°F., invert for 2 min. to sterilize cover, and cool in water.

PAPAYA-PINEAPPLE JAM

Formulation:	Papaya puree	22.5 to 33.3 parts
	Pineapple	11.1 to 22.5 parts
	Sugar	55.6 parts
	Pectin, slow set 208 grade	0.35 part
	Citric acid to 3.5 pH	0.2 part approximately

Preparation: Select only ripe whole fruit. Wash, peel, halve, and deseed papayas and pass through a pulper fitted with a 0.020-in. screen. Wash pineapples, peel, core, and cut to ¼-in. dice. Mix the papaya and pineapple in a steam jacketed kettle and bring to a brisk boil. Stir in pectin mixed with 5 times its weight of dry sugar and when thoroughly dispersed add the sugar in three portions allowing 2-min. interval between additions. This procedure will insure sugar penetration into the pineapple portions. Boil to 222°F.

Fill: Fill hot into suitable containers without headspace.

Process: Close at a minimum temperature of 180°F., invert cans for 2 min. to sterilize cover, and cool in water.

Note: The proportion of pineapple ingredient may be increased up to 50 percent of the total fruit weight to suit individual taste requirements.

PASSION FRUIT-PAPAYA JAM

Formulation:	Passion fruit juice	33.3 parts
	Papaya puree	11.1 parts
	Sugar	55.6 parts
	Pectin, slow set 208 grade	0.35 part

Preparation: Select only ripe whole fruit. Wash passion fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Wash, peel, halve, and deseed papayas, and pass through a pulper fitted with a 0.020-in. screen. Heat passion fruit juice in a steam jacketed kettle to 160°F. Stir in pectin mixed with 5 times its weight of dry sugar and bring to brisk boil. Add balance of sugar and papaya puree. Bring to boil and boil moderately to 222°F.

Fill: Fill hot into suitable containers without headspace.

Process: Close at a minimum temperature of 180°F., invert for 2 min. to sterilize cover, and cool in water.

PASSION FRUIT-PINEAPPLE JAM

Formulation:	Passion fruit juice	33.3 parts
	Pineapple	11.1 parts
	Sugar	55.6 parts
	Pectin, slow set 208 grade	0.35 part

Preparation: Select only ripe whole fruit. Wash passion fruit thoroughly and remove pulp mechanically. Pass pulp through a pulper fitted with a 0.033-in. screen and then finish through a 60-mesh screen. Wash pineapples, peel, core, and cut to ¼-in. dice. Mix the passion fruit and pineapple in a steam jacketed kettle and bring to a brisk boil. Stir in pectin mixed with 5 times its weight of dry sugar and when thoroughly dispersed add the sugar in three portions allowing 2-min. interval between additions. This procedure will insure sugar penetration into the pineapple portions. Boil to 222°F.

Fill: Fill hot into suitable containers without headspace.

Process: Close at a minimum temperature of 180°F., invert cans for 2 min. to sterilize cover, and cool in water.

VEGETABLES AND VEGETABLE PRODUCTS

CANNED ACIDIFIED POI (READY-MIXED)

- Definition:** Acidified poi is the unfermented product prepared from standard grade poi not more than 4 hours old to which has been added 1 percent commercial lactic acid (50 percent lactic acid). Standard grade poi contains not less than 30 percent total solids and ready-mixed poi contains not less than 18 percent total solids.
- Formulation:**
- | | |
|---|-----------------|
| Poi (30 percent total solids) | 60 parts |
| Water | 40 parts |
| Lactic acid (commercial, 50 percent) | 1 part |
- Preparation:** The standard grade poi and the water are thoroughly mixed and heated in a steam jacketed kettle to 205°F.
- Process:** Close at a minimum temperature of 200°F., invert for 2 min. to sterilize cover, and cool in water.

CANNED FRESH POI (READY-MIXED)

- Definition:** Fresh poi is the unfermented product prepared from standard grade poi not more than 4 hours old. Standard grade poi contains not less than 30 percent total solids.
- Formulation:**
- | | |
|--------------------------------------|-----------------|
| Poi (30 percent total solids) | 60 parts |
| Water | 40 parts |
- Preparation:** The standard grade poi and the water are thoroughly mixed and heated in a steam jacketed kettle to 160°F.
- Fill:** Fill hot 20 oz. into a No. 2 enamel can and close without vacuum.
- Thermal process:** Cook 100 min. at 240°F. and cool immediately.

CANNED SOUR POI (READY-MIXED)

- Definition:** Canned sour poi is the product prepared from standard grade poi by natural fermentation at atmospheric temperature. The final active acidity should be in the range pH 3.8 to pH 4.0.

Formulation:	Fermented poi	60 parts
	Water	40 parts
Preparation:	Commercially prepared standard grade poi is allowed to ferment for several days, thoroughly mixed with the water, and heated in a steam jacketed kettle to 205°F.	
Fill:	Fill hot 20 oz. into a No. 2 enamel can.	
Process:	Close at a minimum temperature of 200°F., invert for 2 min. to sterilize cover, and cool in water.	

CANNED TARO LEAF

Formulation:	Taro leaf	72.20 parts
	Brine (2 percent)	27.77 parts
	Monosodium glutamate	0.03 part
Preparation:	Wash leaves and blanch in water for 5 min. at 180°F.	
Fill:	Fill into No. 2 enamel cans 13 oz. taro leaves, 5 oz. brine containing 0.005 oz. monosodium glutamate. Close at 15-in. vacuum <i>or</i> exhaust in steam to a center temperature of 160°F. and close without vacuum.	
Thermal process:	Cook 75 min. at 240°F. and cool in water.	

CANNED STRAINED TARO LEAF

Formulation:	Taro leaf	99.47 parts
	Salt	0.50 part
	Monosodium glutamate	0.03 part
Preparation:	Trim ends from taro leaf stalks, wash, and blanch in water 5 min. at 180°F. Pass through horizontal high speed mill fitted with $\frac{3}{8}$ -in. diameter screen. Add 0.5 percent salt and 0.03 percent monosodium glutamate.	
Fill:	Fill 19 oz. (4/16-in. headspace) into No. 2 enamel cans and close at 20-in. vacuum <i>or</i> exhaust in steam to a center temperature of 160°F. and close without vacuum.	
Thermal process:	Cook 105 min. at 240°F. and cool in water.	

MEATS, MEAT PRODUCTS, AND FISH

CANNED FRANKFURTERS

- Definition:** Frankfurters are linked sausages, each $\frac{3}{4}$ to 1 in. in diameter and 4 in. or more in length. Generally they are made of about 60 percent beef and 40 percent pork, cured, spiced, cased, smoked, and cooked. The curing mixture usually consists of nitrate, nitrite, sugar, and salt, its quantitative addition being governed by regulation.
- Raw materials:** Beef and pork trimmings.
Beef — Steer, heifer, stag, or bull meat of canner grade containing low fat content.
Pork—Trimmings should not contain more than 50 percent fat, and head and seedy parts of the belly should not be used.
Cereal or milk powder may be added to the extent of 3.5 percent.
Casings should be commercial grade—16 to 24 millimeters, sheep or artificial.
- Preparation:** Trimmings are ground through a $\frac{3}{8}$ -in. plate and minced in a silent cutter or through a fine plate in the following order: beef, salt, spices, cure, and ice or cold water. The pork is added last to lessen the breakdown of fatty tissue. Continue mixture at a temperature below 55° F. in silent cutter until a finely cut product is obtained. Pack product tightly in a sausage stuffer to exclude air.
Linking may be done by hand or by a linking machine. The sausages are cured for several hours and hung over a smoke stick and smoked, usually at 130° F. for 2 hrs. They are then transferred to a hot water bath until the center temperature reaches 160° F. After a cold water spray the sausages are allowed to dry and held in a cooler. Shrinkage during smoking and cooking amounts to about 15 percent.
- Fill:** The frankfurter links are separated, but for vienna canning the links are cut to approximately $\frac{6}{16}$ in. less than the height of the can. The sausages are next

weighed into the can, hot 2 percent brine added, and the open cans are exhausted to 160°F. and closed.

Thermal process:

	<i>Initial</i>	<i>Process</i>	
<i>Can Size</i>	<i>Temperature</i>	<i>Time</i>	<i>Temperature</i>
211 × 400	140°F.	105 min.	240°F.

CANNED KAU YUK (CHINESE POT ROAST PORK)

Formulation:

Belly pork
 Chinese red bean curd
 Chinese spice
 Chinese parsley
 Sugar
 Water

Preparation:

Parboil pork and drain well. Brown in oil, cut into ½-in. pieces and simmer in sauce made from other ingredients for 10 min.

Fill:

Fill hot into a No. 2 enamel can 14 oz. pork and 5 oz. sauce. Close preferably under vacuum and cook for 100 min. at 240°F. Cool in water.

CANNED SWEET-SOUR SPARERIBS

Formulation:

Spareribs	53 parts
Pineapple	21 parts
Brown sugar	5 parts
Vinegar	7 parts
Soyu sauce	4 parts
Flour	1.4 parts
Ginger	0.8 part
Garlic	0.2 part
Salt	0.6 part
Water	7.0 parts

Preparation:

Cut pineapple into 1-in. cubes. Make a sauce of crushed ginger, garlic, brown sugar, vinegar, soyu sauce, salt, flour, and water. Trim fat from ribs, cut into 1½-in. pieces, and marinate in sauce 1 hr. Remove ribs from sauce and brown. Return browned ribs to sauce and simmer for 20 min.

Fill:

Fill hot into No. 2 enamel cans 12 oz. spareribs, 4 oz. pineapple, 5 oz. sauce.

Thermal process:

Close at 15-in. vacuum. Cook at 240°F. for 100 min. (initial temperature 160°F.) and cool in water.

PROCESSED TUNA CHICKEN

- Formulation: Tuna fillets
Brine (55° salometer 10 percent)
Monosodium glutamate (if desired)
- Preparation: Fillet fresh tuna and immerse for 1 hr. in 55° salometer 10 percent brine with or without the addition of monosodium glutamate. Steam cook fillets for 15 min. at 250°F. in a retort and cool in air. Remove skins and bones by hand.
- Fill: Pack into suitable containers in sections *or* mold under pressure into blocks and pack.
- Process: Quick freeze and store at 0°F.

PROCESSED TUNA HAM

- Formulation: Tuna fillets
Brine: Salt 14.5 parts
Sugar 3.0 parts
Sodium nitrite 0.094 part
Sodium nitrate 0.031 part
Water 82.5 parts
- Preparation: Fillet fresh tuna and immerse for 24 hrs. in 55° salometer brine of the above formulation maintained at 120°F. for the period. Drain fillets well, and smoke them in heated wood smoke at 170°F. for 4 hrs.
- Fill: Pack into suitable containers in sections *or* mold under pressure into blocks and pack.
- Process: Quick freeze and store at 0°F.

CANNED LAULAU

- Formulation: *Per Lau Lau*
Pork 48 parts
Taro leaf 28 parts
Butterfish 24 parts
Ti leaves for wrapping (2) 2 oz. approx.

- Preparation:** Trim excess fat and bone from pork. Cut meat into 4-oz. pieces and parboil. Remove scales, fins, tail, and large bones from fish, cut into 2-oz. cubes and soak in water 1½ hrs. to remove excess salt using several water changes. Blanch ti leaves 5 min. at 180°F. Wrap taro leaves about fish and pork and envelop whole in 2 ti leaves placed crosswise, draw ends of ti leaves together and cut off excess ti leaf. Preheat laulus in steam for 15 min.
- Fill:** Pack 2 laulus per No. 2 enamel can (heads and tails) to give a filled weight of 19 oz. Close at 20-in. vacuum *or* exhaust cans in steam for 15 min. and close without vacuum.
- Thermal process:** Cook 100 min. at 240°F. and cool in water.

MISCELLANEOUS

CANNED BIRDS' NEST SOUP

- Definition:** Birds' nest is the gelatinous substance of the salivary glands of a swallow native to China. This substance serves to bind together the materials of the birds' nest.
- Formulation:**
- | | |
|-----------------------------|-----------------|
| Chicken | 3 pounds |
| Dried Birds' Nest | 1 pound |
| Water | 8 pounds |
| Salt | } to taste |
| Monosodium glutamate | |
- Preparation:** Soak birds' nest in water 12 hrs., cook 2 hrs. at just below boil, drain to remove hot water, soak in cold water, and remove impurities. Cook the chicken in the water until the meat will strip from the bones. then return the bones to the stock, and cook 2 hrs. longer. Add the birds' nest to the stock and cook for 30 min. Add salt and monosodium glutamate to taste. Dice chicken to ¼ in. and add to soup.
- Fill:** Fill about 20 oz. into a No. 2 enamel can and close at 10-in. vacuum and minimum temperature of 160°F.
- Thermal process:** Cook 85 min. at 240°F. and cool in water.

CANNED CHOCOLATE TARO BEVERAGE

Formulation:	Poi	15.50 parts
	Sugar	5.50 parts
	Milk solids	3.40 parts
	Cocoa	0.50 part
	Diamalt	0.50 part
	Vanilla extract	0.50 part
	Salt	0.05 part
	*SeaKem 2	0.05 part
	Water	74.00 parts

Preparation: Mix SeaKem 2 with 10 times its weight of sugar, dissolve in cold water using a blender or comparable mixer, and heat to 140°F. to insure solution. Keep hot. Dissolve milk solids and cocoa in hot water. Mix remaining ingredients thoroughly, add milk-cocoa mixture, and heat to 160°F. Add stabilizer-sugar solution and homogenize immediately.

Fill: Fill hot to 3/16-in. headspace into No. 2 enamel cans. Close without vacuum.

Thermal process: Cook 60 min. at 240°F. and cool immediately. After removal from retort cool to 45°F. Store at room temperature.

°A refined Irish moss extractive manufactured by Seaplant Corporation, New Bedford, Mass.

CANNED SHREDDED COCONUT

Formulation:	Shredded coconut	82.00 parts
	Sugar	2.50 parts
	Water	15.50 parts
	Potassium meta-bisulfite ($K_2S_2O_5$)	400 parts per million

Preparation: Select only whole mature nuts. Husk nuts and remove meat from shell. Peel brown skin from meat and pass through shredder. Dissolve $K_2S_2O_5$ and sugar in water. Mix $K_2S_2O_5$ -sugar solution thoroughly with the shredded coconut.

Fill: Fill 19.5 oz. into a No. 2 enamel can. Close at 20-in. vacuum *or* exhaust to a center temperature of 160°F. and close without vacuum.

Thermal process: Cook 90 min. at 240°F. and cool in water.

CANNED HAUPIA

Formulation:	Coconut milk	42.2 parts
	Water	42.2 parts
	Starch	7.3 parts
	Sugar	8.0 parts
	Potassium meta-bisulfite ($K_2S_2O_5$)	0.025 part

Preparation: Select only mature whole coconuts. Husk and shell coconuts and peel off brown coating from coconut meat. Shred or grind meat as fine as possible. Extract milk by pressing meat in a screw press or in a hydraulic press. Mix the ingredients thoroughly and heat in a steam jacketed kettle to 170°F. with constant stirring.

Fill: Fill hot without headspace into No. 2 enamel cans. Allow to cool to 120°F. or less and close at 20-in. vacuum.

Thermal process: Cook 105 min. at 240°F. and cool immediately.

CANNED FRIED RICE

Formulation:	Rice, 60 percent moisture content	75 parts
	Pork (diced)	19 parts
	Egg (fresh)	6 parts
	Green onions, shrimp sauce, soyu sauce, herbs, spices, and salt as required	

Preparation: The rice should be edible grade, clean, sound, free from insect infestation and other objectionable foreign matter. Wash rice thoroughly with agitation in cold water to remove adherent surface starch and dust. Soak rice in water at 90°–100°F. for 40 min. Blanch the well-drained soaked rice in boiling water, the pH of which has been adjusted to 7 or slightly less, for 5 to 6 min. Moisture content of rice after blanching is approximately 60 percent. Brown the diced pork in small amount of oil, mix in the rice, egg, and seasoning.

Fill: Fill hot into a No. 2 enamel can 15 oz. of fried rice.

Thermal process: Close, preferably under 20-in. vacuum, and cook at 240°F. for 100 min. Cool in water.

REFERENCES

1. ANON. 1949. THE CANNED FOOD REFERENCE MANUAL. American Can Co., New York.
2. BAUMGARTNER, J. G., and A. C. HERSOM. 1956. CANNED FOODS. AN INTRODUCTION TO THEIR MICROBIOLOGY. J & A Churchill, Ltd., London, England.
3. CAMPBELL, CLYDE H. 1950. CAMPBELL'S BOOK. A MANUAL ON CANNING, PICKLING, AND PRESERVING. Vance Publishing Corporation, Chicago.
4. CRUESS, W. V. 1948. COMMERCIAL FRUIT AND VEGETABLE PRODUCTS. McGraw-Hill Book Co., Inc., New York.
5. MILLER, CAREY D., and BARBARA BRANTHOVER. 1957. NUTRITIVE VALUES OF SOME HAWAII FOODS. Hawaii Agric. Expt. Sta. Cir. 52.
6. PARKER, MILTON E., ELLERY H. HARVEY, and E. S. STATELER. 1954. ELEMENTS OF FOOD ENGINEERING. Reinhold Publishing Corporation, New York.
7. TOWNSEND, CHARLES T., IRA I. SOMERS, FRANK C. LAMB, and NORMAN A. OLSON. 1956. A LABORATORY MANUAL FOR THE CANNING INDUSTRY. National Cannery Association, Washington, D.C.
8. TRESSLER, DONALD K., and MAYNARD A. JOSLYN. 1954. THE CHEMISTRY AND TECHNOLOGY OF FRUIT AND VEGETABLE JUICE PRODUCTION. The Avi Publishing Co., Inc., New York.
9. TRESSLER, DONALD K., and CLIFFORD F. EVERS. 1957. THE FREEZING PRESERVATION OF FOODS. The Avi Publishing Co., Inc., New York.

**UNIVERSITY OF HAWAII
COLLEGE OF AGRICULTURE
HAWAII AGRICULTURAL EXPERIMENT STATION
HONOLULU, HAWAII**

LAURENCE H. SNYDER
President of the University

MORTON M. ROSENBERG
Dean of the College of Agriculture
and
Director of the Hawaii Agricultural
Experiment Station