HANDBOOK ON THE PROCESSING OF BANANA IN PALAU MARERO AND TARO 2013

Handbook on the Processing of Banana in Palau

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Message

A research on "Product Development for Food Security in the Republic of Palau" was funded by the Hatch Act of 1887 administered by the National Institute of Food and Agriculture—United States Department of Agriculture (NIFA-USDA), as one of the programs of the College of Micronesia Land Grant.

One of the research outputs is utilization of bananas which is the subject of this book. Bananas are important food resource not only in Palau, but also in Micronesia, as well as the whole Pacific region.

This hand book is a practical application of research knowledge which can be used by families and as product ideas for food business enterprise.

Dr. SINGERU SINGEO
Executive Director
College of Micronesia Land Grant Program

Foreword

Production and utilization of local foods in Palau help address self-sufficiency and enhance food security in the Republic. Development of value-added food products from bananas will benefit the people in meeting the needs for nutritious and healthy food items. It also supports the tourism industry, the lifeblood of Palau economy, with the production of local foods.

With the availability of information as results of researches conducted at the Research and Development (R & D) Station of the Palau Community College-Cooperative Research and Extension (PCC-CRE), consumers will be benefited. Increasing productivity of farmers for their value-added agricultural produce will also be addressed. Moreover, this is an opportunity of creating job opportunities for those who engage in food microenterprises in the production of various processed products derived from bananas.

Technology transfer of developed products are conducted by PCC-CRE free of charge to participants of outreach programs like Expanded Food and Nutrition Education Program (EFNEP) and Food Technology Classes.

PATRICK U. TELLEI, EdD
President
Palau Community College

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LYDIA M.MARERO
THOMAS TARO

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INTRODUCTION

Bananas, *(Musa sapientum L.)* also called dessert bananas, are mainly consumed as a fresh fruit. There is a great potential for promotion of consumption of banana varieties and farmers can profit from these opportunities.

Consumers are becoming increasingly aware of the health and nutritive benefits of eating more fresh fruits like bananas. Bananas are considered to be good for the treatment of gastric ulcer and diarrhea. Bananas act as an aid to digestion. Due to their high content of B6 vitamin (pyridoxine), they help to reduce stress and anxiety. They are also considered beneficial for cancer prevention and heart diseases. The high content of carbohydrates makes them a very good source of energy for example for people practicing sports. High in potassium, bananas helps to better brain functioning.

Sweet dessert bananas are generally eaten raw, while cooking bananas and plantains are boiled, steamed, fried or roasted. As the fruit has a limited shelf life, processing is important.

Bananas are easy to digest and, since they are similar in chemical composition to the mucus of the stomach lining, have a soothing effect in the treatment of gastric ulcers and diarrhea. It is also known as good mood food since the high Vitamin B6 content can help relieve stress and anxiety (Lieberman, 1990).

Stems can be made into dietary supplement and aid to prevent or cure cancer (Goldberg, 1994).

Worldwide, bananas rank fourth as the most consumed food after rice, wheat, and corn.

In Palau, there are three most common varieties of bananas: meskebesang (the cooking variety), mechad (dessert bananas), and rubiang (bananas used to make bread).

The Palau Community College-Cooperative Research and Extension (PCC-CRE) has tissue-cultured banana planting materials given out to farmers for free as an extension activity of the Agriculture Section of R & D Station.

The advantage of growing bananas is that the crop is planted only once and the main plant grow its suckers for the next plant.

There are many processing possibilities for bananas which are attractive to consumers, especially for tourists who come to Palau and always creating demand for banana food products.

Fig. 1. *Rubiang variety (Musa sapientum var. cineria)*

Fig. 2. *Lacatan* variety *(Musa sapeintum var. lacatan)*

Fig. 3 . Mechad variety (Musa sapientum var. cinerea)

Fig. 4. Meskebesang variety (Musa sapientum var. compressa)

NUTRITIONAL VALUE OF BANANAS

Bananas contain mostly carbohydrates (25.4%0) next to water (72%) and has an energy value of 104 kilocalories per 100 grams. Table 1 shows the nutritional composition of different varieties of bananas, such as Cavendish (Musa sapientum var. Cavendish); Mechad (*Musa sapientum var. cinerea); and meskebesang (Musa sapientum var. compressa*).

Among the three banana varieties, *Meskebesang* has the most energy, beta carotene, and ascorbic acid contents.

Due to its high Vitamin B6 (pyridoxine) content, bananas help reduce anxiety and stress. Pyridoxine is important in chemical reactions of proteins and amino acids in the body and important in the production of red blood corpuscles (Lieberman et al., 1986). Because bananas are mainly carbohydrates, there is a calming effect and after consumption there is greater sleepiness in studies on carbohydrate foods on human mood (Spring, 1982).

Bananas are also rich sources of the mineral potassium, which helps regulate muscle contraction, nerve impulses, and functions of heart and kidneys (Rosenman, 1992).

Table 1. Nutritional composition of different varieties of bananas.

Nutrient	Cavendish	*Mechad*	*Meskebesang*
Edible portion, %	64	73	57
Water,%	74.4	73.4	72.2
Energy, kcal	104	105	159
Protein,%	0.9	1.2	1.1
Fat,%	0.9	0.3	0.4
Carbohydrate,%	23.1	24.4	25.5
Crude Fiber,%	2.0	0.5	0.6
Ash,%	0.7	0.7	0.8
Calcium, mg%	40	17	23
Phosphorus, mg%	20	34	23
Iron, mg%	0.8	0.7	0.9
Retinol, mg%	0	0	0
B-carotene, mg%	75	30	190
Total Vit. A (RE), mcg%	12	5	32
Thiamin, mg%	0.04	0.02	0.06
Riboflavin, mg%	0.04	0.02	0.06
Niacin, mg%	0.8	0.6	0.7
Ascorbic acid, mg%	10	21	32

Adapted from FCT-FNRI, 1997.

PROCESSING OF BANANA PRODUCTS

BANANA CHIPS

Fig. 5 Banana chips.

Ingredients:

2	lbs	*Meskebesang* bananas, mature green
1	cup	sugar
1	cup	water
1	cup	oil

Procedure:

- Clean, peel, and slice green cooking bananas to about 1 mm thick.
- Fry bananas until yellowish brown (first frying).
- Soak fried bananas in sugar solution of 1 cup sugar and 1 cup water for 1 minute. Drain.
- Fry again until chips are shiny.
- Cool, pack, and label.

BANANA CATSUP

Fig. 6. Banana catsup.

Ingredients:

2	lbs	*Meskebesang* bananas, ripe
1	cup	vinegar
1	cup	sugar
½	cup	onion, chopped
¼	tsp.	red food color
½	tsp.	cinnamon powder
½	tsp.	black pepper, powdered
½	tsp.	cloves, powdered
½	tsp.	paprika, ground

Procedure:

- Boil ripe cooking bananas in water for 15 minutes. Peel.
- Blend with equal amount of water and transfer to a saucepan.
- Add all the ingredients and cook to jam consistency.
- Pour into sterile bottles with new caps.
- Cool, label, and seal.

BANANA BREAD

Fig. 7. Banana bread.

Ingredients:

1	lb	*Rubiang* bananas, ripe
2	cups	all-purpose flour
1	tsp.	baking soda
½	cup	oil
½	cup	sugar

Procedure:

- Peel and mash ripe bananas.
- Mix bananas with flour, sugar, and baking soda.
- Add oil gradually, mix well, and knead.
- Set dough for 30 minutes in an unlighted oven covered with wet paper towel.
- Transfer to baking pans and bake at 300^{O} F for 30 minutes.

BANANA FIGS

Fig. 8 Banana figs.

Ingredients:

2	lbs	Cavendish bananas, ripe
2	cups	brown sugar
1	cup	water

Procedure:

- Peel bananas and blanch in boiling water for 30 seconds.
- Prepare syrup by boiling 1 cup water and 1 cup sugar.
- Drop bananas in boiling syrup and cook 1 minute.
- Remove from fire and let bananas soak overnight.
- Drain. Add 1/3 cup sugar to syrup and boil. Add bananas and cook 5 minutes. Repeat procedure for 3 days.
- Plump bananas by soaking in syrup for 1 week.
- Drain bananas and dry.

BANANA PASTILLES

Fig. 9. Banana pastilles

Ingredients:

2	lbs	Meskebesang bananas, ripe
1	cup	sugar
1	cup	water
1	cup	dry milk
1	Tbsp	butter

Procedure:

- Boil ripe bananas, peel and slice 3 cm thick and mash.
- Mix sugar, water, dry milk and mashed banana s and cook in slow fire until thick. Add butter.
- Place cooked bananas in a plastic bag and press with rolling pin to 1 cm thick. Slice 4 cm long and 1 cm wide.
- Wrap in cellophane.

BANANA SALAD

Fig. 10. Banana salad.

Ingredients:

1	lb	*Mechad* bananas,ripe
1	cup	salad greens, sliced (lettuce)
1	pc	med. tomato, sliced crosswise
1	cup	carrots, diced
½	cup	yoghurt

Procedure:

- Peel ripe mechad bananas and slice diagonally 1 inch thick.
- Lay on plate as base.
- Top with sliced lettuce, carrots and yoghurt.

BANANA PRESERVES

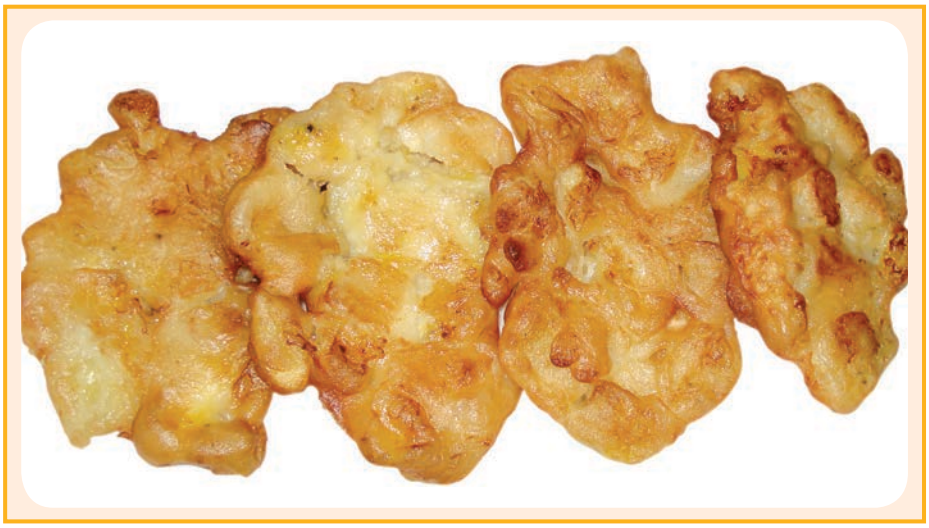
Fig. 11. Banana preserves.

Ingredients:

2	lbs	*Meskebesang* bananas, ripe
2	cups	sugar
1	cup	water

Procedure:

- Boil ripe cooking bananas and peel.
- Prepare syrup with 2 cups sugar in 1 cup water and boil.
- Cook bananas in syrup for 15 minutes. Drain.
- Pack in sterile jars and fill with the cooking syrup.
- Remove air by inserting knife between bananas and sterilize half-sealed in boiling water for 25 minutes.
- Seal fully, cool, label, and store.



BANANA FRITTERS

Fig. 12. Banana fritters

Ingredients:

1	lb	ripe cooking bananas,
1	cup	all-purpose flour
1	pc	egg
½	cup	sugar
½	cup	water
1	cup	oil

Procedure:

- Peel ripe cooking bananas and slice in two longitudinally.
- Mix flour, egg, sugar and water.
- Dip bananas in batter and fry in hot oil.

BANANA CREPES

Fig. 13. Banana crepes.

Ingredients:

1	lb	Mechad bananas, ripe
1	cup	all-purpose flour
1	pc	egg
½	cup	water
½	cup	sugar

Procedure:

- Peel and slice bananas and dredge in sugar. Set aside.
- Prepare crepes by mixing flour, egg, and water and transfer 1/2 cup of mixture in a greased pan, tilt to make a wide circle and cook until brown.
- Wrap bananas with crepes.

BANANA –ROOTCROP DELIGHT

Fig. 14. Banana-root crop delight.

Ingredients:

5	pcs	ripe cooking bananas, cubed
2	pcs.	coconut, grated
5	cups	water
2	cups	taro, cubed
2	cups	cassava, cubed
2	cups	sweet potato, cubed
½	cup	sago
2	cups	ground glutinous rice
2	cups	sliced jackfruit
1	cup	sugar

Procedure:

- Mix 2 cups grated coconut and 1/2 cup water and squeeze out about 1 cup coconut milk. This is thick coconut milk,
- Pour 4-1/2 cups water again to the grated coconut and squeeze out 5 cups coconut milk (thin milk). Transfer to a stock pot and boil.
- Add taro, cassava, sweet potato and sago and simmer until tender, with constant stirring.
- Shape powdered rice moistened with water into small balls and drop into the simmering mixture.
- Stir in bananas, and jackfruit, and simmer 10 minutes.
- Blend in sugar and 1 cup thick coconut milk.
- Cool and serve.

BANANA TURNOVER

Fig. 15. Banana turnover.

Ingredients:

1	lb	ripe banana, Rubiang variety
1	cup	sugar
1	cup	all-purpose flour
1	pc	egg
½	cup	water
½	cup	yoghurt
1	cup	oil

Procedure:

- Peel and mash ripe bananas.
- Mix mashed bananas with sugar and cook for 5 minutes with constant stirring. Set aside.
- Mix flour, water, egg, and yoghurt and knead into a dough.
- Cut dough into pieces and flatten with a rolling pin.
- Shape dough with a round -rimmed saucer. Fill each wrapper with mashed bananas, fold over and seal edges with fork tines.
- Fry in hot oil.

BANANA FLAKES

Fig. 16. Banana flakes.

Ingredients:

2	lbs	cooking bananas, mature but green
1	cup	sugar
1	cup	water
1	cup	oil

Procedure:

- Peel green cooking bananas and slice thinly.
- Fry in hot oil. (first frying).
- Dip in syrup prepared from boiling 1 cup sugar and 1 cup water.
- Fry again until golden brown.
- Cool, pack, seal, and label.

BANANA ROLLS

Fig. 17. Banana rolls.

Ingredients:

1	lb	ripe cooking bananas
1	cup	sugar
25	pcs	flour wrappers
1	cup	oil

Procedure:

- Peel and slice longitudinally ripe cooking bananas into 2.
- Lay sliced banana on a wrapper, sprinkle sugar and wrap.
- Fry in hot oil.

BANANA PIE

Fig. 18. Banana pie.

Ingredients:

1	lb	ripe banana, *Rubiang* variety
1	cup	sugar
1	cup	all-purpose flour
1	pc	egg
½	cup	water
½	cup	yoghurt

Procedure:

- Peel and mash ripe bananas. Mix mashed bananas with sugar and cook for 5 minutes with constant stirring. Set aside.
- Mix flour, water, egg, and yoghurt and knead into a dough.
- Cut dough into pieces and flatten with a rolling pin.
- Divide dough into 2, flatten out 1 part with a rolling pin and line a pie plate with the dough. Fill with cooked mashed banana and cover with the flattened remaining dough. Bake at 300° F for 30 minutes.

BANANA BLOSSOM CROQUETTE

Fig. 19. Banana blossom croquette.

Ingredients:

1	pc	banana blossom
1	cup	all-purpose flour
1	pc	egg
½	cup	water
1	cup	oil

Procedure:

- Separate banana blossoms from the peels and remove the middle hard part. Boil in water for 5 minutes.
- Cool, press, and chop blossoms.
- Mix flour, egg, water, and chopped banana blossoms.
- Heat oil and fry 1/2 cup mixture.

BANANA FLOUR

Fig. 20. Banana flour.

Ingredients:

2 lbs cooking bananas, green

Procedure:

- Cook green bananas.
- Peel and grind.
- Dry in the sun for 8 hours or until crisp.
- Blend and sift.
- Pack in thick plastic bags, seal, label, and store.

BANANA PANCAKE MIX

Fig.21. Banana pancake mix

Ingredients:

2	cups	banana flour
2	cups	all-purpose flour
1	cup	sugar
1	cup	dry milk
¼	cup	baking powder
1	tsp.	salt

Procedure:

- Mix together all ingredients in a plastic bag.
- Pack 1 cup mixture in thick (0.5 mil) plastic bags, seal and label.
- Store in a clean, dry place.

BANANA PANCAKES

Fig. 22. Banana pancakes.

Ingredients:

1	pack	Banana Pancake Mix
1	pc	egg
½	cup	water
¼	cup	oil

Procedure:

- Mix all ingredients in a mixing bowl to form a batter.
- Pour ¼ cup batter into frying pans, cook both sides.
- Serve banana pancakes with syrup, jam, margarine, or peanut butter.

BANANA STEAMED CAKE MIX

Fig. 23. Banana steamed cake mix.

Ingredients:

2-½	cups	banana flour
2-½	cups	all-purpose flour
2	cups	sugar
¼	cup	baking powder
1	pack	coconut powder

Procedure:

- Mix all ingredients in a plastic bag.
- Measure 1 cup mixture and pack in thick plastic bags, seal, label and store in a clean, dry place.

BANANA STEAMED CAKES

Fig. 24 Banana steamed cakes.

Ingredients:

1	pack	Banana Steamed Cake Mix
¾	cup	water
1	Tbsp	grated cheese

Procedure:

- Mix Banana Steamed Cake Mix with water and transfer ¼ cup mixture into muffin pans. Top with grated cheese.
- Steam for 20 minutes.

BANANA DOUGHNUT MIX

Fig. 25. Banana doughnut mix.

Ingredients:

3	cups	banana flour
3	cups	all-purpose flour
1	cup	dry milk
1	cup	sugar
4	Tbsp.	baking powder
½	tsp.	nutmeg powder
½	tsp.	cinnamon powder

Procedure:

- Mix all ingredients in a plastic bag.
- Pack one cup (240 g) in thick (0.5 mil) plastic bag, seal, and label.
- Store in a clean, dry place.

BANANA DOUGHNUTS

Fig. 26. Banana doughnuts.

Ingredients:

1	pack	Banana Doughnut Mix
1	pc	egg
2	Tbsp.	oil
1	cup	oil for frying

Procedure:

- Empty 1 pack Banana Doughnut Mix into a mixing bowl, add I egg and 2 Tbsp. oil.
- Knead and divide dough into 6 balls.
- Flatten thickly and cut with doughnut cutter or form into rings.
- Deep fry in hot oil.

BANANA TAMA MIX

Fig. 27. Banana *tama* mix .

Ingredients:

3	cups	banana flour
3	cups	all-purpose flour
1	cup	dry milk
1	cup	sugar
4	Tbsp.	baking powder
1	tsp.	salt

Procedure:

- Mix all ingredients in a plastic bag.
- Pack 1 cup (240 g) in thick (0.5 mil) plastic bag, seal, label and store in a clean, dry place.

BANANA TAMA

Fig. 28. Banana *tama*

Ingredients:

1	pack	Banana Tama Mix
1	pc	egg
2	Tbsp.	oil

Procedure:

- Empty 1 pack of Banana Tama Mix into a mixing bowl, add 1 egg and 2 Tbsp. oil.
- Mix well , knead and divide dough into 6 balls.
- Deep fry in hot oil.

BANANA PASTA MIX

Fig. 29. Banana pasta mix.

Ingredients:

2- ½ cups banana flour
2- ½ cups all purpose flour
1 Tbsp. salt

Procedure:

- Mix all ingredients in a plastic bag. Shake bag well to obtain a uniform mixture.
- Pack 1 cup mixture in a thick plastic bag, seal, label, and store in a clean, dry place.

BANANA PASTA

Fig. 30 Banana pasta.

Ingredients:

1	pack	Banana Pasta Mix
1	pc	egg

Procedure:

- Empty 1 pack of Banana Pasta Mix into a mixing bowl , add 1 egg, and mix well to form dough.
- Roll dough on a floured cutting board with a rolling pin, and cut into pasta with a knife.
- Drop banana pasta in boiling water and cook until pasta floats (about 2 minutes).
- Drain, add 1 Tbsp. oil, and toss.

BANANA PASTA WITH SAUCE

Fig. 31 Banana pasta with sauce.

Ingredients:

1	cup	chicken, cooked, and diced
¼	cup	onion, chopped
1	Tbsp.	garlic, minced
¼	tsp.	black pepper
1	can	Nestle's Cream
1	Tbsp.	oil
1	cup	chicken stock
	sprig	parsley or green onions

Procedure:

- Saute garlic, onion, and chicken in vegetable oil.
- Add chicken stock, salt, pepper, and Nestle's cream.
- Cook for 5 minutes.
- Pour over cooked pasta. Garnish with parsley or chopped green onions.

BANANA COOKIE MIX

Fig. 32. Banana cookie mix.

Ingredients:

6	cups	banana flour
6	cups	all-purpose flour
¼	cup	baking powder

Procedure:

- Mix all ingredients in a plastic bag and shake well to obtain a uniform mixture.
- Measure 4 cups of Banana Cookie Mix into thick (0.5 mil) plastic bags, seal, and label.
- Store in a clean, dry place.

BANANA COOKIES

Fig. 33. Banana cookies

Ingredients:

1	pack	Banana Cookie Mix
1	cup(2 sticks)	margarine
1	cup	sugar
3	pcs	eggs
1	Tbsp.	vanilla

Procedure:

- Cream margarine with 1 cup sugar.
- Add eggs, one at a time, and mix well.
- Add 1 Tbsp. vanilla and mix well.
- Empty 1 pack Banana Cookie Mix into the mixture, and knead into dough.
- Roll with a rolling pin and cut with cookie cutter.
- Bake banana cookies at 275° F for 45 min.
- Pack in thick plastic bags, seal, and label.

BANANA BROWNIE MIX

Fig. 34. Banana brownie mix

Ingredients:

3	cups	banana flour
3	cups	all-purpose flour
3	tsp.	baking Soda
3	cups	cocoa powder
3	tsp.	salt

Procedure:

- Mix all ingredients in a plastic bag.
- Measure 2 cups mixture and pack in thick (0.5 mil) plastic bags, seal, and label.
- Store at room temperature in a clean, dry place.

BANANA BROWNIES

Fig 35. Banana brownies

Ingredients:

1	pack	Banana Brownie Mix
1	cup	butter
2	cups	sugar
3	pcs.	eggs
1	tsp.	vanilla
1	cup	chopped nuts

Procedure:

- Cream butter, then add sugar gradually.
- Add eggs one at a time mixing very well after each addition. Mix in vanilla.
- Add 1 pack Banana Brownie Mix and mix well.
- Add 1/8 cup chopped nuts.
- Pour mixture into greased pan. Smoothen surface with a rubber scraper and top with the remaining nuts.
- Bake at 350◦ F for 15 minutes.

BANANA MUFFIN MIX

Fig. 36. Banana muffin mix

Ingredients:

3	cups	banana flour
3	cups	all-purpose flour
4	tsp.	baking soda
1	tsp.	salt

Procedure:

- Mix all ingredients in a plastic bag.
- Measure 2 cups mixture and pack in thick plastic bags, seal, and label.
- Store at room temperature in a clean, dry place.

BANANA MUFFINS

Fig. 37. Banana muffins

Ingredients:

1	pack	Banana Muffin Mix
½	cup	raisins, chopped
½	cup	nuts, chopped
1	cup	yoghurt
1	pc.	egg
2	Tbsp.	margarine
½	cup	brown sugar

Procedure:

- Preheat oven to 350 F.
- Combine margarine, egg, and yoghurt. Add 1 pack Banana Muffin Mix and mix with a few strokes.
- Fold in chopped nuts and raisins.
- Fill greased muffin pans ½ full.
- Bake at 350° F for 20 min. or until toothpick comes out clean.

BANANA WINE

Fig. 38. Banana wine

Ingredients:

5	ripe	cooking banana, boiled and mashed
5	cups	sugar
20	cups	water
2	Tbsp.	yeast
1	Tbsp.	brown sugar

Procedure:

- Boil banana in water until soft about 1 hour, peel and cut into small pieces.
- Place 1 cup bananas and 1 cup water in a blender and blend for 2 minutes. This is banana puree.
- Dissolve yeast in 1 cup lukewarm water and add brown sugar. Let stand 10 minutes or until foamy.
- Mix banana puree with equal amount of water and stir in sugar and yeast solution.
- Transfer the mixture to a bottle and cover with paper towel secured with a rubber band.
- Ferment for 1 month and filter. The filtrate is banana wine.
- Pasteurize banana wine by heating to 90° C for 15 minutes.
- Cool, bottle, seal, and label.

BANANA VINEGAR

Fig. 39. Banana vinegar

Ingredients:

5	lbs.	ripe cooking bananas, boiled and mashed
5	cups	sugar
20	cups	water
2	Tbsp.	yeast
1	Tbsp.	brown sugar

Procedure:

- Boil bananas in water until soft, about 1 hour, peel and cut into small pieces and blend to make puree.
- Dissolve yeast in 1 cup lukewarm water .
- Mix banana puree with equal amount of water and stir in sugar and yeast solution.
- Transfer the mixture to a bottle and cover with paper towel secured with a rubber band.
- Ferment for 3 months and filter.
- Pasteurize at 90^{O} C for 15 minutes.
- Cool, bottle, seal and label.

SENSORY EVALUATION OF BANANA PRODUCTS

Banana bread and other selected products were evaluated by about 5,000 respondents in the span of five years. The products was served to the public during events like Earth Day, Career Awareness Week, Women's Month, Tourism Week, Olechotel Belau Fair, World Food Day, Independence Day, as well as a main visitors' item at the PCC-CRE R & D Station, served to school children, students, parents, teachers, and other guests All food tasters liked the product very well.

The food products, particularly the dry mixes, were put on exhibit at the 2002 and 2006 Japan Food Expo, Hawaii in 2006,Guam in 2007, and Italy Food Expo in 2007. During the 2006 "Taste of Palau" event, the tourists tasted the banana food products and they signified their interest in buying these foods if sold in the market.

Fig. 40. School children tasting banana products.

PACKAGING STUDIES AND SHELF-LIFE OF PROCESSED BANANA PRODUCTS

Banana food products and their suitable packaging materials were studied and results are shown in Table 2.

Table 2. Selected banana food products and their suitable packaging materials.

Food Product	Packaging Material
Flour, and flour products	Polyethylene(PE) and poly propylene (PP) bags, 0.5 mil
Chips	PP bags, 0.5 mil
Fermented products	PET(poly ethylene terepthalate) plastic bottles

Banana flour and dry mixes were found stable when packed in 0.5 mil thick PE or PP bags and stored at room temperature. Banana Chips was found stable in 0.5 mil PE plastic bags. Frozen products were suitably packed in 0.5 mil PP bags.

Fig. 41. Banana food products under storage studies.

The processed products kept well in their respective suitable packaging materials for a period of one year or longer for the dried and fermented products.

Banana Flour and dry mixes also kept for one year or longer at room temperature (27° to 32° C) when packed in thick (0.5 mil) plastic bags.

Baked/cooked/fried banana products like cookies, and chips, had a shelf-life of two weeks at room temperature (27°-32° C). Cooked products kept for two weeks at refrigeration temperature (10° C) and 6 months at freezing temperature (<0° C).

Fermented products like wine and vinegar, packed in PET bottles were found to be stable at room temperature (27°-32° C) for more than 2 years or longer.

TECHNOLOGY TRANSFER OF PROCESSED BANANA PRODUCTS

Selected banana food products were taught to 636 participants in PCC-CRE Expanded Food and Nutrition Education Program (EFNEP) and Food Technology Classes in a 24-hour training period, usually done in a three-week, 2-hour per day sessions. The places and number of participants of training are shown in Table 3.

Fig. 42. Participants of Food Technology Class in Ngiwal State.

Table 3. Number of participants and places where Food Technology Classes were held.

Place	Number
Ngeremlengui State Old Age Center	23
Melekeok State Old Age Center	17
Airai State Ked Center	19
Airai State Abai	17
Koror State PCC Campus	18
Koror State Ngarachamayong Cultural Center	16
Koror State Maibrel Center	18
Ngeremlengui State Old Age Center	9
Ngeremlengui State Training Center	23
Ngiwal State School Cafeteria	23
Ngatpang State	12
Ngerbeched, Koror	23
Kayangel State	17
Peleliu State	19
Airai State	11
Ngardmau State	12
R & D Station	3
Angaur State	23
Ngeremlengui Elementary School	53
Emmaus High School	24
Palau High School Special Education	12
Upward Bound Math- Science	18
Palau Parents Empowered	16
Bethania High School	27
Ngarchelong Head Start Parents	19
Meyuns Head Start Parents	24
Madalaii Head Start Parents	14
Peleliu Head Start Parents	19
Ngerbeched Head Start Parents	24
Expats Group I	22
Expats Group II	26
Cafeteria Staff	20
Ngaraard Ongall Group	15
Total	**636**

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