

# Edible vascular plants of the Line Islands

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## Introduction

The purpose of this article is to identify and provide the nutrient content (if available) of edible vascular plants currently growing in the Line Islands. With increased population pressures in the Pacific region, it is important to have an understanding of the plant life that exists.

## The Line Islands

The Line Islands, lie approximately 1,000 miles south of Hawaii and are comprised of a chain of 10 atolls and coral islands spreading 1,200 miles across the equator in the Central Pacific. Two of the islands, Palmyra and Jarvis, are

to the people. Pandanus fruit appears to be a good source of Vitamin A, and guava, a good source of Vitamin C.

The other plants may also be good nutrient sources, but analysis has yet to be done and/or made available.

**Artocarpus altilis – Breadfruit:** This large tree with large, glossy leaves is com-

found throughout Polynesia. The durable wood is used for building houses and canoes and the inner bark was used one time to make a kind of tapa cloth. The fruit, considered the staff of life on many of the islands, can grow up to 100 pounds in weight. It can be baked, steamed, fried, or pressed into breadfruit poi. Table 2 shows the nutrient content of breadfruit.

**Asplenium nidus – Bird’s Nest Fern:** The bird’s nest fern is a fern with glossy fronds. It is commonly found at near sea level as well as in the rain forests. The frond tips can be eaten raw in salads, or eaten cooked in coconut cream. No nutrient analysis was found.

**Boerhavia:** The *Boerhavia* species are vine-like plants that grow close to the ground. There are three species and one, *Boerhavia repens*, is frequently seen as a weed in coastal areas. The thickened, fibrous, starchy taproots are reported to be a famine food. No nutrient analysis was found.

identified the plant species existing on the islands. Special effort was made to identify and list pre-European (Polynesian introduced) and native plants. More recently introduced plants able to survive without special cultivation were also included. An extensive literature search was then undertaken to determine whether nutrient analysis has ever been done on any of these plant species.

## Findings

A total of eighteen edible plants were identified, with the number of species varying from island to island (see Table 1). Vostok Island, for example, only had two edible plants while Fanning Island had fifteen.

Information and nutrient analysis of the edible plants of the Line Islands is given when available. Certain varieties of coconut, breadfruit and swamp taro can survive after being initially cultivated and can provide a significant source of calories. The rest of the islands belong to Kiribati, of which, only three, Christmas, Fanning and Washington, are inhabited. The people live on a subsistence level, making copra and fishing.

The small and low-lying Line Islands are home to hundreds of thousands of sea birds, coconut and land crabs, and sparse plant life. Almost all of the islands seem to have been inhabited at some point in their history. Phosphate (from the guano, bird droppings) was mined during the 19th to 20th centuries. Some islands were planted with coconut for copra and coconut oil. All of the islands are spectacular in their beauty, many with enclosed lagoons teeming with sea life.

## Methodology

The M.V. *World Discoverer*, sponsored by Society Expedition Cruises, voyaged to eight of the ten Line Islands—Palmyra, Fanning, Christmas, Malden, Starbuck, Vostok, Caroline and Flint—from June 18–30, 1995. The author was accompanied on the expedition by two naturalists who

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Scientific Name	Common Name	Island *							
		Ca	Ch	Fa	Fl	Ma	Pa	St	Vo
<i>Artocarpus altilis</i>	Breadfruit		X	X	X		X		
<i>Asplenium nidus</i>	Bird's nest fern						X		
<i>Boerhavia (3 species)</i>	-	X	X	X	X	X	X	X	X
<i>Cocos nucifera</i>	Coconut	X	X	X	X	X	X	X	X
<i>Cordia subcordata</i>	-	X	X	X	X	X	X		
<i>Cyrtosperma chamissonis</i>	Swamp taro		X	X					
<i>Ficus tinctoria</i>	Dyer's fig		X	X					
<i>Lepidium bidentoides</i>	Scurvy grass	X	X	X	X		X		
<i>Morinda citrifolia</i>	Indian mulberry	X	X	X	X		X		
<i>Neisosperma oppositifolium</i>	-						X		
<i>Pandanus tectorius</i>	Pandanus or Screwpine	X	X	X	X		X		
<i>Pisonia grandis</i>	Puka tree	X	X	X	X	X	X		X
<i>Portulaca lutea</i>	Seaside purslane	X	X	X		X	X	X	
<i>Portulaca oleracea</i>	Purslane		X	X	X				
<i>Psidium guajava</i>	Guava			X					
<i>Sesuvium portulacastrum</i>	Seaside ice plant	X	X	X					
<i>Tacca leontopetaloides</i>	Polynesian arrowroot	X		X	X		X		
<i>Terminalia catappa</i>	Tropical almond		X	X	X		X		

\* Ca=Caroline, Ch=Christmas, Fa=Fanning, Fl=Flint, Ma=Malden, Pa=Palmyra, St=Starbuck, Vo=Vostock

**Cocos nucifera – Coconut:** The coconut is a palm tree dispersed by seawater and is found on sandy shores throughout the tropics. It is the most valued tree of the Pacific region with every part having some use. The husk is made into rope and cords, the shell into dishes and fuel, the leaves into weaving and plaiting material, and the trunk for timber.

The meat of the coconut is used for food. The immature meat, called spoonmeat, is gelatinous in nature and commonly used for baby food. The dry, shredded mature meat (copra) is the most recognized form of coconut available in the global market today and is often used in pastry products. Sprouting coconut contains the edible spongy meat of the embryo (called *uto* in many Polynesian languages). It is said to be easily digested and is commonly fed to infants. Coconut cream, coconut milk and coconut water can all be obtained from the coconut palm.

Coconut nutrient content varies depending on its maturity. During the very immature gelatinous stage and again during the embryo stage the fat content (mostly saturated fat) drops

dramatically. Also interesting to note is that coconut water contains no fat. Tables 3a to 3d show the nutrient contents.

**Cordia subcordata:** This tree is found on sandy shores from tropical Asia eastward to Hawaii. Its wood is highly prized, and the bark is used for making mats, baskets, and skirts. The small edible seed has been used as food in times of famine. No nutrient analysis was found.

**Cyrtosperma chamissonis – Swamp Taro:** Swamp taro is the largest and most commonly grown aroid (taro-like plant). It has big leaves and a large, coarse, edible tuber-like corn. The many common methods of cooking swamp taro include roasting it on hot stones, baking it in an underground oven, boiling or frying. Cooking destroys the plants' calcium oxalate crystals that cause uncomfortable itching in the mouth. Table 4 shows the nutrient content.

**Ficus tinctoria – Dyer's fig:** The Dyer's fig is a small tree common in lowlands and forest areas. The red-orange fruit is edible. No nutrient analysis was found.

**Table 2. Breadfruit - the nutrient content of fresh breadfruit**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	29.2	Kcal	Vitamin D IU	0.0	IU
Fat Total	0.0652	g	Vit E-Alpha Eq.	0.3175	mg
Saturated Fat	-	g	Thiamin-B1	0.0312	mg
Cholesterol	0.0	mg	Riboflavin-B2	0.0085	mg
Sodium	0.567	mg	Niacin-B3	0.2552	mg
Carbohydrates	7.683	g	Vitamin B6	0.0241	mg
Dietary Fiber	1.389	g	Folate	4.82	mcg
Sugars	0.9072	g	Vitamin B12	0.0	mcg
Protein	0.3062	g	Biotin	-	mcg
Vitamin A IU	11.34	IU	Pantothenic	0.1296	mg
Vitamin C	8.222	mg	Phosphorus	8.505	mg
Calcium	4.82	mg	Iodine	-	mcg
Iron	0.1531	mg	Magnesium	7.088	mg
Water	20.04	g	Zinc	0.034	mg
Ash	0.2637	g	Copper	0.0238	mg
Potassium	138.9	mg			

\* Serving: 28.35 g (1 oz). Water content: 70.7%  
 Source: Genesis 1995

**Lepidium bidentatum –Scurvy Grass:** This plant is a low lying, somewhat succulent-leaved plant that grows on limestone, basaltic rock or coral sand close to the sea. The leaves are edible raw or cooked. During the early European period in Polynesia, the leaves were collected and fed to sailors to prevent scurvy. No nutrient analysis was found.

**Morinda citrifolia – Indian Mulberry:** The Indian mulberry is a small tree found typically on high islands. In ancient times it was used as a valuable red (from the bark) or yellow (from the roots) dye. The fruit, although unpleasant tasting, has been used as food, especially during times of famine. It is also the most widely used traditional medicine plant in Polynesia. No nutrient analysis was found.

**Neisosperma oppositifolium:** This tree is found on sandy shores, high islands, and atolls. Its soft wood is used for light construction, tool handles, and firewood. The wafer-like seed is edible, but is eaten only in times of famine. No nutrient analysis was found.

**Pandanus tectorius – Pandanus or Screwpine:** Pandanus is an extremely useful tree, second only to the coconut palm. It is most commonly found on rocky and sandy shores of atolls and high islands. Its leaves are woven and plaited for mats, thatch, sails, baskets, hats and many other items. The fragrant

male flowers are used to scent coconut oil, and the wood of the trunk is used in making native houses.

The fruit of the numerous cultivated varieties is a major source of food on atolls. The roots can also be eaten although nutrient analysis is unavailable. It is interesting to note that the pandanus fruit is high in vitamin A, and also a significant source of fat. Table 5 shows the nutrient content.

**Pisonia grandis –Puka Tree:** This tree is most commonly seen on sandy shores of high islands and atolls. It has soft

**Table 3a. Coconut - the nutrient content of the germinating coconut embryo**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	24	Kcal	Protein	0.43	g
Carbohydrate	3	g	Fat	1.2	g
Vitamin C	2	mg	Calcium	6.3	mg

\* Values are for 28.35 g (1 oz.) of material.  
 All the rest of the nutrients are below 0.2 mg or data is unavailable.  
 Source: Nutritionist IV 1994

**Table 3b. Coconut - the nutrient content of fresh coconut**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	100.4	Kcal	Potassium	100.9	mg
Fat - Total	9.497	g	Soluble Fiber	0.2835	g
Saturated Fat	8.42	g	InSol. Fiber	2.381	g
Cholesterol	0.0	mg	Vitamin D	0.0	IU
Sodium	5.67	mg	Vit E-Alpha Eq.	0.207	mg
Carbohydrates	4.309	g	Thiamin-B1	0.0187	mg
Dietary Fiber	2.665	g	Riboflavin-B2	0.0057	mg
Sugars	1.755	g	Niacin-B3	0.1531	mg
Protein	0.9469	g	Vitamin B6	0.0153	mg
Vitamin A IU	0.0	IU	Folate	7.484	mcg
Vitamin C	0.9384	mg	Vitamin B12	0.0	mcg
Calcium	3.969	mg	Biotin		mcg
Iron	0.6917	mg	Pantothenic	0.085	mg
Water	13.32	g	Phosphorus	32.04	mg
Ash	0.275	g	Iodine	0.2835	mcg
18: 0- Stearic	0.4905	g	Magnesium	9.072	mg
Mono Fat	0.4504	g	Zinc	0.3147	mg
Poly Fat	0.1038	g	Copper	0.1233	mg

\* Values are for 28.35 g (1 oz). Water content: 47%  
 Source: Genesis 1995

**Table 3c. Coconut - the nutrient content of fresh coconut cream**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	93.56	Kcal	Potassium	92.14	mg
Fat Total	9.837	g	Vitamin D IU	0.0	IU
Saturated Fat	8.732	g	Vit E-Alpha Eq.	0.3188	mg
Cholesterol	0.0	mg	Thiamin-B1	0.0085	mg
Sodium	1.134	mg	Riboflavin-B2	0.0	mg
Carbohydrates	1.888	g	Niacin-B3	0.2523	mg
Dietary Fiber	0.6237	g	Vitamin B6	0.0133	mg
Sugars	1.264	g	Folate	6.52	mcg
Protein	1.032	g	Vitamin B12	0.0	mcg
Vitamin A IU	0.0	IU	Biotin	-	mcg
Vitamin C	0.7966	mg	Pantothenic	0.074	mg
Calcium	3.118	mg	Phosphorus	34.59	mg
Iron	0.6492	mg	Iodine	0.567	mcg
Water	15.28	g	Magnesium	7.938	mg
Ash	0.3289	g	Zinc	0.2722	mg
18: 0- Stearic	0.5103	g	Copper	0.1072	mg
Mono Fat	0.4196	g			
Poly Fat	0.1074	g			

\* Values are for 28.35 g (1 oz). Water content: 53.9%  
 Source: Genesis 1995

**Table 3d. Coconut - the nutrient content of fresh coconut milk**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	68.94	Kcal	Soluble Fiber	-	
Fat Total	7.134	g	InSol. Fiber	-	
Saturated Fat	6.325	g	Sugar Alcohol	-	
Cholesterol	0.0	mg	Vitamin D IU	0.0	IU
Sodium	4.496	mg	Vit E-Alpha Eq.	0.2188	mg
Carbohydrates	1.664	g	Thiamin-B1	0.0078	mg
Dietary Fiber	0.6625	g	Riboflavin-B2	0.0	mg
Sugars	1.001	g	Niacin-B3	0.2188	mg
Protein	0.6894	g	Vitamin B6	0.0099	mg
Vitamin A IU	0.0	IU	Folate	4.826	mcg
Vitamin C	0.8423	mg	Vitamin B12	0.0	mcg
Calcium	4.796	mg	Biotin	-	mcg
Iron	0.4946	mg	Pantothenic	0.0549	mg
Water	20.26	g	Phosphorus	29.98	mg
Ash	0.2158	g	Iodine	-	mcg
18: 0- Stearic	0.3687	g	Magnesium	11.09	mg
Mono Fat	0.3028	g	Zinc	0.2008	mg
Poly Fat	0.0782	g	Copper	0.0797	mg
Potassium	78.84	mg			

\* Values are for 29.98 g (1.057 oz). Water content: 95.0%  
 Source: Genesis 1995

**Table 4. Taro root - the nutrient content of fresh swamp taro root**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	25	Kcal	Protein	0.17	g
Cholesterol	6	g	Fat	0.07	g
Na	24	mg	Saturated Fat	unavailable	
Mg	7	mg	Potassium	22.33	mg
Zn	0.7	mg	Calcium	60.67	mg
Folate	unavailable		Phosphorus	unavailable	
Vitamin C	5.23	mg	Vitamin A	1.67	ug
Iron	0.2	mg			

\* Values are for 28.35 g (1 oz).  
 All the rest of the nutrients are below 0.2 mg or data is unavailable.  
 Source: South Pacific Commission, 1994

**Table 5. Pandanus - the nutrient content of fresh pandanus fruit**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	41.0	Kcal	Protein	1.4	gm
Carbohydrates	3.4	gm	Fat	2.4	gm
Iron	1.0	mg	Calcium	3.7	mg
Vit. C	2.3	mg	Vit. A (beta carotene)	202.4	mg

\* Values are for 28.35 g (1 oz).  
 All the rest of the nutrients are zero or data is unavailable.  
 Source: Nutritionist IV 1994

**Table 3e. Coconut - the nutrient content of fresh coconut water**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	5.695	Kcal	Potassium	74.94	mg
Fat Total	0.06	g	Vitamin D IU	0.0	IU
Saturated Fat	0.0528	g	Vit E-Alpha Eq.	0.0	mg
Cholesterol	0.0	mg	Thiamin-B1	0.009	mg
Sodium	31.47	mg	Riboflavin-B2	0.0171	mg
Carbohydrates	1.115	g	Niacin-B3	0.024	mg
Dietary Fiber	0.3327	g	Vitamin B6	0.0096	mg
Sugars	0.7824	g	Folate	0.7524	mcg
Protein	0.2158	g	Vitamin B12	0.0	mcg
Vitamin A IU	0.0	IU	Biotin	-	mcg
Vitamin C	0.7224	mg	Pantothenic	0.0129	mg
Calcium	7.194	mg	Phosphorus	5.995	mg
Iron	0.0869	mg	Iodine	-	mcg
Water	28.48	g	Magnesium	7.494	mg
Ash	0.1169	g	Zinc	0.03	mg
18: 0- Stearic	0.003	g	Copper	0.012	mg
Mono Fat	0.0024	g			
Poly Fat	0.0006	g			

\* Values are for 29.98 g (1.057 oz). Water content: 95.0%

Source: Genesis 1995

weak wood. The bark is occasionally used in native medicines. The edible, young leaves can be boiled and eaten as a tasty vegetable, or are used fresh in salads. No nutrient analysis was found. Table 5 shows the nutrient content.

**Portulaca lutea – Seaside Purslane and Portulaca oleracea – Purslane:** Seaside purslane are low growing, succulent plants commonly seen on lava or limestone shores and sandy beaches while purslane is a weed of disturbed places. They both have a large edible root that is cooked, often with coconut cream. The leaves are good when eaten fresh, but nowadays the plants are used mostly as food for pigs. No nutrient analysis was found.

**Psidium guajava– Guava:** Guava grows as a small tree commonly found in pastures, plantations, and along roadsides. The fruit, containing a yellow to pink pulp, is edible and can be eaten ripe or made into jams, jellies, or drinks. Table 6 shows the nutrient content.

**Sesuvium portulacastrum – Seaside Ice Plant:** The Seaside ice plant is a low growing succulent herb found on rocky shores, sea cliffs and coastal salt marshes. It is very salt-tolerant and flourishes in wave-splashed, high saline habitats.

The leaves are edible, fresh or boiled. No nutrient analysis was found.

**Tacca leontopetaloides – Polynesian Arrowroot:** The Polynesian arrowroot is found throughout the tropical Pacific islands. Starch can be extracted from the grated root and used as a thickener for other foods. The starch has also been used to stiffen fabrics and as an ingredient in some native medicines. It can be mixed with uto (the spongy meat of a germinating coconut) and sugar to make a pie filling. No nutrient analysis was found.

**Terminalia catappa – Tropical Almond Tree:** The Tropical almond is a large tree originally from tropical Asia and is now commonly found on high islands of Polynesia. The highly prized wood is used in making houses and canoes, and the bark has commonly been used for treating mouth infections.

The edible kernel of the fruit is eaten mostly by children because it is so laborious to extract. During times of famine, however, it is a source of food for all age levels. No nutrient analysis was found.

**Table 6. Guava - the nutrient content of fresh guava**

Nutrient	Amount*	Unit	Nutrient	Amount*	Unit
Calories	14.46	Kcal	Soluble Fiber	0.7654	g
Fat Total	0.1701	g	InSol. Fiber	0.7654	g
Saturated Fat	0.0488	g	Sugar Alcohol	0	g
Cholesterol	0.0	mg	Other Carbs	0.1418	g
Sodium	0.8505	mg	Vitamin D IU	0.0	IU
Carbohydrates	3.374	g	Vit E-Alpha Eq.	0.3175	mg
Dietary Fiber	1.531	g	Thiamin-B1	0.0142	mg
Sugars	1.701	g	Riboflavin-B2	0.0142	mg
Protein	0.2325	g	Niacin-B3	0.3402	mg
Vitamin A IU	224.5	IU	Vitamin B6	0.0405	mg
Vitamin C	52.16	mg	Folate	3.969	mcg
Calcium	5.67	mg	Vitamin B12	0.0	mcg
Iron	0.0879	mg	Biotin		mcg
Water	24.41	g	Pantothenic	0.0425	mg
Ash	0.1701	g	Phosphorus	7.088	mg
18: 0- Stearic	0.0045	g	Iodine		mcg
Mono Fat	0.0156	g	Magnesium	2.835	mg
Poly Fat	0.0717	g	Zinc	0.0652	mg
Potassium	80.51	mg	Copper	0.0292	mg

\* Values are for 28.35 g (1 oz). Water content: 86.1%

Source: Genesis 1995

## Conclusion

A number of edible vascular plant species exists on the Line Islands but nutrient analysis data is sparse. Few of the plants have been previously analyzed for nutrient content. It is important to identify these plants and have the nutrient analysis available especially for those who intend to settle or visit the area (planned or unplanned) for an extended period of time.

## Acknowledgments

The author wishes to gratefully acknowledge Doctors W. Arthur Whistler and Angela Kay Kepler for their generous and inspirational sharing of their time and expertise.

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**“ ... the current average population growth of Pacific countries is around 2.2% and projections suggest that the population will grow at 2.7% a year ... and the population will double in the next 25 years. ... there is a very close correlation between population and poverty ... and health-related concerns. ... I believe we face a very challenging task in our health problems in the next quarter century. ”**

**THE HONORABLE MR. BERENADO VUNIBOBO**

***Address to Meeting on Postgraduate Medical Education in the Pacific, Dec. 1995***