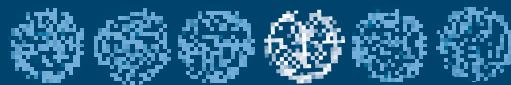


PACIFIC ROOT CROPS





4.0 ROOT CROPS IN THE PACIFIC

Tropical root crops are grown widely throughout tropical and subtropical regions around the world and are a staple food for over 400 million people. Despite a growing reliance on imported flour and rice products in the Pacific, root crops such as taro (*Colocasia esculenta*), giant swamp taro (*Cyrtosperma chamissonis*), giant taro (*Alocasia macrorrhiza*), tannia (*Xanthosoma sagittifolium*), cassava (*Manihot esculenta*), sweet potato (*Ipomoea batatas*) and yams (*Dioscorea* spp.) remain critically important components of many Pacific Island diets, particularly for the large rural populations that still prevail in many PICTs (Table 4.1).

Colocasia taro, one of the most common and popular root crops in the region, has become a mainstay of many Pacific Island cultures. Considered a prestige crop, it is the crop of choice for traditional feasts, gifts and fulfilling social obligations in many PICTs. Though less widely eaten, yams, giant taro and giant swamp taro are also culturally and nutritionally important in some PICTs and have played an important role in the region's food security. Tannia, cassava and sweet potato are relatively newcomers to the Pacific region but have rapidly gained traction among some farmers on account of their comparative ease of establishment and cultivation, and resilience to pests, disease and drought.

Generations of accumulated traditional knowledge relating to seasonal variations in rainfall, temperature, winds and pollination, and their influence on crop planting and harvesting times now lie in jeopardy given the unparalleled speed of environmental change impacting the region. Left unchecked, climate change will seriously erode food security and agricultural livelihoods in all Pacific Island countries. To make substantial reduction in the pending impacts of climate change on agricultural productivity in the region, climate change must be tackled head on with a calculated and planned approach that draws on both modern and indigenous agricultural production practices. Arguably the greatest challenge lies in synthesising and transferring this knowledge to the many thousands of Pacific Islanders growing crops for the dinner plate and market place alike. (See [TOOLS 1-46](#) for further information.)

Table 4.1: Root crop production, populations, total and arable land areas for FAO member states in the Pacific region

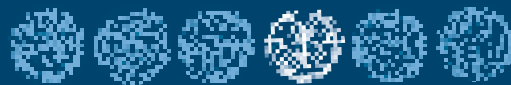
PACIFIC COUNTRY	TARO (tonnes/year)	CASSAVA * (tonnes/year)	TOTAL POPULATION (year)	RURAL POPULATION	LAND AREA (km ²)	ARABLE LAND
Cook Islands		1 500	19 569 (06)	30%	236	12.7%
FSM			107 008 (00)	78%	702	3.7%
Fiji	74 009	55 773	827 900 (07)	49%	18 272	9.2%
Kiribati	2 200	50	92 533 (06)	54%	726	2.5%
Marshalls			50 840 (99)	33%	181	10.8%
Nauru			8 800 (07)	0%	21	-
Niue	3 300		1 625 (06)	-	260	11.6%
Palau			1 990 (05)	23%	459	2.2%
PNG	285 000	145 000	6 600 000 (09)	85%	462 000	0.5%
Samoa	18 634		180 741 (06)	78%	2 831	8.8%
Solomons	44 000	25 000	533 672 (06)	84%	28 896	0.6%
Tonga	3 800	97 000	101 134 (06)	57%	747	19.9%
Tuvalu			12 177 (08)	58%	26	-
Vanuatu	Unreported		217 000 (05)	76%	12 189	1.7%

*Estimated production source = 2008 FAOSTAT data: www.faostat.fao.org

4.0.1 Root crop nutrition

Root crops are widely available in all PICTs and form one of the main sources of energy and nutrients for Pacific Islanders. For example, tubers represent almost 40 percent and 50 percent of the energy intake in Tonga and the Solomon Islands, of which taro is a vital component. The taro tuber (corm) is an excellent source of both energy and fibre and, when eaten regularly, provides a good source of calcium and iron. Sweet potatoes and yams are also good sources of energy, which the body needs to stay active. The yellow and orange varieties of the sweet potato root contain a high amount of Vitamin A and all varieties contain appreciable quantities of Vitamin C. Yams provide significant quantities of vitamin B1, vitamin C and dietary iron and niacin.

Some Pacific root crops such as sweet potato, taro and cassava have leaves that are also edible and nutritious. Taro leaves, for example, are an excellent source of protein, dietary fibre and a wide range of vitamins and minerals including carotene,



potassium, calcium, phosphorous, iron, riboflavin, thiamine, niacin, vitamin A and vitamin C. (See [TOOLS 33 & 44](#) for further information on nutrition.)

4.0.2 Pacific trade

While Pacific root crops are grown largely for domestic consumption in gardens and smallholdings, some international trade of root crops is carried out with Australian and New Zealand and, to a lesser extent, North America. While there is good scope to expand these and other international trade markets, efforts are also required to promote and establish intraregional trade of root crops between neighbouring Pacific Islands. Such trade has the potential to improve regional food security and to create livelihood opportunities within Pacific Island agricultural sectors.

4.0.3 Storage and preservation

Most types of root crops can be “field stored”, meaning left in the ground to grow, for varying lengths of time until they are needed for eating. The time varies from a few months to many years in the case of *Cytosperma* taro. In fact, given that some root crops, such as Colocasia taro, can perish quite quickly following harvesting, field storage is often the best solution for keeping root crops fresh.

When field storage is not practicable, there are some traditional methods of preservation that can be used to extend the shelf life of root crops. One such method involves storing the tubers underground in purpose-built pits lined with coconut husks or banana leaves that are then covered with soil. The tubers may be kept for up to 2 to 3 months in this fashion.

It is also possible to bake the tubers in a hot earth oven until an external crust is formed. The tubers can then be stored for up to a week or more before eating. Or, they can be preserved by parboiling the root, slicing it thinly and then sun-drying the tuber slices. Taro root prepared in this fashion will keep up to several months when stored in a tightly sealed jar, tin or plastic bag.

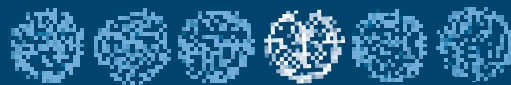
In Hawaii and Tahiti, taro is also stored as poi – a food that is commonly consumed during traditional feasts. Poi is made from *Colocasia taro* that has been steamed in an earth oven, peeled and then pounded on a flat stone or a special wooden bowl (*kumete*) to form a paste-like texture. During the process of pounding, a small amount of water is added to achieve the best consistency of the mixture to form the poi. It can then be eaten fresh, stored overnight to mature (ferment) for flavour, or stored for several weeks before being consumed.

The spread of freezers through the Pacific region has obviously provided a modern method of preserving root crops for long-term storage. Peeling and freezing of root crops can provide convenient storage for several months and is increasingly used by Pacific agricultural exporters to bypass stringent quarantine requirements imposed by developed trading partners. (See [TOOL 45 for further information on traditional food storage techniques.](#))

4.0.4 Growing conditions

Because there are a variety of tropical root crops grown in the Pacific, there are essentially crops suited to almost every climate and growing condition encountered across the region. Even in locations where the soils are sandy, shallow and nutrient deficient, as is the case on many low-lying atolls, farmers improve soil growth conditions through the addition of organic matter and traditional fertilizers.

The variety of soil and rainfall requirements among the different root crops gives farmers the opportunity to mix-and-match different crops to different growing conditions. Astute farmers are also able to hedge their bets against variable rainfall by planting crops with differing soil moisture requirements. For example, cassava, tannia and sweet potato can be grown in semi-arid regions and are considered more drought tolerant than yam and taro species. In contrast, most varieties of taro are best adapted to higher rainfall areas, and some species actually thrive within saturated soil conditions and even within brackish waters containing 25-50 percent seawater.



Such conditions would quickly kill most types of root and vegetable crops. Table 4.2 provides an overview of the growth requirements for the major root crops cultivated in the Pacific region.

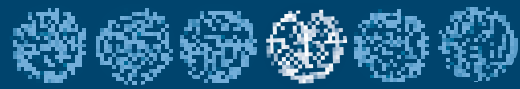
4.1 ADAPTATION STEPS FOR ROOT CROPS

In addition to many of the adaptation steps outlined in Modules 2 and 3, it is also important that farmers do not “*store all their eggs in one basket*”. Climate change is likely to be accompanied by increased climate variability that will see increased frequency and/or intensity of extreme weather events including drought and flooding. By diversifying root crops and using drought and water tolerant varieties, farmers can reduce the risk of crop failure and build resilience into their farming practices. The following three adaptation steps specify root crops but could be applied equally to other agricultural crops.

- ~ Step 28 - Growing multiple crops and diversifying crop mixes – to include drought-resistant varieties of cassava, tannia and taro – provides a useful means of helping maintain food security during dry spells and periods of mild drought. It also protects farmers against market fluctuations that may see the demand for some crops plummet during market surpluses.
- ~ Step 29 - Awareness among stakeholders of the probable impacts of climate change on agriculture and root crops is required at all levels. Farmers and relevant stakeholders should be made aware of the adaptive steps available to maintain and enhance agricultural production food security in the Pacific region.
- ~ Step 30 - Monitoring and evaluation systems to determine the success of agricultural adaptation strategies for root crops are critically important so that farmers can learn from their mistakes and successes and share this vitally important information.

Table 4.2: Description and growth requirements for the major root crops cultivated in the Pacific region (Primary Sources: See TOOLS 29 & 30.)

ROOT CROP	GENERAL DESCRIPTION AND CROP REQUIREMENTS
<p>TARO <i>(Colocasia esculenta)</i></p> <p>Known as:</p> <ul style="list-style-type: none"> ~ <i>dalo</i> in Fiji, ~ <i>talo</i> in Samoa and Tonga, ~ <i>te taororo</i> in Kiribati, ~ <i>taro tru</i> in PNG, ~ <i>aelan taro</i> in Vanuatu. 	<p>Description: Taro is a perennial herb that has heart-shaped leaves and grows 1-2 metres high. It is one of the most widespread root crops of the humid tropics. Its corm may be harvested 8 to 12 months after planting. The taro corm has limited – approximately two weeks – storage life post harvest. While there are eight recognized variants of common taro, only two are usually cultivated. Most of the taro grown in the Pacific is <i>Colocasia esculenta</i> (L.) Schott var. <i>esculenta</i> (also known as “dasheen” taro) which has a large central corm. <i>Colocasia esculenta</i> (L.) Schott var. <i>antiquorum</i> is often preferred in places where taro is grown primarily for leaves because it has a central corm with several relatively large “cormels” surrounding it. <i>Colocasia taro</i> is susceptible to some pests and diseases including taro leaf blight, plant leaf hoppers, caterpillars and mites.</p> <p>Crop requirements: Taro generally grows best in a wet, humid environment. Most varieties do not tolerate drought. It is typically grown in “wetland” conditions in upland areas with rainfall over 2 000mm/year but can tolerate lower rainfall if it is well distributed throughout the growing season. It responds well to N, P & K applications and is often the first crop grown in rotation following bush clearing. It is sometimes grown as a monocrop but is also widely planted in multiple cropping systems with other root crops including bananas, plantains and tree crops. It is not tolerant to salinity and, while shading may improve establishment, production is higher when exposed to direct sunlight in later stages of growth. It can be grown in both light (sandy) or heavy (clay) soils but prefers slightly acidic growing conditions (pH 5.5-6.5) and does not compete well with weeds during establishment.</p>



ROOT CROP**GENERAL DESCRIPTION AND CROP REQUIREMENTS****GIANT SWAMP TARO***(Cyrtosperma Chamissonis)*

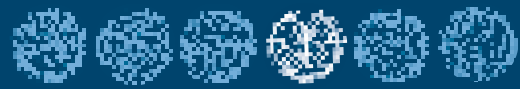
Known as

- ~ *puraka* in Cook Islands,
- ~ *te babai* in Kiribati,
- ~ *pula'a* in Samoa,
- ~ *via kan* in Fiji,
- ~ *pulaka* in Tokelau, Tuvalu,
- ~ *simiden* in Chuuk,
- ~ *swam taro* in PNG,
- ~ *navia* in Vanuatu.

Description: Giant swamp taro is a "lowland" taro species and the largest of the taro family. It may reach heights of 4-5 metres, with leaves and roots much larger than Colocasia taro. It is one of the few subsistence crops that grows well on atolls and within swampy areas of other islands, and its corm can reach weights of 80 kg or more! It may be field stored in the ground for very long periods – up to 30 years or more – and accordingly has traditionally been an important emergency crop in times of natural disaster and food scarcity. It is relatively resistant to disease and pests but is susceptible to taro beetle. It can take several years to mature but is commonly left for 15 years or more before harvest.

Crop requirements: As indicated by its name, giant swamp taro has adapted to growth within fresh water and coastal swamps. It is also commonly grown in purpose-built swamp pits in low-lying coral atolls. In the case of constructed pits various kinds of organic matter and fertilizer are usually added to the pit to improve the soil fertility, physical properties and waterholding capacity. Giant swamp taro is not suitable for growing in upland or rainfed conditions. It exhibits some shade tolerance and is considered mildly tolerant of saline growing conditions compared to other taro species, and can be grown in mildly brackish water.





ROOT CROP

GENERAL DESCRIPTION AND CROP REQUIREMENTS

GIANT TARO*(Alocasia macrorrhiza)*

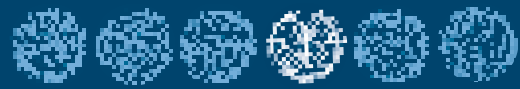
Known as:

- ~ *ta'amu* in Samoa, Tuvalu,
- ~ *kape* in Cook Islands, Tonga,
- ~ *te kabe* in Kiribati,
- ~ *paragum* in PNG,
- ~ *fila* in Solomon Islands,
- ~ *via* in Fiji,
- ~ *pia* in Vanuatu.

Description: Giant taro is a hardy plant with a thick starchy edible stem. It is predominantly found in Tonga and Samoa and is not as popular as other types of root crops. The corm may grow up to 30 cm or more in diameter and up to 2 metres in length. It is increasingly used as fodder for animals in some PICTs but will be eaten when other foods are in short supply. It is a hardy crop that is resistant to insect and pests but often sought out by foraging pigs. It can be harvested after 12 to 18 months but can be left to grow in place for several years, making it an important crop in times of food scarcity.

Crop requirements: This is an upland crop that grows best in well-drained soils with well-distributed rainfall of more than 2 000 mm/year. The crop does not tolerate poor drainage but may be relatively resistant to water stress and shade as it is often grown in stony or rocky soils and within multiple cropping systems with taller crops. It is not considered salt tolerant but is suited to both light (sandy) soils or heavier soils found on volcanic islands.





ROOT CROP**GENERAL DESCRIPTION AND CROP REQUIREMENTS****TANNIA**

(Xanthosoma sagittifolium)

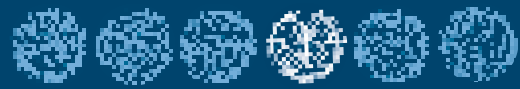
Known as:

- ~ *dryland taro* or *talo futuna* in Tonga,
- ~ *tarua* in Cook Islands,
- ~ *talo palagi* in Samoa,
- ~ *taro Fiji* in Vanuatu,
- ~ *singapo* or *taro kongkong* in PNG,
- ~ *te tannia* in Kiribati.

Description: This crop is considered easy to grow and produces a relatively high yield within 6 to 12 months after planting. It is often grown in Melanesia, where both its pointed leaves and roots are eaten, but is not particularly suited to sandy, infertile atoll soils. Tannia was brought to the Pacific about 100 years ago and is resistant to many of the pests and diseases that affect Colocasia taro. It is also much more tolerant of drought than common taro with the added advantage that, once harvested, the root may be stored in a cool, dry place for several months.

Crop requirements: This crop is considered an upland taro species and grows best in areas receiving between 1 500 to 2 000 mm of rainfall per year, although it can be grown in areas with rainfall as low as 1 000 mm/year. The plant roots within 15-20 cm of the soil surface and requires well-drained and relatively fertile growing conditions. It is not well suited to planting on sandy, nutrient-deficient atoll soils but can be grown where these soils have been amended with organic materials. It is not considered salt tolerant.





ROOT CROP**GENERAL DESCRIPTION AND CROP REQUIREMENTS****CASSAVA***(Manihot esculenta)*

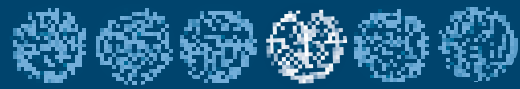
Known as:

- ~ *maniota* in Cook Islands,
- ~ *tapioca* or *tavioka* in Fiji,
- ~ *manioka* in Samoa,
- ~ *manioc* in Vanuatu

Description: The cassava plant is a relatively new import to the Pacific and, given that it is easy to grow and simple to prepare, is becoming increasingly popular as a food and livestock fodder crop. Its nutritious leaves are eaten in some areas. Its starch-rich root is used in industry elsewhere in the world for glue-making and other industrial purposes.

Crop requirements: Grows best in well-distributed rainfall setting of 1 000–1 500 mm/year. Higher rainfall levels can reduce tuber growth. It is considered highly tolerant of drought and can be grown in areas receiving as low as 500 mm/year. Cassava has low nutrient requirements and can be grown in relatively infertile soils. Hence it is often used as a final crop in rotations prior to returning land to fallow. It competes well with weeds but is sensitive to shade.





ROOT CROP**GENERAL DESCRIPTION AND CROP REQUIREMENTS****SWEET POTATO***(Ipomoea batatas)*

Know as:

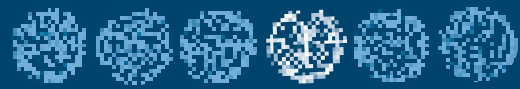
- ~ *kumara* in Cook Islands
- ~ *umala* in Samoa,
- ~ *kumala* in Fiji, Tonga,
- ~ *kaukau* in PNG,
- ~ *te kaina* in Kiribati

Description: Sweet potato is a creeping plant and the only economically important species of the family Convolvulaceae. The starchy, tuberous roots are the major source of food, but the leaves are also a useful source of vegetable greens in some countries.

In PNG, it is the major crop and staple food. It is also an important crop in the Solomon Islands and Tonga, and is increasingly found in other PICTs.

Crop requirements: Grows best in high rainfall areas of about 1 500–2 500 mm/year. Higher rainfall may induce excessive vegetative growth at the expense of tuber growth. Grows well in a variety of well-drained soil types but does not tolerate shading.





ROOT CROP

GENERAL DESCRIPTION AND CROP REQUIREMENTS

YAMS

(*Dioscorea alata*, *D. esculenta*,
D. bulbifera, *D. pentaphylla*,
D. hispida, *D. rotundata*, and
D. trifida, *D. nummularia*)

Known as:

- ~ *u'i* in Cook Islands,
- ~ *ufi* in Samoa,
- ~ *uvi* in Fiji,
- ~ *yam/mami* in PNG.

Description: Yams are a high value food that are easily grown and mature quickly in the right soil conditions. Unlike most other tropical root crops, yams exhibit good keeping qualities and may be harvested well in advance of eating.

Crop requirements: Most varieties of yams grow best in rainfall of >1 500 mm/year and require a minimum 6-month growing season with well-distributed rainfall. Yams do not tolerate poorly drained soils or waterlogging. They are mildly drought tolerant but do not compete well with weeds for soil nutrients. Yams should be staked to improve yield, and reduce weed competition and the incidence of anthracnose disease. They exhibit early shade tolerance during establishment but require full sun for good yields.



