

Tuber crops

Tuber crops are underground crops. The most important ones in Malaysia are the white potato, the sweetpotato*, cassava and cocoyam.

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Plants that produce tubers use the tubers as storage organs, mainly for storing starch. Technically, a tuber is either a modified stem, as in white potato (*Solanum tuberosum*) and cocoyam (*Colocasia esculenta*) when it is also known as a corm, or a modified root such as in sweetpotato (*Ipomoea batatas*) and cassava (*Manihot esculenta*). The tuber crops in Malaysia



Colocasia esculenta



Colocasia esculenta



Colocasia esculenta



Colocasia esculenta: A variety known as "eddo" characterised by small tubers

* Alternative way of writing "sweet potato"

are either indigenous or introduced. Few of the indigenous species (*aroids and various yams*) are cultivated on a commercial scale; they are often found wild in secondary jungle, or planted to a very limited extent in home-gardens. The introduced types were mostly introduced during

the colonial period. Of the introduced species, cassava, sweetpotato, yam bean (*Pachyrrhizus erosus*), tannia (*Xanthosoma sagittifolium*) and arrowroot (*Maranta arundinacea*) are tropical in origin, whereas white potato, carrot (*Daucus carota*) and radish (*Raphanus sativus*) come from temperate regions.

Origins of root crops found in Malaysia

Root crop	Common name	Origin
<i>Amorphophallus paeoniifolius</i>	Elephant foot yam	Southeast and South Asia
<i>Colocasia esculenta</i>	Cocoyam or taro	India, Southeast Asia
<i>Daucus carota</i>	Carrot	Afghanistan
<i>Dioscorea alata</i>	Purple yam, Greater yam	South Asia (Assam-Burma area)
<i>Dioscorea bulbifera</i>	Potato yam	Tropical West Africa, Southeast Asia
<i>Dioscorea esculenta</i>	Lesser yam	South Asia, Papua New Guinea
<i>Dioscorea hispida</i>	Intoxicating yam	Southeast Asia
<i>Eleocharis dulcis</i>	Chinese water chestnut	India, Southeast Asia and Polynesia
<i>Ipomoea batatas</i>	Sweetpotato	Tropical America (Mexico, Central America and Caribbean)
<i>Manihot esculenta</i>	Cassava	Tropical America (from Caribbean to Northeast Brazil)
<i>Maranta arundinacea</i>	Arrowroot, kudzu	Tropical America
<i>Nelumbo nucifera</i>	Lotus root	Southeast Asia
<i>Pachyrrhizus erosus</i>	Yam bean	Mexico and northern South America
<i>Raphanus sativus</i>	Radish	Mediterranean region
<i>Smilax myosotiflora</i>	Ubi jaga	Southeast Asia
<i>Solanum tuberosum</i>	Potato	Andean South America (Colombia, Bolivia and Peru)
<i>Solenostemon rotundifolius</i>	Hausa potato	Central and East Africa
<i>Xanthosoma sagittifolium</i>	Tannia	Central America (Caribbean to North Brazil)

The total area of tuber crops under cultivation in Malaysia is small compared to oil palm, rubber and fruit trees. The major tuber crops like cassava, sweetpotato, cocoyam and yam bean have official statistics published by the Department of Agriculture, Peninsular Malaysia. The cultivated areas of the rest are considered negligible.

Cassava, of the Euphorbiaceae family, is related to rubber and castor-oil plant. White potato belongs to the nightshade family (Solanaceae), which it shares with chilli, brinjal and tomato, while yam bean is actually a legume or bean (of

the family Leguminosae), as its name suggests. The largest group of tuber crops are the aroids (Araceae) which include cocoyam and elephant foot yam (*Amorphophallus paeoniifolius*). A common feature among the aroids is their distinctive inflorescence, which in many species (e.g. *A. titanum* or titan arum) emits an odour resembling rotting meat. This odour attracts flies to visit and pollinate the flowers. The Hausa potato, *Solenostemon rotundifolius*—locally known as ubi kemili—belongs to the same family (*Lamiaceae*) as the colourful foliage plants of the genus *Coleus*. Indeed, its older name was *Coleus tuberosus*.

Area of cultivated root crops in Peninsular Malaysia

Scientific name	Malay name	Chinese name	Area (ha)
<i>Colocasia esculenta</i>	Ubi keladi	yù tou	384
<i>Daucus carota</i>	Lobak merah	hóng luó bo	
<i>Dioscorea esculenta</i>	Ubi torak	sh ^ˇ yù	
<i>Dioscorea hispida</i>	Ubi gadung		80e
<i>Dioscorea alata</i>	Ubi badak, ubi kenduduk		
<i>Dioscorea bulbifera</i>	Ubi cina		
<i>Ipomoea batatas</i>	Ubi keledek	f ^ˇ n sh ^ˇ	2386
<i>Maranta arundinacea</i>	Ubi garut	f ^ˇ n gé	
<i>Manihot esculenta</i>	Ubi kayu	mù shù	3053
<i>Pachyrrhizus erosus</i>	Sengkuang	dòu sh ^ˇ	227
<i>Raphanus sativus</i>	Lobak putih	luó bo	
<i>Smilax myosotiflora</i>	Ubi jaga		
<i>Solanum tuberosum</i>	Ubi kentang	Shù	
<i>Solenostemon rotundifolius</i>	Ubi kemili		15-25 ^e
<i>Xanthosoma sagittifolium</i>	Keladi telur		
° Estimate			

Some tuber crops are largely imported rather than cultivated in Malaysia. These include lotus root (*Nelumbo nucifera*), arrowroot (*Maranta arundinacea*) and Chinese waterchestnut (*Eleocharis dulcis*) from the sedge family (Cyperaceae).

Tuber crops in the Malaysian diet

Starch can be extracted from the tubers for use in a host of manufacturing industries—both food and non-food. However, in Malaysia cassava has been the only tuber crop used for starch processing.

Tuber crops play varied roles in the Malaysian diet. In the past, in times of staple food shortages, tuber crops have proved useful as supplements. For example, cassava and sweetpotato were important during World War II when rice was in short supply. After World War II the role of tuber crops as a staple food in Malaysia declined into insignificance. Instead, there has been an increase in the production of snacks, traditional and new, including *kuih* and desserts. Some popular preparations are cassava and sweetpotato fritters (e.g. *goreng ubi* and *goreng keledak*) and crisps (*kerepek*). These two types of tubers and also cocoyam are used in the production of modern extruded snacks made from reconstituted flour. Sweetpotato is used in *cakar ayam*, a traditional biscuit comprising caramel-coated fried strips, while cassava, because of its good puffing characteristic, is used to make crackers (*keropok*) of various flavours. *Bubur caca*, a favourite local sweet soup dessert, is made of cubes of colourful sweetpotato and cocoyam cooked in a syrup made from brown coconut sugar mixed with coconut milk. The small hairy tubers (also



Dioscorea alata



Dioscorea alata



Dioscorea bulbifera

known as eddo) which are eaten steamed or boiled during the Mid-autumn Festival come from a variety of the cocoyam.

Temperate tuber crops such as carrot, radish and white potato are grown on a small scale, mainly as vegetables, in the highlands of Malaysia, where cooler conditions are more conducive for their growth.

The different ethnic groups in Malaysia have somewhat different food preferences. A number of vegetable root crops are eaten on a regular basis by ethnic Chinese consumers for their reputed health-promoting properties. These include Chinese water chestnut, lotus root, yam bean, radish and arrowroot. The first three share the characteristics of being sweet and crunchy. Except for yam bean and (to a smaller extent) lotus root, these vegetable tubers are mainly imported. Like the Chinese waterchestnut and lotus root, arrowhead (*Sagittaria sagittifolia*) is an aquatic species which appears in the market usually near the Lunar Spring Festival (Chinese New Year). A largely temperate species, its starchy tubers are usually thinly sliced and fried as crisps which are eaten as a popular snack.

Chinese water chestnut, believed to have cooling properties and to sweeten the breath, can be eaten raw or cooked. The juice of Chinese water chestnut is taken to help ease nausea and treat poor appetite in children. Ground into a powder, it is used to relieve coughing. After boiling, the water is drunk to cope with measles. The detoxifying properties of water chestnut help people who have jaundice. Indeed, recent scientific studies show that the phenolics in this root crop have good anti-oxidant activity.



Dioscorea esculenta



Dioscorea hispida

Lotus root is supposed to stop internal bleeding (including nose bleeds) and to counter anaemia. Radish is often used to counter indigestion and to promote bowel movement, besides helping to clear phlegm. The bland arrowroot is especially helpful for those who feel nauseous as it soothes upset stomachs. The mashed tubers of the sweetpotato and some climbing yams are used as a poultice to alleviate soreness and inflammation.

Ubi jaga (*Smilax myosotiflora* of the Smilacaceae family) has supposedly aphrodisiac properties. It is also claimed that water from boiling the leaves and fruit can be used to cure syphilis. The aborigines in Malaysia use *ubi jaga* to treat muscle pain.

How safe are they to eat?

Some tuber crops can be toxic if not properly prepared before eating. The shoots, young leaves and root rind of all cassava varieties contain cyanogen which releases hydrogen



Dioscorea hispida



Maranta arundinacea



Dioscorea hispida

cyanide when the cells are disrupted (possibly a plant defence mechanism against herbivores); even the safe-to-eat root pith or flesh of edible varieties has a low cyanogen content. However, cyanide is highly water-soluble and volatile, and with proper processing the poisonous parts can be rendered safe for humans.

There have been controversial claims that the cyanide in cassava (which is also present in apricot kernels) has anti-cancer properties. Various names such as vitamin B17 (although it is not a vitamin), laetrile or amygdalin, the cyanogen has not shown consistent or lasting results in tests involving laboratory animals as well as in human trials, and (more dangerously) can have the side-effect of cyanide poisoning!

Sweetpotato, cocoyam and giant swamp taro, especially giant taros (which are normally not grown for food) can inhibit growth as the anti-trypsin property they possess interfere with normal protein metabolism. Fortunately, trypsin inhibitors are destroyed by heat, and can be easily deactivated by cooking.



Smilax myosotiflora



Smilax myosotiflora



Pachyrrhizus erosus

Cocoyam (as well as tannia) contains oxalic acid and its salts (as high as 780 mg per 100 g in some varieties), which can decrease calcium absorption and promote kidney stone formation. Fortunately, boiling the corm can reduce these negative effects by at least 50%. An irritant which causes intense discomfort to the lips, mouth and throat is commonly associated with eating cocoyam of unknown variety. This acidity is caused partly by the microscopic needle-like calcium oxalate crystals (raphides) together with probably a protease. Boiling reduces considerably the irritant effect when cocoyam is eaten.

Certain other tubers produce poisonous alkaloids. Some climbing yams, such as *Dioscorea hispida*, produce the alkaloids dioscorine and dioscoricine which have to be washed out before the tubers can be eaten. Even the white potato can be dangerous. If its tubers are exposed to sunlight, the poisonous solanine forms. So, when one comes across greenish white potato, one should beware. The greenish tinge is caused by chlorophyll which develops on exposure to sunlight. Chlorophyll itself of course is harmless, but alerts one to the presence of solanine in the tubers.



Xanthosoma sagittifolium



Xanthosoma sagittifolium