The Status of Keladi China *Colocasia Esculenta* (L.) Schott Cultivation in Peninsular Malaysia

Farah D. Ghani
Lecturer Botany Unit
University of Kebangsaan
Malaysia

Abstract

'Taro' popularly known as *keladi* in Malaysia is found in dry and wet habitats in all parts of the country. More than 30 cultivars have been found growing in semi-wild, semi-cultivated and cultivated states. The edible cultivars are propagated in back garden plots for family consumption. The only cultivar which is grown on a "commercial" scale is "Keladi China." There is good market potential and demand for this variety in Malaysia and Singapore.

The paper summarizes the cultural practices involved in Keladi China cultivation in Peninsular Malaysia.

Introduction

Colocasia esculenta (L.) Schott, a member of the Arum (Araceae) family is most widely known as taro. In Malaysia, this herbaceous, corm-producing plant is popularly known as *keladi.*

In Peninsular Malaysia, 35 varieties of *keladi* have been found growing in the wild, semi-wild and cultivated state. Morphological identification and documentation of the varieties is being prepared (Ghani, 1979-80) as hitherto no complete account exists in Malaysia.

Both wet and dry lowland varieties are grown. Wetland varieties are fewer and are found growing in the wild, or cultivated states in small clumps along side paddy field *batas* (ridges). Dryland varieties have been cultivated in gardens and on a limited commercial scale. A few upland varieties (1219 m) with a peculiar leaf morphology and coloration have also been collected from semi-damp habitats.

The most economically important and widely grown variety is Keladi China, a single corm dasheen under dryland (lowland) management in the Southern State of Johore, Northern State of Perak and in the Central State of Selangor in Peninsular Malaysia.

Other less important and hence less widely grown varieties under dryland cultivation include Keladi Minyak, K. Chinchang Wangi, K. Udang, K. Serakit and K. Pinang to name but a few of the more popular ones.

Cultivated Area. On a country-wide basis, the area under *keladi* cultivation (largely in the three states mentioned) has been decreased from 630 ha in 1968 to 494 ha in 1976 and the area cultivated fluctuates from year to year but on a declining trend (Table 1).

However, it is encouraging to note that *keladi* cultivation is being encouraged by

State agricultural schemes, as a cash crop on peat soils especially in Johore where there has been a significant increase in area from 32 ha in 1973 to 235 ha in 1975 (Chee *et al.*, 1976).

Botanical Description. Keladi China is a corm-bearing plant of 90-110 cm height, with large ovate peltate leaves. The abaxial leaf surface is dark green and glaucos. The adaxial leaf surface is dark green and glucose. The adaxial surface is pale green with a prominent V sinus venation of purplish pink. A complimentary fine margin of the same color outline the wavy lamino margin.

The petioles stand erect with distinct pinkish white basal band leading up two-thirds of the petiole length in dark green and blending into a purplish greenish hue at the petiole-lamina junction.

The elongate, cylindrical (16-28 cm) corm is thickest at the middle (8-10 cm diameter) and tapered at the top and basal ends. Scale leaves and outer skin are purplish pink and the flesh is firm, whitish and speckled with pink fibers and pinkish purple spots (Ghani, 1978). Stoloniferous suckers or *sulur* appear at the third or fourth month from the corm region.

Climate and Soils. Peninsular Malaysia experiences a hot, wet climate with daily average temperatures between 27-32°C, annual precipitation of 2000-2500 m with some variation during the wetter months on the East and West Coasts (Dale, 1959), respectively and a relative humidity range of 70%-90%. The rainy and dry seasons are distinguished as two periods in the year. These climatic conditions are ideal for *keladi* growth in most parts of Peninsular Malaysia. The governing factor for successful cultivation being soil type.

K. China is in fact cultivated on a variety of soils ranging from moist alluvial soils to coastal clays and now on peat soils. The latter have been found suitable for many varieties of *keladi.*

Planting Practices in Malaysia

Land Preparation. Usually, land is cleared of weeds and shrub vegetation by burning and is cultivated with a hand hoe (*cangkol*). Herbicide eg. 'Paraquat' is then applied at 2-4 liters per hectare in 40-50 gallons of water. Among other commonly used herbicides are preemergent weedicide prometryne at 1-2 kg/ha and diuron at 3-4 kg/ha. These have been found to be partially effective by the farmers for dryland *keladi.* After two or three days, the surface is raked smooth in preparation for planting.

Dryland *keladi* is planted on ridges or furrows. Planting rows are prepared 60-90 cm apart between rows using string guides while between plants, the spacing is kept at about 46-60 cm.

The practice of crop rotation allows the grower to plan the harvest of the previous crop so as to accomodate the next *keladi* planting time to coincide with the rains.

Planting Material. Planting material for the same variety of *keladi* difers in the different States. In the Northern State of Perak, the outgrowing stolons or *sulur* from three-month old parent plants are used, while in the south (Johore) and parts of Selangor, setts are preferred. These practices could be due to soil factors or traditional planting methods.

Sulur are removed carefully from disease-free, healthy, parent plants and grown in nurseries for one and a half to two months to allow the first leaves to appear and the underground corm to reach a diameter of 2-3 cm. The plantlets are then secured in bundles of 20-30 cm, loosely packed in sacks and immediately transferred to the prepared fields.

Setts material selected during weeding and desuckering consists of the corm tip (2-4 cm) and the basal (20-30 cm) portion of the petioles. Desuckering is a monthly process after the first three months of growth and is continued until the eighth month stage (Chee *et al.*, 1976). Those required as sett material is left to grow till the required size and also, the smaller corms after harvesting are selected for this purpose.

Fields are usually .5-1 ha in size and a pure stand of *keladi* is managed on it. The neighboring field is planted three to four weeks later. Systematic planting methods are allowed for continuous harvesting.

Crop rotation with vegetables, chilli and maize is popular. Intercropping *keladi* between rows of coconut, oil-palm and fruit trees (bananas, guavas) is also carried out.

Planting. Planting is carried out at the beginning of the rainy season in November and growers report high yields, comparable to those suggested for *dalo* in Fiji (Sivan, 1970).

In the absence of mechanization, the grower and his family (or paid help) manage the crop from planting to harvesting. A typical field of .5 ha would take four persons, each working eight to nine hours on a normal day, to plant 2,500 plants each.

Planting begins with the preparation of the required size of the hole. Using a long (1.8 cm) wooden stick sharpened to a point at one end, a hole 11 cm deep with 4 cm radius is made for the *sulur* or sett. The size and depth of the hole is said to determine the shape and length of the harvestable corm which would have to meet consumer demands.

The planting material is placed upright, the base is covered with soil, leaving a shallow depression around the *sulur* sett to aid retention of water during the rains. Transplanting from nursery to field is carried out within two days to minimize damage or loss of viability.

Fertilizers. Taro is known to respond readily to fertilization (Hodnet, 1958; De la Pena *et al.*, 1972) in *keladi* China under Malaysian conditions. Some Chinese growers use pig manure at the time of planting and subsequently in liquid form during the vegetative period (Chee *et al.*, 1967). Cow dung at the rate of 5 lbs per plant at 2 monthly intervals is applied 4 times. Chemical fertilizer use varies from grower to grower and as required by soil conditions.

In Johore, Chemical Company of Malaysia (CCM) 77 (17% N, 8% P_2O_5, 17% K_2O) and Nitrophoska Blue Special (12% N, 12% P_2O_5, 17% K_2O, 2% MgO) are used Chee *et al.*, 1976). In Perak, NPK (15% N, 15% P_2O_5, 15% K_2O) Rustica and ammonium sulphate (21% N) are used. The application rates are:

1. 10 g/plant at 1 month after planting — NPK
2. 5 g/plant at 5 week intervals x 3 — NPK
3. 15 g/plant at 6½ months — $(NH_4)_2SO_4$

No officially recommended fertilizer rates have yet been made available.

Maintenance. The crop needs to be kept well hand-weeded and sprayed with weed killer. Normally, three weeding rounds are adequate and after seven months, no further weeding is carried out to prevent any damage to the growing corm. Young suckers, and diseased or dried leaves are removed.

Pests and Diseases. Pests and diseases have been reported as relatively unimportant by K. China growers. However, Malaysia has a variety of pests (Aljunid *et al.*, 1978), that feed on the leaves, suck juices and burrow into the corm.

Leaf blight caused by *Phytophthora colocasiae* sometimes occur during the wet weather. A serious infection spreads down the petioles to the corm, both of which eventually decay.

Harvest and Yields. The crop is harvested after nine to eleven months. The corm is hand pulled from the ground after the roots have been loosened with a sharp stick. The leaves and part of the petiole are cut away leaving a portion of the petiole attached to the corm. The corm is hand cleaned with the scale leaves being left on the corm. Most marketable corms with part of the petiole attached have to be of "table quality" in shape and size. The latter requirement has encouraged the use of *sulur* planting material in some states. Corms without petioles fetch a lower price and are sold off quickly as they do not keep long.

Corms are graded according to size:

Grade		Length	Circumference
A	(large)	22-23 cm	33 cm
B	(medium)	15-22 cm	25 cm
C	(small)	11-15 cm	23 cm

Normally, under optimum conditions, yields amount to 30-60 tons/ha with 70% grade A, 15% grade B and 15% C (Chee *et al.*, 1976).

The corms are packed into large, loosely woven rattan baskets with the largest on top and the smallest below. Each basket holds an average of 133 kg. These are loaded onto collecting lorries for distribution to Singapore, Kuala Lumpur, Ipoh and Penang, where they are sold in open markets. The corms may be kept in the baskets up to 2.5-3 weeks.

Corms typically weight 2-3 kg and are bought at US 10-25 cents per kg from the grower by the middle man. The consumer in turn pays US 60-70 cents for grade A corms while grades B and C fetch a lower price. The grower is paid only after the whole basket of corms is sold.

To stabilize *keladi* prices in the country through the year, the official Federal Agricultural Marketing Authority, has recommended scheduled planting so that the area under the crop is always between 45-56 ha throughout the year, with maximum plantings in December, February and March and the least over the April-June period as shown in Fig. 1.

Fig. 1. Schedule for Planting **Keladi** *(in ha)*

Month											
Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
52	56	53	49	49	45	47	47	47	47	49	53

Production. *Keladi* has been rated as a good income-producing crop per unit area. In Peninsular Malaysia production cost for a hectare of *Keladi* in Johore (Chee *et al.*, 1976) was US$ 1,658.00, the main items of costs being labor and fertilizers. For a low yield of 30 tons/ha, and with the corms priced at US 15-20 cents, the gross income of US$ 4,714.00 is obtained. The net income per hectare is US$ 3,055.00. For 1978, the cost of production dropped to US$ 1,326.19 with yields of 10-15 tons/ha. Gross income was US$ 2,540.00 and the net income dropped to a low of US$ 1,190.47.

This sudden drop in net income returns from production has been attributed to the lack of interest in the cultivation of the crop due to poor management, lack of advice to farmers who still resort to traditional methods of cultivation, inadequate methods of crop selection, trial and error methods of fertilizer applications and poor pest control programs.

The potential of *Colocasia esculenta* varieties in Peninsular Malaysia is not reflected by its present production trends.

Conclusion

The success of Taro cultivation in various tropical countries through the world, has contributed towards overcoming present food shortages.

In Malaysia, there is an increasing interest in introducing and developing under-exploited crops of economical, nutritional and medicinal value. *Keladi* being one of these could well receive greater attention from Malaysian researchers.

With as many as 35 or more varieties of *keladi* in Malaysia and very many more cultivars in the SE Asian region, the selection of an "ideal" taro for the region is greatly augmented. Breeding programs using both local and introduced germplasm could play an effective role in viable selective breeding programs.

Therefore, joint regional and interregional cooperative efforts in research would be necessary in maximizing the role and potential of taro.

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Table 1. Area under *Colocasia esculenta (Keladi)* cultivation in Peninsular Malaysia (in hectares)

System of Cropping	Year 1968	1969	1970	1971	1972	1973	1974	1975	1976
Sole Crop	297	87	56	96	67	91	105	247	227
Main Crop	17	19	18	6	9	2	3	2	8
Mixed Crop	642	578	606	803	401	364	416	267	523
Total Sole Crop Equivalent	631	405	373	503	374	275	316	382	494

Table 2. Per capita consumption of *Keladi* in Peninsular Malaysia, 1965-1974

Year	Consumption (tons)	Consumption (kg) per Capita
1965	21,501	2.64
1966	16,289	1.94
1967	14,545	1.67
1968	12,917	1.47
1969	11,223	1.27
1970	8,711	0.95
1971	12,009	1.28
1972	9,650	1.00
1973	8,803	0.89
1974	9,345	0.92

Sources: FAMA Report – 1976.