The Importance of *Colocasia Esculenta* In West Java, Indonesia

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Introduction

For many years, Indonesia has tried to be self-sufficient in producing rice. How serious the attempt is can easily be seen from the wide use of the high yielding varieties, the heavy employment of fertilizers and insecticides, as well as the touch of the modern equipment. However, the importation of rice is not decreasing but is increasing with time.

To ease the burden, the government has set a political will that the target of food production will no longer be rice only. With this policy, it is hoped that the staple food will no longer be rice-oriented. Instead, other available plant resources will be used accordingly.

With regard to calorie resources, tuber crops have been used for centuries. The most important among these is cassava. This is due to the fact that cassava is easy to grow and its uses vary according to the need.

In addition to cassava, there are other species of tuber crops grown in Indonesia. Though most of them are not so important in terms of the national economy, their role in subsistence agriculture is great. Together with grain legumes as a source of protein, they constitute the major diet for the people.

Compared to other minor tuber crops, taro cultivation is done in a more systematic way. It demands more attention on land preparation and other agronomical practices than the rest of the minor tuber crops. In return, the economic value of taro is much higher because the selling price of the individual corm is high. Moreover, the nutritional value of taro is comparable with that of potato, sweet potato or even with rice.

Besides its value as a source of carbohydrate, taro leaves are appreciated as a vegetable. They contain calcium, phosphorus and iron. Not all cultivars are good for this purpose, though.

There are a number of taro cultivars grown in Indonesia. They differ in the petiole and the characteristics of the leaves and tubers. To complete the range of the variation, there are also wild related taxa, the variation of which differ from the cultivated ones.

In view of the government's desire to diversify the food resources, especially those of carbohydrate resources, taro may be considered as one of the potential candidates with good qualification. For many centuries it has been cultivated, yet no serious attempt has been made to develop it into a commercial crop. Its development is possible because a great variation of cultivars is in existence enabling one to select the desired ones. With the available germplasm, one may also breed new cultivars to suit the cropping system either in wet land or dry land. It is true that taro has been neglected scientifically. In

fact, its importance has been pushed by the introduction of cassava and sweet potato. To restore its reputation, research and development are needed.

Colocasia spp.

In Indonesia, the genus Colocasia is represented by two species, i.e., *C. esculenta* (L.) Schott and *C. gigantea* (Bl.) Hook f. and are differentiated from their spathes. *C. esculenta* is characterized by a spathe which is whip-like in structure and pale yellow to deep orange in color. On the contrary, that of *C. gigantea* has a boat-shape and creamy white spathe. The two species may well be identified by their vegetative characteristics. The leaf nerves are quite prominent in *C. gigantea.* Moreover, the mature leaves stand up facing the center of the stem, while those of *C. esculenta* bend downward, away from the center of the stem.

The Indonesian samples of *C. esculenta* so far collected in the Bogor Botanical Gardens belong to two botanical varieties, i.e., *C. esculenta* var. *esculenta* and *C. esculenta* var. *antiquorum.* Though Baker and Bakhuizen van den Brink Jr. (1968) considered the two forms as synonymous, the former differs from the latter on the length of the sterile appendage. In *C. esculenta* var. *esculenta* this part is shorter than the male part. On the contrary, in *C. esculenta* var. *antiquorum* the appendage is longer. The two varieties' forms occupy distinct ecological niches as observed in Java. The wild forms of *C. esculenta* var. *esculenta* are predominantly found in areas not higher than 300 m. The cultivated and the feral forms, however, may grow in areas up to 2000 m. Wild forms of *C. esculenta* var. *antiquorum* are primarily confined to an altitude above 1100 m, and have a more restricted distribution.

With regard to *C. gigantea,* this species grows wild in Java, Sumatra and Kalimantan (Borneo). Outside these islands, this plant is also known to thrive in Malay Peninsula and Cochin China. It is distributed in lowland up to 1000 m. It is occasionally epiphytic since it could grow temporarily in the pockets of trees where humus is usually accumulated. The morphological characters show little variation. The corm in this species is not well developed. Therefore, it is hardly distinguished from the wild one though the edible form is recognized.

The cultivated forms

In Indonesia, taro is planted as a staple food in a part of Irian Java and one of the Mentawai islands. Two places are famous for taro production in Java, i.e., Bogor (West Java) and Malang (East Java). It is continuously available around Bogor but not in Malang. The whole year round supply of rain assumes its availability in Bogor because taro can be planted there regardless of the time. In Malang, however, taro is seen in the markets once a year.

There are a number of market cultivars. The following are the ones cultivated around Bogor and Malang.

1. **Taleus ketan**: It is the most desired cultivar. The flesh is white and glutinuous when cooked. It belongs to the late maturing group.
2. **Taleus lampung bodas**: Flesh yellow or whitish yellow. The petiole is pale green or whitish and the tuber is cylindrically or conically shaped.
3. **Taleus lampung hideung**: It differs from the previous cultivars in that the petiole is purplish green in color. The raw tuber is edible.
4. **Taleus sutera**: It is widely grown because of its early maturity. The leaves are shiny, hence it is easily differentiated from the other cultivars.
5. **Taleus burkok**: The leaves are more valuable than the tuber. The petiole is pale green but purple at the base.

6. **Taleus lahun anak**: This cultivar is characterized by a large number of suckers hence the name Lahun anak. It is also characterized by the purplish red petiole.

7. **Taleus loma**: The flesh of this cultivar is white with purplish or reddish fibres. On the surface of the leaf, a purple central spot may be found.

8. **Taleus pandan**: The tuber when boiled gives a fragrant smell like that of the pandanus leaves, hence the name. The very base of the petiole is pinkish.

9. **Taleus paris**: The flesh is white and causes itching when cooked. There are brownish streaks in the petiole.

10. **Taleus bentul**: The cultivar is characterized by its yellow or pale orange tuber. The petiole is green or purplish green.

The villagers frequently apply the same name to two or more taro forms which share one particular characteristic feature. Talas pandan, for example, is given to a group of cultivars whose steamed tuber possesses a smell like that of pandan leaves (*Pandanus amaryllifolous*). The same holds true for talas lampung hideung. To this group belong two distinct forms of taro. They have purplish green petioles, however, one produces white tubers and the other yellow.

The germplasm collection

Attempts have been made to collect germplasm of taro from several places in Indonesia. Until now, there are about fifty accession numbers represented in the Bogor Botanic Gardens.

Some samples are very susceptible to taro leaf blight, hence several numbers were lost.

It is indeed a tedious job to maintain a living collection of taro. Weeding and application of insecticides should be done regularly. Though rainfall in Bogor is quite high and distributed almost evenly in a year, watering of the plants is necessary in the drier months of July, August and September.

Upon examination, it may be seen that the ability to produce flowers differs from one cultivar to the other. Based on this, the cultivars may be grouped into three, i.e., those which flower frequently, those which flower only rarely and those which are non-flowering. To the first group belong talas sutera, talas burkok, talas paris, talas bentul and talas lampung bodas. The rarely flowering group is comprised of talas lampung hideung, talas lahun anak, talas ketan and talas supa, whereas the non-flowering group is represented by talas singer and some segregates of taleus loma.

Those belonging to the frequent flowering group flower when the plants are eight to ten months old. In the rare flowering group, only a few individuals flower although they are left unharvested in the field. It was observed that out of 7375 individuals of ten-month old talas ketan, only 54 produced inflorescences. Most likely, the rest would not flower even if left unharvested, because the tubers of these cultivars are liable to rot after reaching maturity.

Variation is also observed on the number of inflorescence in each flowering time. In general, each individual cultivar belonging to the frequent flowering group of *C. esculenta* var. *esculenta* will produce 2-4 inflorescences. A higher number of inflorescence was found in some samples of *C. esculenta* var. *antiquorum*. Those collected from Mt. Gede and Mt. Salak (W. Java) were able to produce up to ten inflorescences/plant at each flowering period.

Compared to *C. esculenta*, *C. gigantea* flowers earlier. The inflorescences do not mature at the same time, therefore one may find stages of flower development. A robust plant may flower 4-5 times a year. The cultivated corm easily produces suckers.

In *C. esculenta* var. *esculenta* fruits mature in 35-45 days. Fruits of *C. gigantea* require a longer period to mature, i.e., 50-60 days after pollination. The color of the ripe fruits is yellowish green in talas sutera, remaining green in talas katan, bentul paris lampung, hideung, lampung bodas and burkok. *C. gigantea* produces fruits which are light yellow in color when they are ripe. *C. esculenta* fruits have various strong smell, but all the fruits of *C. gigantea* smell like overripe pineapple.

The seeds of taro are very small. In each fruit, there are about 10-60 seeds 0.1 g of each seed batch may contain about 1000 seeds. The viability of the seeds is very good, however, it declines with storage. The seeds usually become completely inviable after 6 months storage without treatment.

Cultivation of taro around Bogor

From the point of view of agriculture, Bogor is famous for its highland vegetables and lowland fruits. Among the crops sold along the streets are various kinds of bananas, pineapple, avocado, chinese yam, parkia and taro. These crops are in the markets all year round.

With regard to taro, both early and late maturing cultivars are grown around Bogor. All of them are planted in dry lands, either in paddy fields or kitchen gardens. So far, wet land taro have not been observed in this area.

Land preparation is necessary before taro planting. The soils should be hoed. An individual pit 50 x 50 cm is dug and incorporated with organic material. Spacing between plants is 75 cm to allow a maximum growth.

Suckers are used for planting materials. From one individual plant, 4 to 6 suckers may be gathered. If planted during the drier months, watering of the young plants is necessary. Weeding is done regularly during their early development. Once the leaves of the plants cover the ground, removal of the suckers, has to be done.

The disease which is frequently seen around Bogor is leaf blight caused by *Phytopthora colocasiae* Rac. Although death of the infested plant has never been encountered, a drastic reduction in the number of leaves may affect yield. Fortunately, the incidence of this disease is very much affected by the dry season. The relatively long period of dry season in 1977 and 1978 was sufficient to minimize the incidence of this disease in our taro collection. In general, the disease attacks the aerial parts of the plant indiscriminately destroying the inflorescences as well as the infructescences. Once the disease symptom is visible, the damage of the affected part is progressive.

The cultivars differ in their degree of susceptibility to this disease and so far no full resistance is found among them. Selection for resistance seems to be better focused on cultivars with reasonable field resistance.

As for pests, there are several species which may be potential production risks. Taro leaf hopper, for example, was reported by Purseglove (1972) to damage crop from Indonesia to Tahiti. Our observation showed, however, that this pest did not produce serious damage around Bogor. The other insect which feeds on taro leaves is grasshopper. Though this insect damaged the individual leaf total destruction was not encountered. In addition to these two, there are mites, caterpillars and termites. Mites could become serious pests during the dry season. The population, however, is greatly reduced with the coming rain. The population of the caterpillar is frequently checked by a fungal species of the genus *Cordyceps*. This fungus is parasitic to the caterpillar.

It is often observed that termites damage taro grown in dry areas. With controlled irrigation, the trouble caused by termites is minimized.

So far, the farmers do not apply fungicides or pesticides to control pests and

diseases on taro. Any sign of attack is controlled by removing and destroying the infested parts.

Harvest is done by digging up and uprooting the individual plant. The leaves are removed and the petioles with a length of ± 30 cm are left. The tubers are cleaned and sold in a bunch of 5 individuals.

Taro has the highest market price of all tuber crops in Java. This fact encourages farmers to grow taro despite the relatively long growing period. Around Bogor, 10 sizable tubers will cost ± Rp. 1000, -(± US$1.50). Visitors to Bogor always buy them as a unique souvenir to take home. To them, taro is known as "talas Bogor." Lately, however, there is a tendency for the market price of taro to decline. This is due to the fact that visitors who are less familiar with the cultivars will buy any taro tuber offered. And in general, the good quality taro needs a longer period to be harvested than the inferior ones. Thus, in the market, the latter are predominating.

Taro is used as a staple food in some islands of Indonesia where irrigated rice is not grown. In addition to taro, cocoyam is also employed. They are usually steamed or roasted.

In West and East Java where the crop is commonly cultivated, the tuber is cooked for snacks. It is cooked with coconut milk and palm sugar, or steamed and then served with shredded coconut. Fried sliced taro is a favorite snack in Bogor, while recently introduced taro chips are popularly served with drinks.

The leaves of several varieties of *C. esculenta* are valuable for "buntil" preparation. Buntil is a typical dish consisting of shredded young coconut, salted fish, chili pepper and leucaena bean. The mixture is then wrapped in taro leaves after being spiced, and steamed afterward. The cultivated forms of *C. gigantea* are especially good for this purpose. The petioles are valuable for soup. However, using the wrong variety will cause an itchy feeling in the mouth.

Though *C. esculenta* and *C. gigantea* have been cultivated for quite sometime in Indonesia, research to improve the existing cultivars has not been initiated. Several good cultivars have been recognized. In general, these cultivars are long maturing. However, a number of early maturing cultivars are also available. Hence, it is possible to breed early maturing cultivars. It is true that some of the cultivars are non-flowering, but between those which flower there is always a chance to cross-pollinate.

Indonesia where many species of tuber crops as well as tree crops are available as souuces of carbohydrate, any particular species of carbohydrate producing plant will not gain popularity unless the species is really a superior one. The same holds true for vitamin and mineral resources. Green vegetables are plentiful and found all year round. Thus, the need to focus the attention on the use of one or two species of plants seems not to be there.

Realizing the heavy burden of the ever increasing rice import, the government is launching a program on food resources diversification. With the program, it is hoped that the dependence on rice as the main carbohydrate source can be lessened, and with it a chance that *Colocasia* might be elevated from its present status. Compared to *Dioscorea* for example, it has a better opportunity to be cultivated in a larger scale. It requires no staking and the suckers produced can be consumed as vegetable. Moreover, the leaves are a source of vitamins and minerals. What is needed to be done then is the development of a high yielding cultivar with the necessary desired combination of characteristics.