

# Tuber Crops in Irian Jaya: Diversity and the Need for Conservation

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## Introduction

Irian Jaya stands apart from the rest of Indonesia for the importance and diversity of its tuber crops (Dimiyati 1988). Tuber crops are a traditional crop in Irian Jaya, and various kinds of tuber crops are staple foods for the indigenous population. Tuber crops have been spreading and adapting for a long time and genetic variation has occurred as a result of sexual reproduction. The province thus represents a center of primary or secondary diversity for tuber crops such as taro, sweetpotato, and yam.

Research on tuber crops in Irian has been discontinuous. Tuber crop research had been conducted by the Dutch government in Irian Barat since 1955, and especially after the establishment of an agricultural research station in Manokwari in 1960. Thereafter, research came to a halt until the 1980s when the Research Center for Tuber Crop Research (*Pusat Studi Ubi-ubian*) was established. At the same time cooperative research efforts were initiated both nationally and internationally.

For the majority of the local people in Irian Jaya, tuber crops are both a staple food and a food supplement or substitute. The planting of tuber crops in Irian Jaya is interwoven with ritual and traditional ceremonies, reflecting the fact that much of the people's lives, time, energy, and attention is focused on their tuber crop gardens. The tuber species commonly cultivated are: sweetpotato (*Ipomoea batatas*), taro (*talas*, *Colocasia esculenta*), cassava (*Manihot utilissima*), cocoyam (*keladi*, *Xanthosoma* sp.), or *kiha* (*Alocasia* sp.) and yam (*ubi kelapa*, *Dioscorea bulbifera*; *gembili*, *Dioscorea alata*). Of these seven species of tuber crops, sweetpotato is most extensively grown both in the lowlands and up to almost 3,000 meters above sea level in the highlands.

## Patterns of consumption

Based on their patterns of consumption, Irian Jaya's inhabitants can be divided into four groups and their respective areas (Map 1):

- people whose staple food is rice are usually found in urban or transmigration areas.
- people with a mixed pattern of staple food consumption (rice, sago, tuber crops) are mainly in suburban and coastal areas.
- people with a sago and tuber food crop pattern are found in swampy and rather remote areas.
- people whose diet is based on tuber crops are found in the remote mountain areas.

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Map 1 Tuber crops in the diet as a staple food in Irian Jaya.



Taro: *Colocasia* sp. + *Xanthosoma* sp. + *Alocasia* sp.

Yam: *Dioscorea alata* + *Dioscorea esculenta* + *Dioscorea hypsipida*

## Genetic diversity

Research has shown that Irian Jaya is a center for of diversity of tuber crop germplasm. Suhar and Sawor (1988) report about 33 sweetpotato cultivars found in the Paniai division in the highlands. In the Anggi subdistrict, around 60 cultivars can be found (Sawor et al. 1993). In Kanaan Biak village, 88 cultivars were found (Lasse 1983), and in the Jayawijaya subdistrict region, the authors estimate that there may be around 600 local cultivars. On the basis of the author's observations there are 15 cultivars in the Jayapura subdistrict area (La Achmady and Schneider 1993).

As far as taro is concerned, Sluyters (1957) reports 114 taro cultivars; Van Rheenen (1962) found around 136 cultivars of taro, cocoyam and *Alocasia* cultivated in Irian Jaya. In Biak and Sorong around 30 varieties of taro have been found (Pattiasina et al. 1982). According to La Mat (1979), Manokwari and its surrounding areas has about 30 taro cultivars, 6 taro (?) cultivars and 3 *Alocasia* cultivars. Erari (1982) reported that in Kanaan village subdistrict, West Biak, 36 different cultivars were found. Matanubun et al. (1991) found 52 varieties in the Paniai district. La Achmady and Schneider (1993) indicate that there are around 60 taro cultivars in the Jayawijaya subdistrict, around 20 in the Jayapura subdistrict, and 3 taro (?) cultivars and 3 *Alocasia* cultivars.

Yam (*Dioscorea* sp.) has a wide range of variation in cultivars. Preliminary data indicate that there are 5 varieties in the Jayawijaya subdistrict, around 20 varieties in the Jayapura subdistrict, and more than 20 varieties in the Merauke subdistrict.

Cassava has much less variation. The author found three varieties in the lowland Jayawijaya subdistrict and 5 varieties in the Jayapura subdistrict. The Center for the Study of Tuber Crops (Cendrawasih University) has 5 cassava varieties in its collection in Manokwari.

## Sweetpotato in the highland division of Jayawijaya

The Jayawijaya division (47,960 square kilometers) of Irian Jaya is located in the central cordillera and inhabited areas have altitudes ranging from 700 to 2900 meters. Several valleys cut through this mountain range, the biggest and best known of which is the Baliem Valley (675 square kilometers).

Sweetpotato is the single most important crop in the Jayawijaya division of Irian Jaya and is the staple food of 95% of the population. Most of the crop is planted in monoculture garden compounds, with great cultivar diversity. The authors estimate that about 600 cultivars exist, spread over four cultivation systems and adapted to different slopes and soil water regimes. At present, most of this diversity is still maintained, but there is evidence indicating the slow disappearance of cultivars with long maturation, which are indigenous to the local people.

The local population of the Jayawijaya division has adapted and lived from root crops for a long time. The area has strong ecological, cultural and biophysical links with root crops. The most important root crop is sweetpotato (*Ipomoea batatas*), followed by taro (*Colocasia esculenta*) and yam (*Dioscorea* sp.). With 7.4 people per square kilometer, the Jayawijaya division is the most densely populated area of the whole province.

Daily sweetpotato consumption is estimated at three kilograms per capita, or thirteen kilograms per average family (Soenarto 1987). In addition, sweetpotato is used for pig feed and also for ritual occasions. Horticulture is the predominant mode of subsistence. Apart from the staple food crop, vegetables and a number of secondary crops are cultivated. Pigs and poultry are raised as livestock, with the pig being highly valued socially and in traditional exchange systems.

## Cultivation systems

Gardens are the main source of food (carbohydrate), and a substantial part of labour, especially women's, is invested in garden work. Gardening, for the population of the Baliem Valley, is not just agricultural work, but part of, and subject to, a number of ritual requirements and obligations.

Four types of cultivation systems are distinguished by the authors. For each of them, a set of cultivars, with special adaptations which have been selected over time, can be identified; however, cultivars with broader adaptation also occur in our inventory.

- *Hipere wen* (planting in mounds on big, raised beds with a developed drainage system) exists in the floor of the Baliem Valley.
- *Yabu waganak* (planting in mounds on beds drained by small ditches) occurs on naturally well-drained land in the valley and on medium slopes.
- *Yabu enapipme* (planting on beds without mounds, but with complete tillage of the soil), occurs only on medium to steep slopes. Drains run across contour lines, an indigenous technique that is thought to prevent land slides and the rotting of roots, and to enhance the tillage work.
- *Yabu alome* (planting directly with the dibble-stick, without prior tilling) takes place on very steep and/or stony soil.

## Sweetpotato cultivars: problems and conservation activities

In the Jayawijaya division, a wide range of cultivars can be found in almost every garden. Field identification of sweetpotato crops showed that the number of distinct cultivars planted in one garden compound varies between 20 and over 100 cultivars. Surveys conducted by Root and Tuber Research Center, Manokwari, and International Potato Center extension workers indicate a figure of more than 600 cultivars distributed over the whole area of the Jayawijaya division, at altitudes of 700 to 2800 meters. A breakdown of this figure, by agro-ecosystems, is given in Table 1.

Table 1 Estimated cultivars by agro-ecotype, Jayawijaya division.

Cultivation system	Agro-ecotype	Number of cultivars
<i>Hipere wen</i>	Valley floor cultivation	200
<i>Yabu waganak</i>	Upland (medium slope); lowland (well drained)	50
<i>Yabu enapipme</i>	Upland (steep slope)	200
<i>Yabu alome</i>	Upland slope (no tillage)	150

Source: La Achmady, field surveys.

- Morphological and other characteristics vary widely among these varieties. Some examples of such variation are: cultivars producing just one very large root per plant; cultivars with rolled leaves, which look like scab-infested leaves; cultivars with bright leaves; and some cultivars with roots containing a purple flesh and relatively high carotene content.

Regarding specific cultivar uses, there are cultivars with fibrous roots used as pig food, cultivars with a high starch content and sweet taste planted and used for ritual and ceremonial occasions, cultivars of which only the leaves are eaten as a vegetable, cultivars used for medical purposes, and cultivars planted near garden or homestead fences because their vigorous vine growth makes them suitable for use in tying up these fences. The examples could be multiplied.

## Problems

The most threatened cultivars are those with long maturation, locally referred to as original (*asli*) or indigenous varieties. A number of these cultivars have disappeared from the average garden and planting material is increasingly difficult to find. A number of assumptions can be made as to why farmers tend to select the shorter-maturing varieties, but thorough studies on the trends on the macro- and microlevel are lacking so far:

- Population increase which reduces the land available for the production of the staple.
- Increasing market demand for sweetpotato. As larger quantities of sweetpotato are sold in local markets, and consumed even by newcomers (e.g., in fried form), it is advantageous to grow the faster maturing varieties.
- Changes in local cropping patterns, which reduces land and labour allocated for the staple food. Commercial crops that may enter into competition with sweetpotato are rice, secondary crops, vegetables and coffee.

- Reduction of fallow period to only one to five years as a consequence of more frequent cultivation. This trend certainly has implications for the selection of varieties.
- Changing farmer perceptions. A loss of interest in indigenous cultivars can be observed among younger farmers. Indigenous cultivars are an important requirement for garden ceremonies (opening, planting, harvesting) and are maintained for this reason, primarily by the elder generation.
- Natural disasters such as floods and droughts. The use of shorter maturing cultivars is itself a factor in reducing the risks of natural disasters for the farmers.
- The negligible role of sweetpotato in government extension programs for the area, so far, both with respect to crop development and germplasm conservation.

## The role of research in extension

In studying the main commodity cultivated by a society, one automatically studies and learns a lot about social and cultural aspects of the people in that society. Research that starts with the main local crops or the people's agricultural system will generally meet with little reluctance by the people compared to attempts to unveil other more secret areas of knowledge. The importance of studying and understanding both the pattern of agricultural operations and the main food commodity of the local people should be emphasized to village extension workers at every meeting held at the outposts of the Agricultural Extension Service (BPP). Training in the understanding and use of simple, practical research methods for their work in the villages should be given, as well. Results of research should be written up immediately by the extension worker himself in order to cultivate and nurture a desire to grow and develop in his profession as a functional worker. The extension worker will receive credits and also professional promotion for his research and writing of papers and, less tangibly, personal growth in his professional development.

The impact of this approach and the establishment of an integrated system in agricultural research is that the village extension workers have a better knowledge of the situation in their assigned area of work; they can evaluate the extension methods and systems being used as the research is being carried out. The advantages of such a research approach are the relatively short time period required, its cost-effectiveness, a more extensive scope of investigation and area covered, and the possibility of continuous correction, improvement and adaptation of the method.

According to the author, the rapid rural appraisal method (RRA) or *Pemahaman Pedesaan Dalam Waktu Singkat* (PPWS), as it is known in Indonesian, proved quite suitable for work in the rural areas of Irian Jaya. The activities for RRA or PPWS are intensive and allow exploration for the purpose of discovery. They are suitable for use with a small group, and if used systematically, help one to quickly understand local conditions. The method can be adapted to field conditions and the researchers' needs. Both the method and its tools and techniques enable the researcher to unearth the local people's knowledge, which can then be integrated with modern scientific knowledge.

Teaching and training of rural area extension workers in the correct understanding and application of RRA (or PPWS) for the field is carried out at the BBP meetings. Usually, after one to three training sessions, the extension workers are able to understand well and perform correctly the steps involved in this research method. Monitoring of the extension workers in the field has shown that the RRA (or PPWS) method functions as a useful support to the extension workers' main activity in the field in the following areas:

- identification and diagnosis of the problem,
- development of alternatives,
- planning, control, monitoring and evaluation of the program developed to solve the problem,
- technological transfer,
- precision in decision-making and policy-making, and
- understanding responsiveness to emergency situations.

## Potential conservation activities

The classical approach for conserving germplasm is collection and maintenance *ex situ*. Particularly in areas of outstanding diversity, this approach should be complemented with local activities in germplasm conservation. For the present case, a series of measures may be envisaged to strengthen the role of sweetpotato:

### *Integration of sweetpotato into the programs for the development of secondary crops*

Activities for the development of crops other than sweetpotato are numerous. These need to be balanced with an effort to develop sweetpotato cultivation. In 1993/94, the Agricultural Service of Jayawijaya division made a first trial experiment of a mixed crop of sweetpotato and maize in farmers' fields. The farmers were encouraged to plant as many as possible of the sweetpotato cultivars available in the area. A total of at least 100 cultivars was gathered and planted in two locations (25 hectares), representing demonstration areas of the Agricultural Service of the division.

### *Integration of aspects of sweetpotato cultivation into the training of local agricultural extensionists*

The need to develop sweetpotato cultivation and to maintain local cultivars has been stressed in the training of agricultural extensionists in recent years. In most cases, the extensionists have studied the cultivation practices and cultivars in their areas of assignment.

### *Exploitation of agrotourism potential*

The Jayawijaya division attracts an increasing number of tourists. Some of them will certainly be interested in agrotourism, or visits to farmers fields. This might be a way to strengthen local awareness of traditional agriculture. In 1990, it was proposed that the Agricultural Service organize visits to selected gardens worked under the valley floor (*hipere wen*) system, but no further steps have been taken so far.

### *Community curatorship and on-farm conservation*

An activity to maintain sweetpotato germplasm in cooperation with local farmers is currently being established in the district of Kurulu about 15 kilometers north of Wamena. The plan originated in 1990 in discussions of researchers with a local village elder. As head of a farmers group, he had seen indigenous cultivars becoming increasingly rare and wanted to conserve them. Collaboration has been established, in which the site is worked collectively by the members of the local farmers group and monitored by the local agricultural extensionist. The land includes both dry, sloping land and wet level land. Thus, cultivars can be planted in their normal habitat. As a rule, the agricultural techniques applied follow the local system. If adjustments are proposed or necessary, they will have to fit with local practices. The farmers receive support for their ideas (also in recovering scarce planting

material); the status of the land is not changed and farmers are able to harvest it normally. We, as researchers and conservationists, on the other hand, are able to learn about sweetpotato and the possibility of on farm conservation in this particular context. The location could even develop into something like a field laboratory for people with an interest in sweetpotato cultivation.

On-farm conservation needs to be conceived specifically for each location together with the people living with local plant diversity; it cannot be separated from the overall farming system or the cultural and social life of the community. What are motives for farmers to become more vocal guardians of their germplasm? What can we do to support them in their curatorship? We hope to find a clearer answer to these questions.

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