

## Dani Women's Knowledge on and Its Contribution to Maintenance of Sweetpotato Diversity in Baliem Valley

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### Introduction

Sweetpotato plays an important role in Baliem Valley and other places in the highland areas of Irian Jaya. Since its introduction to New Guinea Island in the 14<sup>th</sup> century, the crop has become the main staple food for the people in the area (Yen 1974) and is cultivated extensively. Besides being a staple food, sweetpotato is also used as animal feed, particularly for pigs, and for ritual ceremonies (Widyastuti 1994).

The importance of sweetpotato has encouraged the Dani people living in Baliem Valley to develop various cultivation techniques such as *wen hipere* (sweetpotato fields on a valley with wide and deep canals) and *wen yawu* (sweetpotato fields on mountain slope with narrow canals and bed positions crossing one another) to reduce erosion and grow different cultivars. There is more to local knowledge. But the information on various sweetpotato cultivation systems (Yen 1974; La Ahmady 1985) and the farmers' indigenous knowledge on sweetpotato (Schneider *et al.* 1994) in Baliem Valley have not been fully uncovered, particularly those that relate to the various social, economic and cultural aspects of Dani society.

It is well recognized that women in many parts of the world play important roles in maintaining biodiversity through traditional ways. The sweetpotato biodiversity in Baliem Valley is very much dependent on the women as farmers, because they are directly involved in different aspects of sweetpotato cultivation, starting from selection of planting material, planting, weeding to harvesting (Widyastuti 1994). It is important, therefore, to undertake in-depth studies on social, economic and cultural aspects of sweetpotato in the valley, as well as on maintenance of the sweetpotato biodiversity.

In 1993, the International Potato Center-East, South East Asia, and Pacific (CIP-ESEAP) Regional Office, Bogor started a research programme related to sweetpotato conservation in Indonesia, largely in Irian Jaya Province. One of the *in situ* activities under this programme was located in Waga-waga Village of Kurulu District, Jayawijaya Regency. A further study to define the relationships between women's status in the society, knowledge on sweetpotato, and roles of women on the sweetpotato biodiversity in the area, needs also to be done.

A case study was carried out with objectives to identify the: 1) mechanism or process of communication of knowledge on sweetpotato from one generation to another and among women of the same generation, as well as the exchange of labour and planting materials, 2) relationship between sweet potato cultivation and the status and role of women as wives of husbands with certain status in society; 3) relationship between status and role of a woman as a wife and sweetpotato and 4) relationship between knowledge of women on sweetpotato in a cropping pattern, use of several cultivars in a mixture and diversity in uses of sweetpotato at the household level.

### Materials and Methods

A field study carried out at an *in situ* conservation site in Waga-waga Village, Kurulu District, Jayawijaya Regency, Papua (Irian Jaya) Province, from February to March 1999. This was an extension of an *in situ* conservation activity of Irian Jaya sweetpotato germplasm in Waga-waga Village that was initiated in 1993 and was carried out on a *sili* (a unit of living place) of the Dani tribe in Baliem Valley. A *sili* is a housing complex of the Dani people that consists of a house for men (*honai/pilamo*), one or more houses for women (*abeai*), a kitchen (*hunila*), and pig cages (*wam-ai* or *wam dabu*). In this complex there is a *silimo*, an open place for certain important social and cultural functions. The *sili* is surrounded by a banana garden (*hakiroma*). The Dani society has strong traditions, and since sweetpotato is an important part of their tradition, it is a taboo for people to discuss this crop. Thus, it is difficult for outsiders to collect information on sweetpotato.

### Data collecting

Data collected from the respondents were: age, religion, location of their *sili*, wives, and status of the respondents (in relation to Yordan Surabut), as well as number of pigs, and number of sweetpotato beds owned by the respondents. A transection of the study area was made to identify field locations, to understand relationship among *sili*, and other factors. Mapping of sweetpotato beds and sweetpotato fields owned by Yordan Surabut and his family, which was also the *in situ* conservation site, was taken up to understand better the sweetpotato biodiversity and ownership of each bed that indicated the number of sweetpotato cultivars grown by a woman. Interviews on knowledge of women were conducted by asking them about the sweetpotato cultivars grown, steps in sweetpotato cultivation, specific knowledge related to sweetpotato cultivars and the way they shared information on sweetpotato diversity.

Quantitative data in the form of information on sweetpotato cultivars owned by each woman was collected by mapping the beds in the *in situ* conservation site in Waga-waga Village followed by interviewing each of the bed owners. Secondary data including rainfall data and data on population of the Baliem Valley collected were organized into tables.

### Data analysis

The unit of analysis was a woman farmer who had certain special status in her family. In this study, 18 women were involved in identifying the sweetpotato biodiversity in fields owned by the respondents. Participatory observations resulted in a map of sweetpotato beds owned by each woman farmer and prepared in the form of a table showing the sweetpotato biodiversity (Table 1). These observations and in-depth interviews also resulted in generating data on genealogy of a member of a *sili*. The secondary data, rainfall, population, and workload of women farmers were transformed into tables.

## Results and Discussion

### Status of women

There were two interesting situations observed regarding the status of a woman in the Dani tribe, i.e., (1) status gained through kinship, and (2) status gained by struggling.

#### Status gained through kinship

The Dani people practise polygamy. In a family, a woman that is the first wife of a tribe chief enjoys a higher social status than the younger wives (second and third). The first wife receives more sweetpotato beds than the younger wives. The first wife also has the privilege to ask her husband to marry another woman or to look for a woman to be engaged by her husband, when she feels that the burden of taking care of the family becomes too heavy for her. As a first wife, she is responsible for having more knowledge on sweetpotato than the younger wives. She gains knowledge on sweetpotato from a place where her husband, her parents-in-law, wives of her husband's brothers and other women lived in the *sili*.

#### Status gained by struggling

This status is attained: (a) by making contributions to the traditional *hone*, such as by bringing original sweetpotato cultivars such as Arugulek, Helalekue Asli, and Musaneken; (b) by being involved in or taking on the responsibility of developing good relationships with relatives and ancestors; and (c) by propagating or maintaining original sweetpotato cultivars for which she is considered as caring for tradition. Among the Dani tribe, older persons and persons with higher status in society contribute more to sweetpotato diversity. It is also known that a woman has indirectly a moral responsibility in Dani tribe to always maintain harmony with (1) her ancestors; (2) other people and (3) her environment or nature, in her daily life.

The harmony with a woman's ancestors can be shown by growing sweetpotato cultivars that are usually brought to the traditional *pilamo*, such as: *Helalekue Lama*, *Arugulek*, *Musaneken*, *Hulok*, *Hoboak*, and *Bogoreken*. Raising pigs for reasons of tradition can also contribute to this harmony. Some of the sweetpotato cultivars commonly used to feed pigs are *Opem*, *Ouluk*, *Duak*, *Musan*, *Mikmak*, and *Hoboak*. A woman is considered as blessed by her ancestors when she works hard and has many pigs and always brings sweetpotato to the traditional *hone*. Harmony with other people can be attained by bringing sweetpotato when one's relative dies or during a celebration. The sweetpotato cultivars brought to such occasions are *Helalekue* and *Yuaiken* or other cultivars grown for consumption that are available in the field.

Growing different sweetpotato cultivars in the field can contribute to harmony with the environment or nature. In Baliem Valley, farmers always grow cultivars *Helalekue*, *Walagein*, *Yeleli* and *Arugulek* to maintain harmony or compatibility with ancestors and nature. A woman is prohibited to bake a catching fish in the field, and if she violates the rule, in order to retain harmony/compatibility with the nature, she has to grow sweetpotato cultivars *Helalekue*, *Arugulek* and *Awelia*.

### **Women's knowledge on sweetpotato**

Women in the Yagawijaya Regency have wider knowledge on sweetpotato than women in other areas. This is because women in this area are responsible for sweetpotato management, including selection of cultivars to be planted, planting, crop maintenance and harvest. Such knowledge of women on sweetpotato has been maintained until now because sweetpotato has always been related to or connected with Dani myths and is used as a staple food, for rituals and other ceremonies, and as animal feed. Generally, knowledge includes the myths, cultivars and their naming, cultivation techniques, and uses of sweetpotato.

### **Cultivation techniques**

Women's knowledge on sweetpotato cultivation mainly includes: the cultivar's growing region (agroecozone), crop arrangement in each bed, and soil fertility. An agroecozone is an area designed for planting, such as in the valley or on the mountain slope. Using this knowledge, the women farmers automatically select sweetpotato cultivars suitable for specific niches. Knowledge on the location of a cultivar in a bed is related to whether a certain sweetpotato should be grown on the periphery (*erapma*) or at the center (*isikenma*). There are two reasons for a certain cultivar to be grown on the periphery of the bed: (a) the cultivar has big and long vines, therefore, these have to have enough space to grow and to produce large storage roots, and (b) to prevent the crop in the centre from being grazed by pigs, the main animals raised by the Dani people. Usually, the sweetpotato cultivars used as pig feed are grown at the periphery of the bed. Table 1 shows sweetpotato cultivars commonly grown in the valley, 11 cultivars commonly grown at the periphery of the bed, 14 commonly grown at the centre, and two cultivars, *Hopoye* and *Helalekue*, grown either at *erapma* or *isikenma*.

**Table 1. Sweetpotato cultivars grown based on their location in the field**

No	Cultivar	Valley		Mountain slope	
		<i>Erapma</i>	<i>Isikenma</i>	<i>Erapma</i>	<i>Isikenma</i>
1	Hulok	✓		✓	
2	Kilu	✓			
3	Humpuk	✓		✓	
4	Musaneken	✓		✓	
5	Mayugwe	✓			
6	Ogopem	✓			
7	Puluk	✓			
8	Duak	✓			
9	Arugulek	✓		✓	
10	Hopoye	✓	✓		
11	Helalekue	✓	✓		✓
12	Pilkha		✓	✓	
13	Nabogum		✓		
14	Bogoreken		✓		
15	Duke		✓		
16	Fibisak		✓		
17	Wenaboge		✓		✓
18	Soporeken		✓		
19	Salisike		✓	✓	
20	Inin		✓		✓
21	Walilum		✓		✓
22	Kulameke		✓		✓
23	Saworok		✓		
24	Tabogole			✓	
25	Musan			✓	
26	Yeleli			✓	
27	Werene			✓	

Note: *Erapma* = the cultivar is grown on the periphery of the bed; *Isikenma* = the cultivar is grown at the center of the bed.

In relation to knowledge on soil fertility, the women farmers in Waga-waga know which sweetpotato cultivars are suitable to be grown in soils with certain levels of soil fertility. For example, they know that local traditional sweetpotato cultivars produce storage roots better in newly opened fields, or in a field that has been left fallow for several years, or in old fields that have been planted with sweetpotato for several times without fallowing. Some of the sweetpotato cultivars, considered as traditional are *Helalekue*, *Arugulek*, *Musaneken*, *Hupuk*, *Namokera*, *Ogopem*, *Inin*, *Abukul*, *Hibisak*, *Hulok*, *Saworok*, *Pilkha*, *Suweal*, *Hibisak*, *Ogopem*, *Juaiken*, *Tabogole*, *Puluk*, and *Duak*. Certain cultivars also need higher levels of soil fertility than others. For example, cultivar *Inin* grows better in a field where the grass has been burned than in other fields. Some cultivars such as *Helalekue* produce better storage roots when grass biomass is layered on the beds during planting. Women farmers are aware of sweetpotato cultivars that have a climbing habit and require provision of a stake. Women farmers also know that certain sweetpotato cultivars should be grown erect in order to produce big storage roots for ceremonial purposes. Sweetpotato cultivars that can be grown erect are *Musaneken*, *Mikmak*, *Wililum* and *Tinta*.

### Uses of Sweetpotato

Farmers in Jayawijaya Regency have selected different sweetpotato cultivars over many generations based mainly on different uses. Many changes in traits of cultivars have occurred due to the selection based on use. For Waga-waga Village, sweetpotato is a staple food, distinguished as adult food, baby food and animal feed. Sweetpotato used for infants and

baby food usually is with soft storage root flesh, fibre-less, sweet (higher sugar content) and colored yellow to orange. For example, cultivar *Wortel* has orange color and contains B-carotene, which is important for eye health and growth of children (Table 2). Sweetpotato cultivars used to feed pigs are with large storage roots, have a skin frequently cracked, are fibrous, tasteless, and with either hard or very soft texture. Besides being fed with storage roots, the pigs are also fed with rotten or small-size storage roots of almost all cultivars.

### **Specific knowledge on sweetpotato**

Women of the Dani tribe also have knowledge on sweetpotato cultivars that have specific characters, such as: 1) cultivars to be grown for the first time in a newly opened field (*Hipere alago*), 2) cultivars that mature early (*Leget piloda*) and 3) differences between new and old sweetpotato cultivars.

### **Sweetpotato cultivars to be grown for the first time in a new field**

During the first planting of sweetpotato in a newly opened field, the fertility chief plants a stem cutting of cultivar *Hupuk* or *Hulok* at the centre of the field. After this ceremony, no other persons are allowed to enter the field until a few days. A prohibition sign (*silo*) is placed at the entrance of the field. The first plant grown by the fertility chief is not harvested and the storage roots are left to rot in the field. This is probably a symbol of strength of land ownership of the Dani people, which is considered as a 'mother of a woman'.

### **Hipere alago**

Farmers in Waga-waga harvest their sweetpotato periodically according to their needs and process the roots immediately. However, some of the farmers also store the roots for one week after harvest as stored food or *hipere alago*. Only sweetpotato cultivars that produce good quality storage roots without any damages or spots are used as *hipere alago*. The sweetpotato cultivars commonly used as stored sweetpotato are *Helalekue*, *Pilkha*, *Arugulek*, *Hupuk* and *Inin*.

### **Harvest age**

Sweetpotato is utilized as adult food, infant or baby food, pig feed, offering in ritual ceremonies, or sold. Sweetpotato cultivars with different maturities are therefore needed, so that the farmers could have stocks of storage roots the whole year around. The women know the maturity or harvest ages (i.e., the precise time to harvest a cultivar for a particular use or degree of quality) of the different cultivars grown in their fields.

### **Cultivars with early maturity**

Some of the sweetpotato cultivars have early maturity. Generally such cultivars are harvested early, while waiting for other cultivars such as *Musan* and *Tamue*. The roots are cooked by the stone-baking technique.

### **Leget pilodok**

These cultivars are commonly grown surrounding the *sili* or close by a *hone*, because the women use the leaves as vegetables.

### **Difference between new and old cultivars**

The differences between new and old (traditional) sweetpotato cultivars include the persistent stem after harvest. Stems of old sweetpotato cultivars do not dry out quickly after harvest and keep on producing new branches until they are utilized as new planting material of pig feed. The stems of new cultivars usually do not produce new branches after harvest.

### Transfer of knowledge

According to Thrupp (1998), specific knowledge on biodiversity is frequently related to a rich traditional culture that is usually transferred from one generation to another. Transfer of knowledge in the Yordan *sili* proceeds from one generation to another and among women of the same generation.

### Transfer from one generation to another

The transfer of knowledge usually occurs by transferring it to children, grandchildren, or children in-law. Knowledge transfer to children occurs through involvement of children in various activities. Young children follow their mothers and watch them planting, weeding, and harvesting sweetpotato. At this stage, children start to learn how to grow sweetpotato, particularly those who do not go to school. They start planting it when they are about 10 years old, with the help of their mothers. The mothers set an example and teach their daughters about sweetpotato cultivars suitable to be grown at the periphery and at the centre of the field, and about cultivars suitable to be grown in soils with particular levels of fertility. Knowledge transfer/distribution can also happen from grandmother, such as that which occurred from Elisabeth Wantik (grandmother) to Yosita Surabut, Bisige Surabut, and Aroge (grand daughters). This process can occur in the field or in the kitchen. The same process can occur from a parent in-law such as from Elisabeth Wantik to Dokop Pabika (Table 3). The genealogy of Yohan Surabut is shown in Figure 1.

**Table 2. Sweetpotato cultivars grown by farmers in the Waga-waga village, Baliem Valley, Irian Jaya according to their uses**

No.	Ritual ceremonies	Adult Food	Infant/Baby Food	Pig Feed
1	Helalekue	Helalekue baru	Wortel	Musan
2	Arugulek	Soporeken baru	Kentang	Juaiken
3	Hupuk	Kafiar	Wililum	Hibisak
4	Hopoye	Suweal baru	Musaneken	Kakum eka
5	Abukul	Leget pilodok	Wililum baru	Tinta
6	Hulok	Wenabuge	Pilkha	Musan baru
7		Suweal	Werene	Mikmak
8		Dilahake	Wiyayuken	Namokera
9		Wosilolo		Hoboak
10		Wopem		Aluage
11		Tinta putih		Tamue
12		Nabogum		Soporeken
13		Kulameke		
14		Tinta merah		
15		Yakik		
16		Lisuge		
17		Baruke		

Source: Primary data, 1998.

### Transfer among women within the same generation

Transfer of knowledge among women proceeds from childhood (at about 7 years) while playing. The girls play together and learn how to cook using the stone-baking (*bakar batu*) technique. Stone-baking is a traditional way of cooking food that does not need cooking utensils. This is done by digging a hole on the ground followed by sandwiching dry sedge grass, hot stones, and food material to be cooked such as sweetpotato and vegetables. While cooking goes on, they exchange information such as on the names of sweetpotato cultivars being cooked (Table 3).

**Table 3. Process of women in gaining knowledge and their level of knowledge on sweetpotato in Waga-waga Village**

No.	Age	Knowledge gained	Process of gaining knowledge
1	About 7 years	Recognizing names of new sweetpotato cultivars, such as: <i>Wililum Baru, Kentang, and Helalekue Baru</i> , without knowing characters of the individual cultivar	Following her mother to the field and watching her work (AG).  Watching her mother and grandmother working in the kitchen (AG).  Telling stories among friends (IG).
2	7 – 14 years	Recognizing names of new cultivars and be able to characterize some of them. For example: Yosita Surabut (daughter of Sanimon Marian) recognized: <i>Musan, Helalekue Lama, Kilu, Hulok, Hupuk, Musaneken</i> , etc	Joining her mother to the field after school hours (AG).  Being taught by her grandmother while in the kitchen (AG).  Telling stories among friends (IG).
3	> 15 years	Recognizing various sweetpotato cultivars and their characters, such as skin colour, flesh colour, and texture of the storage roots.  Not able to decide the location of planting material to be grown in a bed. For example, Aronge (a daughter of Linsogo Marian), recognizes various new and old sweetpotato cultivars as well as their uses. However, she grows only her preferred cultivars that usually produce high yields.	Being taught by her mother knowledge on agroecozone, cultivation, soil fertility, etc., during planting (AG).  Learning from her grandmother in the kitchen (AG).  Exchanging knowledge with friends of by telling stories (IG).
4	After marriage	Recognizing most sweetpotato cultivars and their characters. Having knowledge on agroecozone, cultivation technique, location of a cultivar in a bed, and sweetpotato use.	Learning from parent-in-law (AG).  Learning from older wives (IG).  Learning from other women in or outside the sili (IG).

Note: AG = Among women of same generation; IG = Inter-generation. Source: Primary Data, 1999.

The process of knowledge exchange on sweetpotato among women continues until adolescence. They exchange knowledge on the growing region (*agroecozone*), crop arrangement in a bed, different uses and characters of certain cultivars. An occasion for knowledge exchange is when a woman asks help from other women, because she does not have enough time to grow sweetpotato on her own. At planting time, the woman prepares the planting materials of selected cultivars to be grown in her field according to her needs. She, then asks other women to help plant the cuttings, and if the women do not know the location of a certain cultivar to be planted, the owner tells them whether that particular cultivar should be planted at the periphery (*erapma*) or at the centre of the field (*isikenma*). This happened to Wenabaga Walilo when she invited Sanimon Marian, Dokop Pabika, Lesina Wetipo, Wera Aropa, Linsogo, Aroge, Mari Haluk, Waya Haluk and Saluk Haluk to help her to plant sweetpotato. Exchanges of knowledge on sweetpotato among women occur indirectly this way.

## Conclusions and Suggestions

Women farmers in Waga-waga Village have been found to be endowed with wide knowledge on sweetpotato, including 1) crop management, including knowledge on agroecozone, position of a certain cultivars in a bed, and soil fertility, 2) cultivar uses, such as for rituals and ceremonies, adult food, infant or baby food and animal feed, and 3) cultivar characteristics, including specific knowledge regarding growing of certain cultivars for the first planting, on cultivars that could be stored more than one week; maturity of each cultivar, and new and old cultivars. Women in Waga-waga village transfer and exchange knowledge within and between generations (grandmother, mother, and granddaughter) to ensure continuity of knowledge on sweetpotato. Status of women in the society affects the biodiversity of old sweetpotato cultivars as these are commonly used for traditional ceremonies and other occasions related to harmony with their ancestors, society and environment. The willingness to grow sweetpotato is, therefore, very much dependent on the effort of the Dani people to maintain harmony with their ancestors, society, and environment, as well as to meet their needs such as for adult food, baby food, animal feed, and cash. When the women grow new sweetpotato cultivars, they also consider the harvest age, ease of growing in the valley and on the mountain slopes.

It is expected that the research results of this study will provide additional information on sweetpotato, a crop that researchers have generally neglected, particularly on how much a woman farmer knows about sweetpotato, and whether this knowledge can contribute to maintaining sustainably the sweetpotato biodiversity in Baliem Valley. It is also expected that other scientists interested to study further the sweetpotato and the Dani tribe will use the written report as reference. Results of the study can also be used as an input into government agenda for Jayawijaya Regency and the central government in relation to the status, knowledge and contribution of women to sweetpotato biodiversity. It is also expected that the data gathered will be used as reference in developing program in food policy, food security, and sweetpotato conservation in the region, particularly by involving women in such activities.

It is strongly suggested that women need to be involved in an effort to conserve sweetpotato in Irian Jaya, because they play very important roles in its cultivation and conservation. For this purpose, the distribution and transfer of knowledge within and between generations needs to be carefully considered.

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