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Informal Seed System on Greater Yam (*Dioscorea alata*): Knowledge and Practices among Indigenous People in Northern Philippines

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Abstract

Indigenous knowledge on variety, seed selection and seed-related practices is very important in the maintenance of greater yam diversity. However, baseline information on indigenous production, storage, or exchange of traditional greater yam varieties, and planting materials is very limited, especially among the indigenous people of the Northern Philippines. Hence, this documentation using secondary data, key informant interviews, field observation, and photo documentation to validate gathered information. Indigenous farmers' technique on the utilization and management of cut setts that weigh from 200-500g, aerial tubers, and small to big tubers allowed for the multiplication and maintenance of indigenous varieties. At present, the round and elongated varieties with purple-colored-flesh color are utilized in commercial purple yam production. Thus, the need to strengthen research and development on local or traditional varieties conservation and capacity building with emphasis on production, storage, and distribution.

KEYWORDS

cut setts
purple yam
indigenous varieties

Introduction

Indigenous yam of various species and cultivars abound in the Northern Philippines. These are generally important as subsistence and cash crops, especially among the indigenous people. *Dioscorea rotundata* (white yam) and *Dioscorea alata* (purple yam) are among the yam species with economic importance (Aighawe et al., 2014). *Dioscorea alata* is the second most cultivated species and is the most widely distributed species in the world (International Institute of Tropical Agriculture [IITA], n.d.)

While there is great demand for purple yam, its production in the Philippines is limited due to poor seed system, production, and post-production practice (Salda et al., 2015). Unlike staple crops like rice, corn, and many vegetables, which have formal seed systems comprised of plant breeding and selection, variety release and maintenance, and formal chain players producing and distributing certified or quality seeds of verified varieties, yam farmers in the country only have informal seed systems. This informal or also called traditional or farmer seed system involves farmers themselves producing, disseminating, and accessing seeds directly from their own harvest; through exchange and barter among friends, neighbors, and relatives (Food and Agricultural Organization [FAO], n.d.).

Available information on traditional cultivation, propagation, and seed systems of yam are generally from other yam-growing countries, particularly in West Africa, which produces more than 90% of the world's yam (Aighawe et al., 2014; Ricciardi, 2015). Their emphasis is more on white yam because it is the most widely cultivated in their place. In the Philippines, indigenous knowledge on the cultivation and propagation of *Dioscorea alata* is very limited. Hence, this study aimed to document the traditional or informal seed system and seed production technology on greater yam among selected indigenous peoples in Northern Philippines. Specifically, it looked into the local greater yam varieties and planting materials and their sources, seed selection and planting practices, methods of propagation, and harvesting and postharvest practices.

Documentation of traditional practices will help strengthen indigenous knowledge to enhance rootcrops diversity, food security and sustainability of food crop production and utilization systems in marginal uplands, forests and adjacent lowland areas occupied by indigenous people. As recognized in a regional FAO forum, efforts to make local seed systems better known would result in increased support for on-farm seed multiplication activities, more available human and financial resources for local seed production, and greater recognition of the importance of the local seed systems by the scientific community and society as a whole (FAO, 2004).

Methodology

Selection of Site and Respondents

The selection of sites and indigenous people groups were based on secondary data and the endorsement and willingness of collaborating agencies or partner researchers. Proper coordination with the National Commission of Indigenous Peoples (NCIP) was done prior to data collection. The indigenous knowledge on seed system for greater yam was gathered from 149 rootcrop farmers who belong to the 12 indigenous people (IPs) namely; *Aeta, Bago, Biga-Kalinga, Bugkalot, Buhid-Mangyan, Ibaloi, Isneg, Ivatan, Iyattuka, Kalanguya, Kankana-ey,* and *Tingguian*. Key informants were selected further based on their experience and knowledge in rootcrop farming and utilization.

Data Collection and Analysis

Greater yam is one of the crops included in the project "Role of Roots and Tubers in Household Food Security and Income of Indigenous Peoples in Northern Philippines," which had the following research phases: Phase 1–secondary data gathering and linking with local research partners; Phase 2–key informant workshops, where focus group discussion, story-telling, use of cue cards and detailed interview guide, farm visits, and community walk to take pictures and observations were done; Phase 3–tabulation, presentation, and validation of data; Phase 4–writing up of the traditional Roots and Tubers Knowledge and Tubers Knowledge Series per ethnoscape (rootcrops-bsu@hostclink.net) and the integrated write-up per topic.

Secondary data on root crop growing areas, production and utilization statistics, and background of indigenous people were gathered from regional, provincial and municipal offices, the Bureau of Agricultural Statistics (BAS) now Philippine Statistics Authority (PSA), the National Commission on Indigenous Peoples (NCIP) and including published and unpublished literatures.

For the primary data collection, 15 key informant workshops were conducted from April to November 2012. Data were analyzed using categorization of responses, thematic analysis of observations, and stories from the field visits and workshops. Tabulated results were presented to the collaborating partners and some of the key informants for validation (Phase 3).

Results and Discussion

Local Greater Yam Varieties Cultivated by IPs in Northern Philippines

Four major shapes of yam varieties (Figure 1) are cultivated by the IPs, namely: round, cylindrical, flattened or the palm or hand shape, irregular that are classified as short and long and the elongated tubers classified also as C-shaped, reniform or falcate, and slightly spiral or S-shaped

tubers. Classification was based on the descriptors for yam (*Dioscorea* spp.) prescribed by the International Plant Genetic Resources Institute (IPGRI).

Round Shaped

There are eight round-shaped varieties among the IPs: the *Paranan* and *Palisin/Hawaii* varieties of the *Ivatans*; the *Sampero* and *Kinampay Sampero* of the *Ibalois*; the *Sappido* of the *Bagos*; the *Baha-ong* and *Sanglay* of the *Isnegs*; and the *Violet* variety of the *Bugkalots*. The *Sappido* variety of the *Bagos* and *Sampero* or *Kinampay Sampero* of the *Ibalois* are preferred by processing companies because of tuber shape and flesh color.

Cylindrical Shaped

There are 12 cylindrical in shape yam varieties among the I*vatans, Ibalois,* and *Bagos*. The *Ivatans* had the most with 8 varieties, namely; *Lagan-violet, Lagan white, Bataan, Nayingles, Nayvisaya, Pagad/Kalabaw, Tucod,* and *Galas*. The *Ibalois* have the *Daking*, *Majas/Madjas, Mindoro,* and *Mindoro Tungkol*. The *Mindoro* and *Mindoro Tungkol* are both preferred by processors.

Flattened and Irregularly Shaped (palm/hand shape)

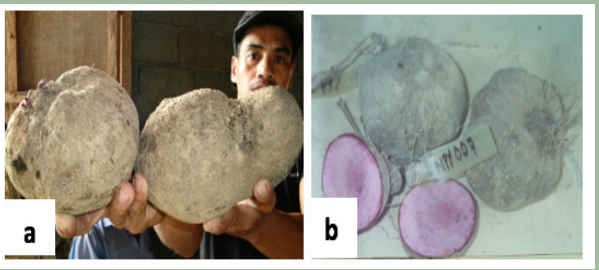
There are three flattened varieties of the *Ibalois* (*Dimdima white, Dimdima violet,* and *Bugkalots Violet*). The *Dimdima* white was mentioned as good for dried chips called 'buku' and the tuber has longer dormancy, thus, longer storage period. Two are irregular in shape, the *Maube* and *Padinse* variety described by the *Ibalois* as big elongated tubers.

Elongated Shaped

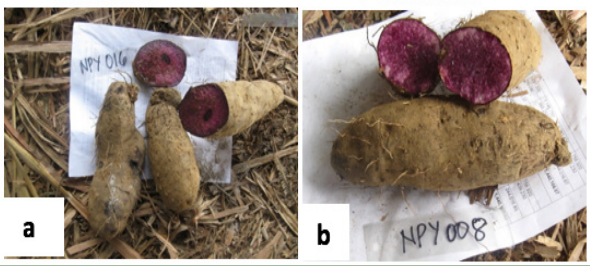
There are 13 elongated yam varieties among the *Buhid-Mangyans, Ivatans, Isnegs, Bagos, Bugkalots,* and *Ibalois*. The *Talapuyo* of the *Ivatans* is a first class variety in Batanes. The *Cabrera/ Kabrera* is a white-fleshed variety that is difficult to harvest in flat areas, preferably planted in rolling areas for easier harvesting. The *Baloktot*

Figure 1

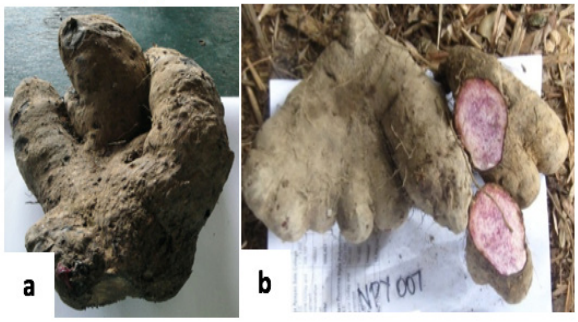
Diversity of Indigenous Yam Varieties



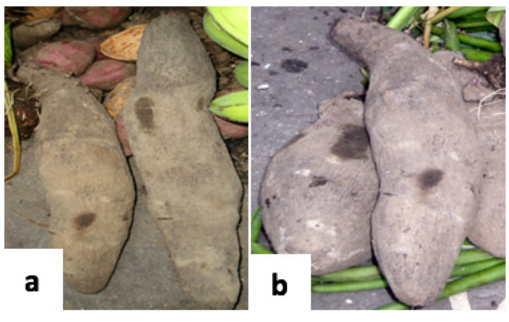
A). **Round Type** (a) *Sappido* in Sugpon, Ilocos Sur, Ilocos Sur and (b) *Sampero* in Tuba, Benguet



B). **Cylindrical Type** (a and b) *Tungkol Mindoro* in Tuba, Benguet



C). **Flattened and Irregular Type** (a) *Rapang* or *Kamay-kamay* in Sugpon, Ilocos Sur (b) *Dimdima* in Tuba, Benguet



D). **Elongated Type** (a) *Lacon* and (b) *Talapuyo* in Batanes

or *Tuwiran* varieties are high-yielding, have tolerance to typhoon but sensitive to bruising and mechanical damage. Elongated varieties like the *Tulad* of the *Isnegs*, *Lacon violet* of the *Ivatans*, *Baloktot* or *Tuwiran* of the *Bagos* and *Ibalois*, and *New Tuwiran* also of the *Ibalois* are further described as elongated C-shaped, reniform or falcate. The *Violet long* of the *Tingguians* is preferred by the bakery proprietors in Abra.

Based on the above results, about 38 local names of yam varieties are being cultivated by the IPs in Northern Luzon. This number of varieties suggests that some level of yam diversity exists in the study areas. The indigenous seed system, which has been practiced for generations and is still being practiced up to the present, contributes to the conservation of the traditional varieties of greater yam. The traditional practices and cultural values on the production, storage, or exchange of planting materials of indigenous yam varieties contributed to the maintenance of yam diversity. Unlike the market-oriented formal seed system characterized by continuous varietal replacement, the IPs rely on seed-saving practices, that is, keeping part of the harvest for planting in the next season. Under this system, farmers usually plant local varieties of seed kept from the previous year's harvest or obtained from neighbors and/or the local market (FAO, 2004).

Farm-saved seeds or planting materials of the traditional food crops are still the predominant seeds used especially in developing countries and, in most cases, integrated into the normal crop production. In Africa, at least 30% of their harvests are kept for the next planting season. Most of the world's genetic diversity in situ lies in natural areas and in the hands of subsistence farmers, who maintain this diversity within their farming systems, i.e., in a "pool" that constitutes a source of seed diversity.

Indigenous People's Greater Yam Local Seed System

Figure 2 presents the common seed system of the IPs in the Northern Philippines. In general, the IP farmers' seed system is seed-saving or keeping selections from their harvested yam for planting in the next season, which is typical of on-farm seed system practiced by smallholder farmers in developing countries (Almekinders, 1994; FAO, 2004; Philips et al., 2013). However, the specific details and reasons for the traditional practices at each stage sometimes vary among IPs.

Selection of Planting Materials

IPs conserve and maintain greater yam, locally named as *ube, ubi, uvi, guhhudan, ongo* or *ulang*, following their own indigenous seed system. Four types of setts can be utilized as planting material in yam: the head, middle, tail (from large tubers cut into pieces), and whole small tuber (Figure 3). *Aetas* and *Tingguians* use aerial tubers (30g), while *Bugkalots* and the *Ivatans* use whole tubers (100g) for bulking to attain the desired size of planting material (Table 1). They use the resulting planting materials for the production of tubers for processing in the next crop year. The cut setts (head portion) they use weigh at least 250-300g. The *Biga-Kalinga* utilize the head setts that weigh 250-500g, or tubers left behind during harvest or peelings that grow voluntarily. Beneath the skin or peelings of the tubers are the meristematic layers of cells where sprouts emerge at the end of dormancy. The *Bugkalots* utilize whole tubers that weigh 250g while tubers that weigh more or less 1kg are cut into setts. The *Buhid-Mangyans* prefer the head portion as planting material because, according to them, it retains the original color. The *Ibalois* use small whole tubers or cut setts weighing 250-500g. Both the *Ibalois* and *Isnegs* utilize the tuber's middle and tail portion when there are not enough planting materials.

Figure 2

Indigenous People's Greater Yam Seed System

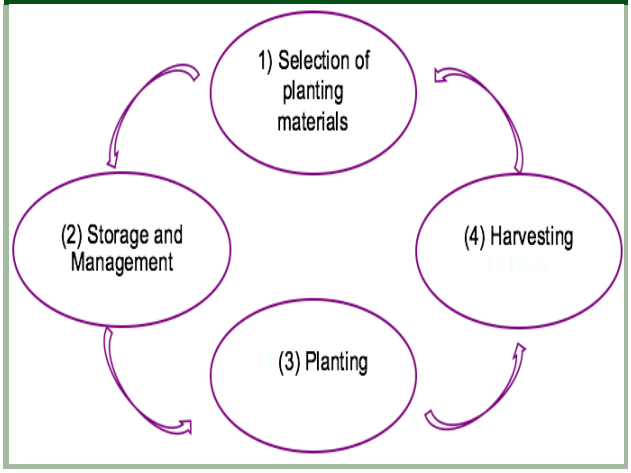
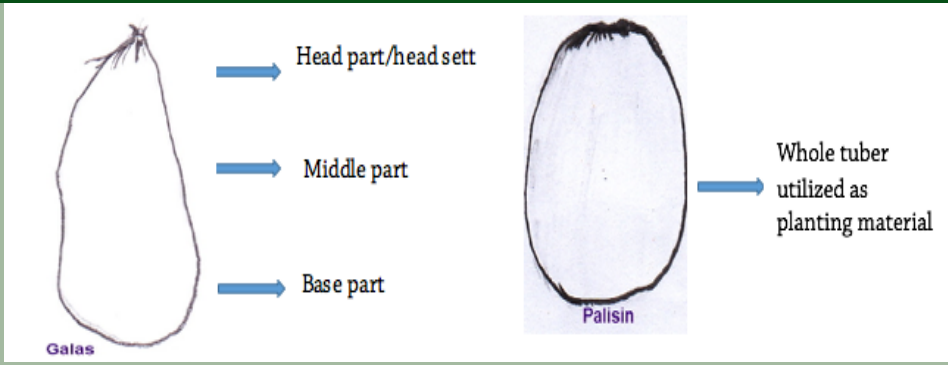


Figure 3

Type of Setts Utilized by the IPs as Planting Material



Note: Type of setts utilized by the IPs as planting material. Adapted from "Indigenous Knowledge, Technology, and Role of Root and Tuber among the Ivatan Ethnolinguistic Group in Batanes, Philippines," by B. T. Gayao, G. S. Backian and R. H. Cultura, 2014, Traditional Roots and Tubers Knowledge Series #5. Copyright 2014 by the Northern Philippine Root Crops and Research and Training Center, Benguet State University.

Table 1

Source and Size of Cut Setts Used as Planting Material

Indigenous People	Local Name	Planting Materials Used	
		Source	Weight (g)
Aeta	*Ubi*	Aerial tubers Cut setts (head portion)	30 250-300
Bago	*Ubi*	Whole tubers Cut setts	100-250 250
Biga-Kalinga	*Ubi*	Cut setts (head portion) Peelings	250-500
Bugkalot	*Ubi*	Whole tubers or Cut setts	250-300
Buhid-Mangyan	*Ubi*	Cut setts (head portion)	
Iyyatuka	*Guhhudan*	Cut setts (head portion)	
Kalanguya	*Ongo*	Whole tubers or Cut setts	Small to big size (no specific wt.)
Kankana-ey	*Ulang*	Cut setts (head portion)	
Ibaloi	*Uve*	Whole tubers or Cut setts	250-500
Isneg	*Ubi*	Whole tubers or cut setts	300-350
Ivatan	*Uvi*	Whole tubers Cut setts (head portion)	150-160 150
Tingguian	*Ubi*	Cut setts (head portion) Aerial tubers	30

Furthermore, the *Ivatan* farmers practice positive selection in seed production. They segregate healthy-looking whole tubers weighing 150-160g during harvest. They also segregate tubers for feeds, food, and for seeds during harvest. Their high yield in greater yam production, like their 'Bataan' variety that yields 25kg/hill, is an attestation of the technology on positive selection, which the *Ivatans* practice.

The local propagation technique using small whole tubers and cut setts provided the opportunity to keep several varieties, which are generally important as subsistence and cash crops, especially among the indigenous peoples. The documented practices in this study support the point that informal or farmer seed systems play a central role in the provision of planting materials, and about 80% of food production is reported to come from farmers with smallholdings (Food and Agricultural Organization - Commission on Genetic Resources for Food and Agriculture [FAO-CGRFA], 2011).

Yam Seed Preparation and Postharvest Management Practices

Aetas and *Tingguians* keep the aerial tubers and cut setts (head portion of tubers) in a shaded area of the farm if not planted immediately. Sun-drying for 1 to 2 days is also done to facilitate the healing of wounds before storing and pre-sprouting.

Greater yam is regarded as a self-supporting crop among the *Iyattukas* of Ifugao. The head setts are just left in the farm during harvest; cut or separated from the harvested tuber then replanted immediately. Sometimes, head setts of greater yam are left in the *dulyah*. *Dulyah* is a dry land near the rice terraces where planting materials, not only greater yam, are stored or kept for the next planting season.

The *Bago* farmers, who grow greater yam for commercial purposes, had established their own system similar to the other IPs who grew greater yam for household consumption. They sometimes delay the harvest of *ubi* seed tubers until sprout initiation. The stored tubers (placed in any shaded and protected corner of the house or yard) are cut into setts and pre-sprouted by covering setts with rice stalks. Based on their experience, termite infestation is avoided if *ubi* seeds are pre-sprouted and exposure of *ubi* seeds to physical damages in the field is minimized. They cover cut setts with rice straw during pre-rooting or pre-sprouting. Pre-rooting or pre-sprouting is the formation of roots, vines, and leaves before planting in a new mound or plot.

The *Ibalois* pre-sprout their cut setts. They cover the setts with dried grasses or banana leaves. It usually takes 1-2 months for the *Ibalois* to store their seed tubers.

The traditional practice of seed preparation of *uvi* among the *Ivatans*, is to store the seed pieces in a pit-like structure called *laveng*, at least 400 pieces of setts in a pit. *Laveng* is a farming practice usually employed to yam and spiny yam, which is done after preparing the seed-pieces intended for planting. It is a pit-like structure about 1.5ft depth. and 1m long. After the seed pieces have been prepared *vinadtak*, these are nicely arranged in the *laveng* in a pile structure. After this process, the setts are thinly covered with soil before covering it with dried grasses or banana leaves and finally with soil on top of the dried grasses/banana leaves. The cut setts are ready for planting after 1-3 weeks or if the sprouts are at least 2 inches long. It shall be covered with *vula* leaves prior to covering with surface soil. The leaves serve as protection from too much moisture during heavy rains and provide warmer temperatures to heal the wounds of seed-pieces. It also prevents cut setts from the attack of soil pathogens.

Yam sett cutting is a common practice among the IPs. The head part is primarily utilized, however, the middle part of the tuber is also used especially when planting materials are not enough.

Planting Methods and Practices for Yam Ware and Yam Seed Production

Farmers dig holes (25-30cm deep and wide), loosen soil, place the setts in a downward position where the sprouted skin is in contact with the soil, and then cover the setts with 1-2 inches of soil. The *Ibalois* dig holes or cultivate soil at least 25cm depth and 30cm wide. They prioritize planting yam near surrounding tree trunks (1-4 hills) and edges/ borders of the farm. Their planting distance between hills may reach 4m, or it depends on the availability of tree stumps,

planting materials, and their farm size. They place 1-2 setts/hill, ensure sprout is in contact with the soil (under or sideways), then cover with soil at least 6cm high. The *Aetas* plant their *ubi* under madre de cacao trees or *bikal*. The *Bago*, who grow yam for commercial purposes, dig to loosen soil and remove stones (at least one-foot depth for 3-5 plants per tree trunk; or at a planting density of 18-40 hills per 500m². They place the tuber/sett with the sprout in the bottom then cover with two inches of soil if there is no rain yet or one inch if it is rainy season. The *Ivatans* plant their *uvi* head setts in prepared holes (*huvang*), arranged in a row or at the center of the *sudi* (taro plant) or corn plants during planting. *Uvi* is usually planted with the skin-covered part, where the shoots are expected to emerge at the bottom touching the soil and then covered with about an inch of soil.

Because the *Isnegs* utilize big yam setts, they usually plant in big holes in standing position with head portion upward or skin downward. Planting of *ubi* among the *Buhid-Mangyan* requires no tillage and simply uses an indigenous tool called *buwak* for loosening the soil. The *Bugkalots* who plant yam enough for home consumption simply put the setts in previously dug soil/holes, the skin or sprout downward or sideways touching the soil, then cover with more or less two inches depth soil in borders or in designated parcels of the *uma*. Loosening of the soil is done by the *Kalanguyas* before planting with their yam sett placed in upward or sideways position once sprouted. They prefer to plant near *pongdol* or *tunged* (tree stump).

The *Tingguians* replant cut head setts (200-500g) in the same area or transfer to a new *um-uma*. The sprout is positioned downward when planting. The *guhhudan* of the *Iyattukas* is also traditionally planted in the *habal* where head setts are again re-planted during harvest and becomes a self-supporting crop.

Harvesting Methods and Practices in Yam Production

Production of greater yam for seed and ware are integrated. Harvesting is usually done at 7-10 MAP (months after planting) or when the leaves start to dry up, which indicates maturity. One-time harvest, or staggered or installment harvesting and *kapon* method of harvesting (getting only the lower part of the tuber leaving the head to continue growing) are practiced depending on the farmer's needs. The yam tubers are located using the vine or stem as guide; soil surrounding the tuber is loosened using an iron bar, sharpened wood, or any appropriate tool; and the whole tuber is lifted or dug.

The *Ibalois* practice staggered or one-time harvest, especially if the price is good. Staggered harvesting highly depends on consumption needs or market price among the *Bugkalots* and the *Ivatans*. *Bago* farmers practice early harvest at 6 MAP by priming certain varieties, *Baloktot* and *Mindoro*, especially during November. Installment harvest of other varieties starts at 7-10 MAP. The installment method of harvest is done to fill up the volume of harvest supplied by these IPs to the processors. The *Aetas* start priming when soil cracks, which indicates that there are tubers ready for harvest. The *Iyattukas* immediately replant the head setts upon harvest while the Benguet *Kankana-eys* harvest their yam when leaves are dried, indicating maturity. The *Buhid-Mangyans* carefully harvest their yam by loosening the soil surrounding the plant then lifting tubers. The head part of the tuber is separated and re-buried during harvest.

Conclusions

The indigenous people's existing traditional knowledge in seed selection, production, and conservation management plays an important role in food security. Rootcrops which include the greater yam are resilient crops and are food security crops in the olden times. With the changing climate and environment, resiliency may have been altered, thus the need to introduce interventions that will help improve greater yam productivity. There are available technologies that farmers can adopt like the rapid multiplication of purple yam through minisett technology.

In the process of documenting the local seed system of the IPs, there are unique practices such as using peelings as planting material; varied sizes and weights of the cut setts; and varied traditional on-farm storage practices.

Recommendations

Further research is recommended to evaluate and optimize these farmers' practices and develop related technologies that may improve yield, productivity, and quality of yam production.

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