



TRADITIONAL KNOWLEDGE ON

ROOTS AND TUBERS:

**KNOWN, GROWN, AND UTILIZED BY INDIGENOUS
PEOPLE IN NORTHERN PHILIPPINES**

ISBN 978-971-92528-9-4

**TRADITIONAL KNOWLEDGE ON ROOTS AND TUBERS:
*KNOWN, GROWN, AND UTILIZED BY INDIGENOUS PEOPLE
IN NORTHERN PHILIPPINES***

**Betty T. Gayao
Dalen T. Meldoz
Grace S. Backian**

Published by:

**Northern Philippines Root Crops Research and Training Center
Benguet State University, La Trinidad, Benguet
Website: www.bsu.edu.ph**

**Neys-van Hoogstraten Foundation, The Netherlands
Website: www.neys-vanhoogstraten.nl**



June 2017

First Printing, 2017

This publication should not be reprinted
or reproduced in part or whole without written
permission from the publishers.

Bibliographic Citation:

Gayao, B. T., D.T. Meldoz, and G.S. Backian. 2017. Traditional Knowledge on Roots and Tubers: Known, Grown, and Utilized by Indigenous People in Northern Philippines. La Trinidad 2601 Benguet, Philippines: Northern Philippines Root Crops Research and Training Center-Benguet State University and Neys-van Hoogstraten Foundation, The Netherlands. 153p.

Editorial Assistant:

Gilda Victoria B. Jacalan
Office of the Director, NPRCRTC

Cover Design: B.T. Gayao/ Gochamayta Print Shop

Layout: B.T. Gayao

CONTENTS

	Page
FOREWORD	iv
ACKNOWLEDGMENTS	v
PREFACE	vii
ABSTRACTS	ix
GENERAL INTRODUCTION	
Conceptual Framework	xv
The Location of Selected Indigenous People and Study Areas	xvi
Profile: The Selected Indigenous People	xvi
Profile: The Selected Majority Ethnoscape	xxiv
Data Gathering Procedure and Analysis	xxv
STUDY 1. Diversity and Knowledge Transfer on Traditional Roots and Tubers among Indigenous People in Northern Philippines	1
STUDY 2. Traditional Varieties and Knowledge Transfer on Taro (<i>Colocasia esculenta</i>) among Indigenous People in Northern Philippines	22
STUDY 3. Traditional Varieties and Knowledge Transfer on Tannia (<i>Xanthosoma sagittifolium</i>) among Indigenous People in Northern Philippines	41
STUDY 4. Traditional Varieties and Knowledge Transfer on Greater Yam (<i>Dioscorea alata</i>) among Indigenous People in Northern Philippines	54
STUDY 5. Traditional Varieties and Knowledge Transfer on Lesser yam (<i>Dioscorea esculenta</i>) among Indigenous People in Northern Philippines	73
STUDY 6. Traditional Varieties and Knowledge Transfer on Sweetpotato (<i>Ipomoea batatas</i>) among Indigenous People and Majority Ethnolinguistic Group in Northern Philippines	85
STUDY 7. Potato (<i>Solanum tuberosum</i>) Varieties and Knowledge Transfer among Indigenous People in the Highlands of Northern Philippines	116
STUDY 8. Traditional Varieties and Knowledge Transfer on Cassava (<i>Manihot esculenta</i>) among Indigenous People and Majority Ethnolinguistic Group in Northern Philippines	126
REFERENCES	143

FOREWORD

Since the establishment of the Northern Philippines Root Crops Research and Training Center at the then Mountain State Agricultural College now Benguet State University in 1977, the collection and evaluation of local and imported kinds and varieties of rootcrops have been a collective and a continuing pursuit. The layman's understanding of rootcrops refers to all underground enlarged roots or modified stems, also called tubers, corms or rhizomes.

This publication introduces the rootcrops that have been cultivated and gathered in the wild by indigenous people in Northern Philippines for their nutrients not only as food and feed but also their therapeutic properties. It is also a comprehensive reference material on the traditional varieties of rootcrops collected and documented in previous published and unpublished reports. It is also a testimony of the farmers' contribution in the management of biodiversity of crops and varieties as conditioned by climate, topography, and the agro-ecological necessities and opportunities in the locality.

The indigenous people in Northern Philippines identified more than 20 roots and tubers and named several traditional varieties e.g. 179 in sweetpotato, 103 in taro, 77 in greater yam, and 30 in tannia.

Formal plant breeding and conservation efforts contributed little to the maintenance of these crops and variety diversity. With this publication, we hope to encourage partnership in *in-situ* conservation, clean-up, and multiplication of farmers' elite crops and varieties.



ANDRES A. BASALONG
Director, NPRCRTC

ACKNOWLEDGMENTS

The researchers are grateful for the grant provided by the Neys-van Hoogstraten Foundation based at The Hague, The Netherlands for the PH 233 project titled "Role of Roots and Tubers in Household Food Security and Income of Indigenous Peoples in Northern Philippines". The funds enabled the Northern Philippines Root Crops Research and Training Center to conduct the field work and workshops to gather information, and to come up with this data base publication. Likewise, the researchers appreciate the cooperation and willingness of the government institutions, local government units and their staff to be partners either as key informants, co-researchers and field coordinators:

1. The Tuba Municipal Agriculture Office and their farmer-leaders specifically Ms. Sonia Loquitan, Ms. Elesia Alilis and Mr. Ricardo Loquio;
2. The Municipal Offices of Sugpon and Sudipen; especially Ms. Victoria C. Sumagca, the Municipal Agriculture Officer of Sugpon, Mr. Nestor Sagayo and Mr. Manuel Kudan, the barangay officials of Banga and Malikliko;
3. The Department of Agriculture-Region III especially Mr. Edwin P. Paningbatan, the Regional Coordinator for Corn and other Feed Crops including cassava and sweetpotato;
4. The Batanes Agriculture College especially Mrs. Rita Cultura, the Administrative Officer and Officer-in-Charge at the time, the Batanes Provincial Agriculture Office, Basco Municipal Agriculture Office and the provincial office of the National Commission on Indigenous People;
5. The Apayao State College especially Mr. Satur Bangyad and Mr. Stephen Bulalin, and Conner Municipal Agriculture Office;
6. Mrs. Perlita C. Esperanza, the City Agriculture Officer of San Jose City, Occidental Mindoro, Mr. Felipe A. Gragasin, Mr. Conrado Benitez and Mr. Antonio Ross, barangay officials of Monteclaro, Ms. Vivian Sodoy Portcuro, a Hanunuo Development Worker of Plan International and Sr. Aida of the Saint Joseph Parish;
7. The Kalinga-Apayao State College especially Dr. Marilyn Tombali;
8. The Nueva Vizcaya National Commission on Indigenous People specifically Mr. Gregorio G. Singangan and Dr. Lasin Osingat;
9. The Barangay of Sagpat, Kibungan headed by the late Mr. Celio Bitayan, and Ms. Viona Yano Cadiog, the workshop coordinator;
10. The Abra State Institute of Science and Technology especially Dr. Elsa D. Bagioan;
11. The Amduntog Barangay Council especially Kagawad Escolastica Dulnuan, Mr. Avelino Lunag, Jr. and Ms. Maribel Bimmuya of the Ifugao Provincial Government Offices on Agriculture and Cultural Heritage, respectively, and the provincial office of the National Commission on Indigenous People; and
12. The Municipal Agriculture Office of Bauko especially Ms. Carolyn B. Wandalen, Ms. Marina Sapdoy and Ms. Ely Rose Payacda.

The authors are also indebted to their colleagues who had been working on traditional varieties and practices on root crops in the eighties and nineties, namely, Ms. Estela Badol, Dr. Ines C. Gonzales, Dr. Violeta B. Salda, Dr. Zenaida N. Ganga, Dr. Leoncia L. Tandang, Dr. Emma Ruth V. Bayogan, Ms. Hilda L. Quindara and Dr. Donita K. Simongo to name a few.

The authors are grateful to the present and previous NPRCRTC Directors, Prof. Andres A. Basalong and Dr. Ines C. Gonzales, the present and former Vice Presidents for Research and Extension of the Benguet State University, Dr. Carlito P. Laurean, Dr. Luciana M. Villanueva and Dr. Julia A. Solimen, for supporting the project as part of the regular workload of the researchers.

The researchers are further thankful for the comments and suggestions of the evaluators during the BSU Agency In-House Reviews as well as for their relevant technical comments made on the research papers submitted for national and international presentation and publication.

Lastly, the researchers are also indebted to the primary source of knowledge, the real authors, being the key informants and respondents, whose names are listed in Appendix 1 for sharing their knowledge, skills, and practices without reservation.



BETTY T. GAYAO
Lead researcher



DALEN T. MELDOZ
Co-researcher



GRACE S. BACKIAN
Co-researcher

PREFACE

Among the less privileged population in the Philippines are the indigenous peoples who are landless and near landless with very limited access to rice lands. Thus, they depend on non-grain staple foods like roots and tubers. These crops are largely produced from small-scale subsistence level systems where production and utilization technologies are mostly traditional. Thus, from the first-hand knowledge of the former President Ferdinand E. Marcos, two root crops research and training centers, one in the Visayas and another in the north of the Philippines, were created. Unfortunately, research and development efforts were focused towards cash cropping and industrialization concentrating on sweetpotato, cassava, white potato, and lately on greater yam.

Traditional production and utilization technologies are mostly not documented, remains the same or if improved were not widely disseminated for household or subsistence level use. This scenario was observed during the conduct of the field work where most of the varieties, roots and tubers known or grown among the indigenous peoples are their own traditional varieties. For the recently acquired varieties these were given names based on the source of planting materials- the individual, the agency or the locality. Hence, the difficulty of knowing if said varieties are indeed products of research.

Variety improvement research that ultimately results to Philippine Seed Board approved high yielding varieties emanate from the screening of local or traditional varieties and imported varieties and progenies. It is during this process that identity, local adaptation and quality attributes of traditional varieties as known by the indigenous growers get lost. This is unfortunate because there are reasons why farmers choose to maintain or discard varieties. In studies conducted by several researchers in the Philippines, Prain (1998) noted that the complex mountain environment contributes to diversification of crops and varieties. For example, the agro-ecological diversity of farms in Bayyo, Mountain Province favors the maintenance of several sweetpotato varieties (Fang-asan, et al., 1998). The annual typhoon season in Batanes led to the adoption of ground-hugging crops like yams and sweetpotatoes (Dayo, Labios and Wagan, 1998). Pretty (1995) also observed that farmers' maintenance of crop and variety mixtures enhanced overall resistance to biotic and abiotic shocks. Biodiversity is also an essential requirement for food security (Gollin, 2008). Maintaining different varieties with short and long maturity, with differing degrees of sweetness and dryness, skin and flesh color, herbage growth, etc., satisfies household various needs for foods, feeds and cash income.

Further, as experienced at the Northern Philippines Root Crops Research and Training Center, *ex-situ* field conservation and maintenance of crops and varieties is not sustainable as in the case of maintaining selections derived from the 807 sweetpotato germplasm collections of the Center (Highland Sweetpotato, Philippines, 1990). Also, in the past 40 years, subsistence swidden agriculture planted to upland rice, root crops and legumes declined; brought about by out-migration and employment of young adults, introduction of high-value crops, private ownership of lands, development of road networks, climate change, environmental degradation, the increasing need of cash among rural populations, and recently diseases are wiping out sweetpotato, greater yam and taro. These factors contributed to the extinction of indigenous root and tuber crops and varieties including the accompanying

knowledge. These continuing changes accompanied by the failure to disseminate knowledge, practices and coping mechanisms experienced by older generations might compromise food and nutrition security for the next generations.

The project '*Role of roots and tubers in household food security and income of indigenous peoples in northern Philippines*' which was given a research grant by the Neysvan Hoogstraten Foundation was proposed for the following reasons; namely (1) the lack of baseline integrated information on technology for quality planting materials, crop production, utilization and postharvest on roots and tubers needed for dissemination to small-scale cash cropping and subsistence farming clients, (2) the increasing importance of roots and tubers as a food crop to feed the world in the coming decades in view of climate change, health and food safety, and (3) the novelty of trying a new methodology for measuring vitality indices of traditional knowledge. With the aforementioned, the goal of the project is to retrieve, revive and strengthen indigenous knowledge on root and tuber crops production and utilization to enhance biodiversity, food security and sustainability of food crop production and utilization systems in marginal uplands, forest and lowland areas within the domains of indigenous people.

Realizing the complexity of enormous data gathered from the 13 indigenous minority and two majority ethnoscapes, this publication aims to integrate into one publication the variety diversity of root and tuber resources which is a tribute and a reminder of the richness of roots and tubers common among indigenous people in the mountainous municipalities in Northern Philippines. It aimed to determine the transfer or loss of traditional knowledge on roots and tubers from the older to the younger generation of indigenous people. This publication is also a reference for all people who are interested to find out what varieties of roots and tubers will meet their specific needs and from where they can possibly access planting materials.

It is a challenge for the Rootcrops R&D researchers to collect and clean-up the planting materials of the indigenous peoples' elite varieties or selections. Hopefully, efforts on *in-situ* conservation and regeneration, and a seed system of relatively clean planting materials will be institutionalized and established in the near future.



BETTY T. GAYAO

Lead researcher

ABSTRACTS

Study 1

DIVERSITY AND KNOWLEDGE TRANSFER ON TRADITIONAL ROOTS AND TUBERS AMONG INDIGENOUS PEOPLE IN NORTHERN PHILIPPINES

B.T. Gayao, D.T. Meldoz, and G.S. Backian

The indigenous people of Northern Philippines like the *Ivatans*, *Isnegs*, *Kalingas*, *Tingguians*, *Applais*, *Bagos*, *Kankana-eyes*, *Iyattukas*, *Ibalois*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans* consider roots and tubers as their staple in the olden times. With the changing lifestyles of the younger generation of indigenous people, and the lack of documentation, indigenous root and tuber crops are at risk of disappearing.

More than twenty roots and tubers consisting of ten cultivated species and more than ten species of wild roots and tubers were identified by indigenous people in northern Philippines. The roots and tubers planted are cassava (*Manihot esculenta*), sweetpotato (*Ipomoea batatas*), greater yam (*Dioscorea alata*), taro (*Colocasia esculenta*), tannia (*Xanthosoma sagittifolium*), lesser yam (*Dioscorea esculenta*), arrowroot (*Maranta arundinacea*), potato (*Solanum tuberosum*), yacon (*Smallanthus sanchifolius*) and yambean (*Pachyrhizus spp.*). Wild roots and tubers include nami (*Dioscorea hispida*), elephant yam (*Amorphopallus campanulatus*), giant taro (*Alocasia macrorrhizos*; *Cyrtosperma chamissonis*), canna (*Cannaceae*), wild yam bean and wild species of taro, greater yam and lesser yam known only by their local names.

The indigenous people's familiarity with the local names is an indication of the number of roots and tubers they have grown or utilized. This ranged from 6-9 kinds among the *Bugkalots*, *Iyattukas*, *Ivatans* and *Mangyans*, 10-13 kinds among the *Kalanguyas*, *Aetas*, *Bagos*, *Kankana-eyes*, *Applai-kankanaeys* and *Isnegs*, to 14-15 kinds among the *Kalingas*, *Ibalois* and *Tingguians*.

Loss of traditional knowledge on the diversity of roots and tubers known and grown is a reality only among the younger generation, particularly those born starting in the 1980's. There is a retention or little loss of traditional knowledge on the diversity of roots and tubers for those born before the eighties.

Study 2

TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON TARO (*COLOCASIA ESCULENTA*) AMONG INDIGENOUS PEOPLE IN NORTHERN PHILIPPINES

B.T. Gayao, D.T. Meldoz, and G.S. Backian

Taro (*Colocasia esculenta*) is one of the four kinds of aroids in the *Araceae* family. It belongs to the Old World staple crops that indigenous peoples in Northern Philippines had been eating. Nowadays, diets had changed but without documentation, knowledge on traditional taro varieties is at risk of disappearing.

Taro is known among the indigenous people in Northern Philippines as *gabi*, *aba*, *ava*, *abah*, *pising*, *pihing*, *gandus*, *gamey*, *buyon*, *putlo*, *ateng*, *sudi*, *lidoy*, *lapa*, *loko* or *rabok*.

Thirteen indigenous groups: *Ibalois*, *Bagos*, *Ivatans*, *Isnags*, *Kalingas*, *Tingguians*, *Aplai-kankanaeys*, *Kankana-eyes*, *Iyattukas*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyan*, mentioned about 103 locally-named taro varieties, each of which naming 2 to 38 varieties. These locally-named varieties were further grouped into 30 variety categories based on their description of stalk, leaf and corm flesh color such as shades of brown, grey, green, violet, white, yellow, with stripes or tinge of pink, red or maroon.

On the extent of diversity, the *Ibalois* had the most number of locally-named varieties at 26, classified as plenty. The *Mangyans* and *Bugkalots* had two widely grown varieties each while the *Bagos* had only one. Moreover, only the *Ibalois* identified one lost variety.

Generally, there was no deterioration of traditional knowledge on taro local varieties among the middle-age (36-56 years) and elderly group (57-77 years) of respondents but there was erosion of knowledge at one percent per year between the younger-age (15-35 years) and middle-age group regardless of IP grouping. There was retention of IK between the middle-age *Tingguians*, female *Bagos*, and an increase in taro indigenous knowledge among the middle-age male *Ibalois*, *Bagos* and *Iyattukas* as compared to the elderly group.

Study 3

TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON TANNIA (*XANTHOSOMA SAGITTIFOLIUM*) AMONG INDIGENOUS PEOPLES IN NORTHERN PHILIPPINES

B.T. Gayao, D.T. Meldoz, and G.S. Backian

Tannia (*Xanthosoma sagittifolium*) also called yautia, cocoyam and malanga is among the roots and tubers that indigenous peoples in Northern Philippines had been eating, known to them as *galyang*, *galiang*, *galyan*, *bila*, *bilah*, *biga*, *amasyan*, *lusya*, *bulawan* and *singapor*. Indigenous knowledge on this crop is at risk of disappearing especially nowadays that diets had changed among indigenous peoples (IPs) - the *Ibalois*, *Bagos*, *Ivatans*, *Isnags*, *Kalingas*, *Tingguians*, *Aplai-kankanaeys*, *Kankana-eyes*, *Iyattukas*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans* in northern Philippines.

The IPs' 33 locally-named varieties were grouped into five variety categories based on leaf, stalk and corm flesh color.

These are GGW-V (green leaf, green stalk and white with violet corm flesh), GGY (green leaf, green stalk and yellow corm flesh), GVV-W (green leaf, violet stalk and violet with white corm flesh), GVV (green leaf, violet stalk and violet corm flesh) and VVW (violet leaf, violet stalk and white corm flesh). To some IPs, the green or white and even yellow (GGWV and GGY) are the same while the violet-colored variety category (GVV and VVW) may also be similar.

Among the IPs, the *Iyattukas* of Ifugao are more familiar with their tannia varieties (78% test score) than the *Bagos* of Ilocos and La Union (64%), the *Ibalols* of Benguet (50%) and the *Tingguians* of Abra (11%).

Furthermore, there is retention of knowledge between the young (15-35 years) and the middle-age (36-56 years) groups of *Ibalols* and *Iyattukas*. But there is loss of knowledge among the young *Tingguians* and *Bagos*.

Study 4

TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON GREATER YAM (*DIOSCOREA ALATA*) AMONG INDIGENOUS PEOPLE IN NORTHERN PHILIPPINES

G.S. Baekian, B.T. Gayao, and D.T. Meldoz

Greater yam (*D. alata*) and its wild species are among the root crops that had served as the principal source of food and nutrition for many of the world's poorest and undernourished households. Yam was once an important alternate staple food of some indigenous people in the Philippines. The tubers are generally valued for its high yield even if left alone to grow for some years in fallowed farms. But, because of changing diets brought about by changes in livelihood, economic, environmental and climatic conditions, traditional greater yam varieties are at risk of disappearing.

Seventy-seven indigenous greater yam varieties were known or grown within the domains of the indigenous people in Northern Philippines. Of this number, 64 are indigenous or old varieties, 13 are new introductions, 50 were perceived as common or plenty, 22 are few or occasionally available, one is rare or endangered and four are already lost. These varieties were classified as to tuber shape and flesh colour, the characteristics commonly remembered by the indigenous people and industry buyers. The Ivatans had named the highest with 18 varieties, followed by the *Ibalols* at 17; *Bagos*, 9; *Aeta* and *Isnegs*, 6 each; *Kalanguya*, 4; *Kalinga*, *Bugkalot*, *Tingguian* and *Mangyan*, 3 each; the *Iyattuka* and *Applai*, 2 each and the *Benguet-Kankana-eyes* with only one variety. There were 16 wild species named, gathered only from the forest in times of food and feed scarcity.

Traditional rootcrop knowledge (TRK) on yam varieties significantly differed according to age group, occupation and source of information.

The oldest group of 55-77 years old scored the highest TRK at 70%, followed by the middle-aged (36-56) group at 58% and the lowest TRK score came from the young group of 15-35 years old at 41%.

The farmers had the highest TRK mean score of 72% and the students had the lowest at 40%. Vitality index scores, however, did not validate the claim that younger generation has higher loss of TRK. In fact, a higher TRK index, meaning the retention of knowledge of greater yam varieties, was noted among the younger female group of the *Iyattukas* and the male middle-age group of the *Bagos*.

Study 5

TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON LESSER YAM (*DIOSCOREA ESCULENTA*) AMONG INDIGENOUS PEOPLE IN NORTHERN PHILIPPINES

G S. Backian, B T. Gayao, and D T. Meldoz

Lesser yam (*D. esculenta*), popularly known as *tugui* is a perennial crop grown and cultivated to supplement human food and cash needs. Reference data on indigenous varieties is limited. Hence, this documentation using secondary data, key informant interviews, and field observation to determine varieties grown and cultivated and the retention or loss of transfer knowledge among the indigenous people in Northern Philippines.

Some 25 cultivated and four wild species were named by the IPs, 12 of which were classified as plenty, 11 as few, and two as rare or endangered. Most of the lesser yam varieties mature in eight months; six were classified with sweet in taste, and four with bitter taste. Wild lesser yam is only known among the *Aetas*, the *Kalingas*, the *Buhid-Mangyans*, and the *Tingguians*, respectively called *Limeng*, *Atap-ontoy*, *Borot* and *Anayed* or *Boga*.

The *Bago* group had the highest traditional knowledge mean scores of 90% and the least was among the *Ibaloi* group with a score of 34%. There is not only retention but also an increase in traditional knowledge on lesser yam between the middle-age group (36-56 years) and the older-age group (57-77 years) of male and female *Iyattukas*, and male *Tingguians*. There is a loss of knowledge on lesser yam between the younger group (15-35 years) and middle-age group of male and female *Ibalois* and *Iyattukas*. The decrease in knowledge on lesser yam was 1-3 percent annually between the younger group and the middle-age group.

Study 6

TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON SWEETPOTATO (*IPOMOEA BATATAS*) AMONG INDIGENOUS PEOPLE AND MAJORITY ETHNOLINGUISTIC GROUP IN NORTHERN PHILIPPINES

D.T. Meldoz, B.T. Gayao, and G.S. Backian

Sweetpotato (*I. batatas*) is a traditional crop with a big role in the food system and the overall culture of indigenous people in Northern Philippines. Sweetpotato varieties have been planted for several generations of families and in various types of landscapes. This study documented the varieties grown and determined the retention or loss of knowledge on said varieties.

A total of 179 locally-named sweetpotato varieties were documented during this 2012-2013 survey. More of these varieties are in addition to the 210 varieties previously documented from 1989 to 2002. Of the 179 recently documented varieties, 99 are native or traditional varieties and 80 are introduced varieties. Further, 94 sweetpotato varieties were assessed as commonly grown, 63 as endangered and 22 as lost varieties.

Leaf shape and color, root skin and flesh color, taste and texture, maturity, yield potential and use were the distinguishing characteristics mentioned by the IPs and the majority ethnoscapes. Leaf-shape is lobed or non-lobed while leaf-color as green (60 varieties) and green with purple tips (34 varieties). Predominant root skin color is red and white with 44 and 301 varieties, respectively. Predominant flesh color is white (73) followed by purple (30), yellow (29) and cream (14). There were 49 varieties that IPs consider having sweet flavor, eight having mealy texture, two soft texture and two are mealy texture with bland taste. There were 32 short maturing and 72 long maturing varieties. Twenty-four out of the 179 locally-named varieties were considered high yielding but only 18 were identified as market preferred, four for home consumption, five suitably ideal for vegetable-tips, and three as source of herbage for animal feeds. Seven varieties were identified good for processing into dried chips, flour, wine, candies, and native delicacies like *camote cue*, *halaya* and *guinataan*. One sweetpotato variety (*Alla-at*) was claimed suitable for juicing.

Between the younger (15-35 years) and the middle-age (36-56 years) groups, there is an erosion or loss of indigenous knowledge on sweetpotato varieties specifically among *Masadiit-Tingguians* and female *Ibalois*, *Bagos* and *Iyattukas*. Between the elderly (57-77 years) and middle-age groups, an apparent retention of indigenous knowledge specifically among the male *Ibalois*, *Bagos*, and *Iyattukas* was noted.

Study 7

POTATO (*SOLANUM TUBEROSUM*) VARIETIES AND KNOWLEDGE TRANSFER AMONG INDIGENOUS PEOPLE IN NORTHERN PHILIPPINES

B.T. Gayao, C.G. Kiswa, and A. B. Bautista

The indigenous vegetable farmers particularly the *Ibalois*, *Kankana-eyes*, *Applais* and *Kalanguyas* consider potato as a cash crop intensively cultivated in the highlands of Northern Philippines. Unfortunately, continuous planting caused build-up of plant pest and diseases ultimately leading to fast degeneration and loss of varieties. Potato industry demand is high, thus the continuous introduction of new varieties is imperative. Similarly, a need to update information on potato varieties grown has been a nagging concern to determine knowledge or identify varieties which are no longer grown and cultivated.

Thirty-three (73%) of the 45 variety names listed including the so-called native varieties are not known; four were once grown but lost; and nine are still grown consisting of locally-bred and originally imported varieties. These are Igorota or Po3 (87-89%), Granola short/dwarf (87%), Granola long or Granola Mexican (87 and 46-74%, respectively), Raniag (69%), Po4 or Solibao (35-50%), Fina (43%), Greta (30%), Montañosa (28%) and Ganza (26%). Almost 50% of farmers have wide areas planted to Igorota and Granola. Small areas are planted to Raniag by 61% of the farmer respondents. For the other varieties, 1-7 farmers are planting them. The native variety introduced in the 17th and 18th centuries is not known or no longer existing.

In the case of transmitting knowledge on potato varieties, the elderly (57-77 years) group had higher knowledge retention scores than the younger (15-35 years) group. The 36-

56 years old group did not only retain but also increased their knowledge of potato varieties. This means horizontal transmission like access to market and government extension services had contributed more to transmission of knowledge on potato varieties.

Study 8

TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON CASSAVA (*MANIHOT ESCULENTA*) AMONG INDIGENOUS PEOPLE AND MAJORITY ETHNOLINGUISTIC GROUP IN NORTHERN PHILIPPINES D. T. Meldoz, B. T. Gayao, and G. S. Backian

In this 2012-2013 survey, results pointed to 51 cassava varieties documented and classified into 22 native varieties and 29 introduced varieties. These were further categorized as 30 cassava varieties commonly grown, 19 endangered and two as lost varieties.

Cassava (*M. esculenta*) is one of the roots and tubers that served as an important alternate staple food in the olden times among the indigenous peoples in Northern Philippines.

The IPs and majority ethnoscapes in Northern Philippines distinguished characteristics of cassava varieties along crop maturity, root flesh color, taste and texture of cooked roots, and uses. Along maturity, 11 varieties mature in 3-4 months, four in 4-6 months (short-long), and 15 in 6-12 months (long). Twenty-four varieties have white-flesh color, 17 with yellow flesh and one variety with cream flesh. Four varieties have sweet flavor (*Abuhay*, *Dayakot*, *Diket*, *Shihet*) and only one variety with slightly bitter taste. Moreover, seven varieties have sticky texture, two mealy, and five with soft texture. Twenty-seven of these locally-named varieties were only for home use.

Between the middle-age and elderly groups of IPs, generally there is a retention of traditional rootcrop knowledge on cassava locally-named varieties. Between the middle-age and younger groups of the *Bagos*, *Tingguians* and female *Ibalois* and *Iyattukas*, there is a retention in indigenous knowledge on cassava varieties although a loss of knowledge among the male *Ibalois* and *Iyattukas* was apparent.

GENERAL INTRODUCTION

Conceptual Framework

Supporters of indigenous people claim that their indigenous knowledge and farming practices have ensured food security by providing households with a diverse diet consisting of cereals, root crops, legumes, and a variety of vegetables and fruits. Many of the developing world's poorest and most food insecure households will continuously look up to these crops as contributing, if not the principal, source of food, nutrition, and cash income. However, the advent of the Green Revolution and government policies that allowed erosion of indigenous knowledge on the production of subsistence foods like root crops, and the continuing bias towards cash crop food production, repressed indigenous knowledge in the production and utilization of roots and tubers food crops for household food and nutrition security, especially among traditional mountain dwellers and indigenous people. Such apparent bias, obscured further by the changes in environment, culture, food systems, the political and economic structures, and lack of information consequently led to erosion or loss of knowledge, which in turn may compromise household food security, food sovereignty, income and dietary intake (Figure 1). According to Gollin (2008), biodiversity is an essential requirement for food security. Studies also show that diversity in local food species correlated positively with several nutrients and dietary quality (Kuhnlein, 2007).

As observed and as mentioned in Niehof (2010), the younger generation no longer recognize some traditional foods like root crops. As a consequence, the potential development of root and tuber crops as sources of food and cash income is also compromised.

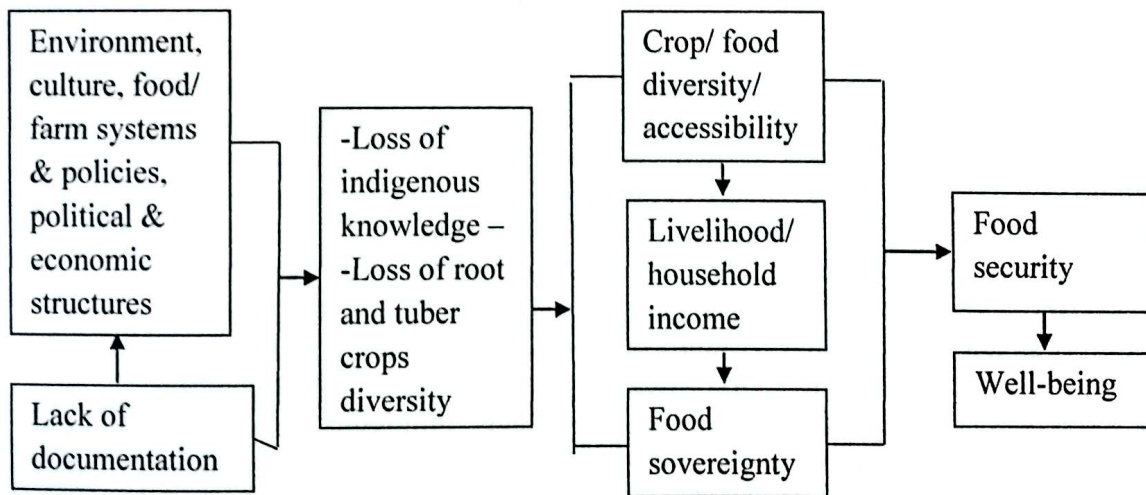


Fig. 1. Consequences of lack of documentation in indigenous knowledge of root and tuber crops: A Conceptual Framework

The Location of Selected Indigenous People and Study Areas

Included in this documentation are the 13 IPs and two majority ethnoscapes known in this study as root crops farmers and consumers in Northern Philippines (Figure 2).



Fig. 2. Location of the indigenous people and study areas in Northern Philippines

The Profile of Selected IPs

Indigenous people are those groups especially protected in international or national legislation as having a set of specific rights based on their historical ties to a particular territory, and they retain social, cultural, economic and political characteristics that are distinct from other politically dominant populations (<https://en.wikipedia.org>; www.un.org; www.indigenouspeople.net).

According to the Episcopal Commission on Tribal Filipinos, there are approximately 6.5 million indigenous peoples composing about 10 percent of the total Philippine population, and belonging to over 40 distinct ethnolinguistic groups (www.culturalsurvival.org). Included in the northern Philippines are the indigenous inhabitants of the Cordillera mountain ranges, collectively called 'Igorots' like the *Ibalois*, *Kankana-eyes*, *Applais*, *Biga-Kalingas*, *Iyattukas-Ifugao*, *Isnegs*, *Tingguians*, *Kalanguyas*, to mention some. The others are those that settled in the uplands or mountains bordering the Ilocos plains like the *Bagos*; those that roam the Sierra Madre mountain ranges like the *Bugkalots*, and the hinterlands of Central Luzon and Mindoro like the *Aetas* and *Mangyans*, and the native inhabitants of Batanes, the *Ivatans*.

The Ibalois

The *Ibalois* are one of the two dominant indigenous peoples in Benguet Province. They comprise about 29.2% of the Benguet population in the 2000 census. They are mostly concentrated in the municipalities of Kabayan, Bokod, Tuba, Itogon, Tublay, La Trinidad, Sablan, and Atok. In Tuba, the *Ibaloi* dominated barangays are Taloy Sur, Taloy Norte, San Pascual, Tabaan Norte, Tabaan Sur and Nangalisan. They speak *Ibaloy* or *Nabaloy*.

The *Ibalois* are peaceful, hardworking and hospitable people, generally fair in complexion, short in height with medium and narrow nose, and straight hair though there are some exceptions. The *Ibalois* are predominantly farmers who grow a variety of crops and raises livestock. They are also gold panners (Sacla, 1987).



In 1624, Don Quirante, a Spanish explorer, mentioned that the *Ibalois* who occupied La Trinidad Valley, grew cassava, sweetpotato, taro, beans and tomatoes for food; and rice for ceremonial purposes (<http://www.la Trinidad.gov.ph>).

The Kankana-eyes

Of the two *Kankana-ey* groups in the Cordillera Administrative Region, the southern *Kankana-eyes* also called *Ibenget* are from the upland areas of Benguet. They are different from the northern *Kankanaeys* from Mountain Province (<http://en.wikipedia.org/wiki/Igorot>; http://www.ethnicgroups.philippines.com.;litera1no4.tripod.com/kankanay_frame.html).

The *Ibenget Kankana-ey* farmers of today are predominantly engaged in vegetable cash crop production (www.scribd.com/doc/142198873/Benguet-Kankanaey). In the mountainous province of Benguet, the *Kankanaey* built rice paddies in lower mountain slopes and cleared upper mountain slopes for swidden farms. But now, former rice and rootcrop growing areas give way to vegetable cash crop production. Nowadays, cash earnings are changing the staple diet of the *Kankanaeys*, from sweetpotato, rice, and other root crops to mostly rice, vegetable and meat.



The Applai-Kankana-eyes

The *Kankana-eyes* of Benguet and Mountain Province speak the same language with a variation in intonation and word usage. Those from Benguet speak the soft *Kankana-ey* and those from Mountain Province speak the hard *Kankana-ey*. For this reason, the hard *Kankana-ey* speakers are sometimes referred to as northern *Kankana-eyes*, *Applai* or *Iyaplay*, usually from the western part of Mountain Province, the municipalities of Besao, Sagada and parts of Sabangan, Bauko and Tadian (http://en.wikipedia.org/wiki/Igorot_people;

Jacqueline K. Cariño . November 2012. Country Technical Notes on Indigenous Peoples' Issues. Republic of the Philippines. www.ifad.org).



The *Applais* engage in a variety of economic activities all year round. Wet farming, slash and burn agriculture, sweetpotato farming, trade and handicraft like backloom weaving, bamboo basket weaving and pottery are among their activities as a means of living. They also raise fruits and vegetables in all seasons of the year. Just like in early times, they raise domesticated animals such as chickens and dogs ([http://en.wikipilipinas.org/index.php?title= Applai](http://en.wikipilipinas.org/index.php?title=Applai)).

The *Biga-Kalingas*

The *Kalinga* as an IP group consists of 46 sub-tribes or district tribes, one of which is the *Biga* tribe. *Kalingas* are said to be the ancestors of Indonesian immigrants that came to Luzon thousands of years ago. They are generally known to be dark complexioned and slender with high bridged nose. They are clannish and show great respect for elders. Many of their villages are located in strategic areas of defense because of tribal wars.

Tribal wars occur when a *bodong* peace pact system was broken or violated. *Bodong* was developed to minimize traditional warfare and headhunting, and served as an institutional renewal, maintenance, and reinforcement of social ties.



Farming is the main source of livelihood, mostly in rice and corn paddies, and swidden farms with some loom weaving, rattan basketry, banana chips processing, gold jewelry manufacturing and coffee pre-processing in Tabuk; and animal feeds production in Rizal. The Province of Kalinga is within the Cordillera mountain ranges with valleys and floodplains near streams and rivers like the Chico, Pasil and Tanudan River, grass hilly lands, wide plateaus and steep mountains at elevation ranging from 300-5,000 feet. Dry season occurs from November to April while the rest of the year (May to October) is generally wet (<http://library.thinkquest.org/C003235/kalinga.html>; www.world66.com/asia/_southeastasia/philippines/kalinga; John B. Donqui-is, [http:// www.ncca.gov.ph](http://www.ncca.gov.ph))

The *Iyattukas-Ifugao*

Many anthropological writings (Beyer, 1955; Keesing, 1962; Conklin, 1967 and Maher, 1984 as cited by Acabado, 2012) reported on the famous Ifugao rice terraces. In essence, this reinforces the common knowledge that the Philippines' is rice growing and rice eating country.



Yet, ethnographic, ethno-historic and radio carbon studies in Northern Philippines also show that roots and tubers like taro and sweetpotato had served as sufficient staple food given the low density population in the region in the olden times (Peralta, 1982 and Acabado, 2012). This is also true among the *Hanglulaw* indigenous people or more appropriately the *Iyattuka* as claimed by the key informants in Amduntog, Asipulo in Ifugao Province. The *Iyattuka* informants also claimed that the *Alim* and *Hudhud* chants contain many *Yattuka* dialects, the reason why *Iyattukas* can also speak other Ifugao dialects. *Iyattukas* specifically reside in Amduntog and Nungawa villages in Asipulo. Asipulo is generally mountainous with the highest elevation at approximately 5000 feet above sea level and traversed by brooks and rivers, the Bukig and Camandag Rivers which are tributaries of the mighty Magat River.

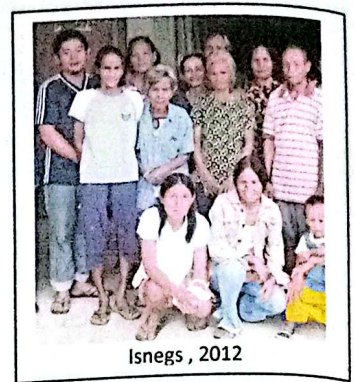
Climate is temperate with short dry season and long wet season. The average temperature is 20 degrees Celsius. Dry season usually lasts four months starting in January and ending in April. The wet season sets in May and lasts up to December. About 95% of Asipulo populace derives their income from farming. The municipality's dialects are *Kalanguya*, *Ayangan* and *Tuwali* which also includes *Hanglulo* or *Hanglulaw* and *Keley-i*. Asipulo is composed of 9 barangays, namely: Amduntog, Antipolo, Camandag, Cawayan, Haliap, Namal, Nungawa, Panubtuban and Pula. Its remotest barangays are Cawayan, Camandag and Namal which can only be reached by hiking for about 8 hours. (DILG-CAR, 1999. Cordillera Almanac Vol.1- Local Government Units. www.dilgcar.com/index.php/lgu/car-rofile/ifugao/ ; Amduntog Annual Report, 2010).

The Isnegs

The *Isneg*, also *Isnag* or *Apayao*, live at the northwesterly end of Northern Luzon, in the upper half of the Province of Apayao. The term “*Isneg*” derives from a combination of “*is*” meaning “recede” and “*uneg*” meaning “interior.” Thus, it means “people who have gone into the interior” (nlpdl.nlp.gov.ph:9000).

The term *Isnegs* during the Spanish period was referred to as los Apayaos, referring to the river along which they live; and los Mandayas, taken from the *Isneg* term meaning ‘upstream’ (en.wikipedia.org/wiki/Isneg). Even if the *Isnegs* are a small IP group, the *Isneg* dialect is classified into three, namely: *Bahan* or *Baren*, *Nabuangan*, and *Apayao Isnag*. *Bahan* and *Nabuangan* are spoken in the Municipality of Conner, while *Isnag* is generally spoken by the *Isnegs* of Calanasan, Kabugao, Flora, Pudtol, Sta. Marcela, and Luna (Kalinga-Apayao Socio-Econ Profile, 1989; Katablangan Profile, 2005). The *Isnegs* have always built their settlements on the small hills that lie along the large rivers of the province. Their villages and houses are close together for purposes of security and companionship (www.ethnicgroupsphilippines.com/people).

The *Isneg's* main staple is rice, which they have traditionally produced in abundance. This is raised through the wet-rice agriculture as influenced by migrants and their lowland neighboring provinces and the slash-and-burn farming up the hills at certain time of the year. Apart from rice, other crops raised are corn, taro, sweetpotato, sugarcane for making *basi* or wine, bananas, yams, fruit orchards, and tobacco (nlpdl.nlp.gov.ph; Bisht and Bankoti, 2004). For the Isnegs, root crops are of low prestige, with taro preferred over sweetpotato and yams (Keesing, 1962).



Isnegs, 2012

The *Tingguians*



Masadiit Tingguians, 2012

The *Tingguians* are indigenous people concentrated in the province of Abra. *Tingguian* population in 1990 is almost 25% (51,422) of the Province total population of 210,017 in 2000 (www.oocities.org; <http://class.csueastbay.edu>). They are sometimes called *Itneg* or *I-tineg*, referring to their settlements near the *Itneg* or Abra River. There are 10 subgroups of *Tingguians*, namely: *Adassen*, *Masadiit*, *Inlaod*, *Binongan*, *Applai*, *Banao*, *Gubang*, *Luba*, *Maeng*, and *Balatok* (Antonio, 2011).

Tingguians are classified into two main groups- the valley *Tingguians* that depends on wet rice cultivation and the mountain *Tingguians* that thrives on dry rice cultivation and rootcrops. Aside from rice, the *Tingguian* raises maize, tobacco, legumes, sugarcane, sweetpotato and taro and many other vegetables, roots and tubers as well as fruits; used for food to a considerable extent.

According to Cole (1908) Manabo, to the south of the Abra River, is the last pure *Tingguian* municipality; Bulilising (near Villavieja) in the municipality of Villaviciosa is strongly *Tingguian* but Barit, Amtuagan, Gayaman, and Luluno in the municipality of Luba are *Tingguian* mixed with *Applai* from Agawa, Besao and Sagada, Mountain Province.

Cole's research concluded that the *Tingguians* are actually primitive *Ilokanos*. Many of the leading *Ilokano* families of Bangued and Vigan were only four or five generations removed from the *Tingguians*.

The *Kalanguyas*

The *Kalanguyas* are indigenous people originating from Tinek (now Tinoc) municipality, Province of Ifugao. Tinoc is nearest the peak of Mt. Pulag, the highest mountain in Northern Luzon. At the base of Mt. Pulag are the municipalities of Kayapa, Ambaguio and Kabayan. The *Kalanguyas* in Northern Philippines has a population of approximately 70,000 (Arsenio and Stallsmith, 2008). Genealogically, the *Kalanguyas* are closest to the *Ibaloi* and *Kankanaey*, the indigenous groups living in most of Benguet Province (Lewis, 1992 as cited by Daguitan, 2010).

The *Kalanguya* group lived in the mountain ranges of the municipalities of Ambaguio, Santa Fe, Kayapa and a portion of Aritao in Nueva Vizcaya province. Others are at the other side of the mountain range covering portions of the municipalities of San Nicolas and San Manuel in Pangasinan Province, then upstream to the Municipalities of Buguias and Kabayan in Benguet Province then upward to the Municipalities of Asipulo and Tinoc, both in Ifugao Province .(Rey Awatin, <http://www.joshuaproject.net/people>).



Kalanguya in Ambaguio, 2012

The *Bagos*



Bago tribe in Sugpon, 2012

The *Bagos* are indigenous people (descendants of *Ilokano* and *Kankanaey* parents or longtime *Kankanaey* migrants) residing in the hills and mountain villages bordering the Ilocos and the Cordillera Regions, notably the provinces of La Union and Ilocos Sur, and the Benguet Province.

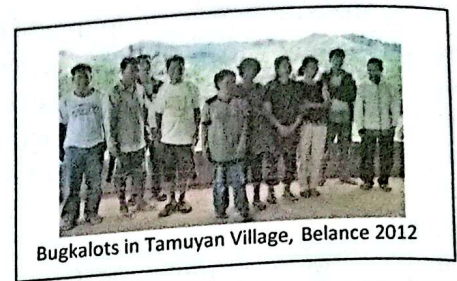
As J. de la Cruz claimed ([http://litera1no4.tripod.com/bago frame.html](http://litera1no4.tripod.com/bago%20frame.html)), there are *Bago* tribes residing in Pangasinan. *Bago* settlements are results of avoiding tribal conflicts, in search of rice fields, trade and intermarriages mostly between the *Ilokanos* and the *Kankana-eyes* of Benguet or the Applais of Mountain Province. Likewise, Alviento (2009) mentioned that *Bagos* are the hill tribe dwellers and original inhabitants in the border regions between the Ilocos and Cordillera mountains.

During the process of Christianization period under the Spanish regime, *Bagos* were dubbed as "Bagong Kristyano," thus, the name calling *Bago*, which stuck to the present day. Generally, the *Bagos* speak a dialect akin to the *Kankanaeys*, *Applais*, *Tingguians* and *Ibalois*. However, to this day, most of them speak the Iloko dialect with distinct intonation. The *Bago* rituals, practices, customs, systems, and beliefs are performed with a little difference to those of the *Kankanaeys*, *Applais*, *Tingguians* and *Ibalois*.

The *Bugkalots*

The *Bugkalots* are one of those described in literatures as subsisting on hunting wild game in the forest, fishing in the rivers and harvesting from their kaingin system of agriculture with root crops as their main product. The *Bugkalots*, is a self-designation of the people themselves (Rosaldo, 1978; Cosgoya, 1865; and Wilson, 1947 as cited by Osingat, 2011) and were once known to the outsiders as *Ilongots*. They are the early settlers found within the quadrilateral boundaries of three provinces, namely: Nueva Vizcaya, Quirino and Aurora. They were among the first wave of Indonesians who came to the Philippines (Nueva Vizcaya Heritage, 1989 as cited by Osingat, 2011) whose language belongs to the Austronesian, Western Malayo-Polynesian family (Thomas and Healy 1962 as cited by Osingat, 2011).

They are described as short, nomadic people with dark skin and kinky hair. But nowadays, they do have permanent dwellings and because of intermarriages some or majority of them are taller (+/- 5 ft) with brown skin and straight hair.



Bugkalots in Tamuyan Village, Belance 2012

The *Bugkalots*' Certificate of Ancestral Domain Title was issued by the National Commission on Indigenous Peoples on February 24, 2006. The government recognizes an area of 202,324 hectares (Northern Philippine Times, April 8, 2008) as their ancestral domain within the Sierra Madre and Caraballo Mountain ranges. Nevertheless, stories passed on from generations to generations point their origin to Mount Simad in sitio Nagakay, Belance, Dupax del Norte. They claimed that it is because of this mountain that their ancestors were saved from the great flood.

The *Aetas*

The *Aetas* of Central Luzon are believed to be descendants of the earliest inhabitants of the Philippines, the *Negritos* that landed on the archipelago more than 30 thousand years ago (<http://www.ethnicgroupsphilippines.com>).



Aetas in Pampanga, 2012

Aetas in Tarlac, 2012

Aetas share some physical features with the African pygmy populations like short stature, small frame, dark skin, kinky hair, snub nosed, and have big black eyes (http://en.wikipedia.org/wiki/Aeta_people).

While before, they have unsteady pattern and style of settlements (Fox, 1952), nowadays especially after the Mount Pinatubo eruption in 1991, they live in re-settlement areas with stewardships of land (3 or more hectares) in the uplands and mountainous areas of Tarlac, Pampanga, Zambales and Bataan. Some have improved physical features as a result of intermarriages with lowland neighbors. *Aetas* closer interaction with non-*Aetas* implied changes in their settlement pattern, religious beliefs, territorial units, language and adoption of western material culture like using GI sheets and cement for their houses, pants, canned goods and fast foods, except that their sense of 'communalness' remained (Gaillard, 2006). They also prefer being called as '*Kulots*' rather than being called '*Balugas*' which they feel is derogatory. However, swidden agriculture remained as their primary source of livelihood supplemented with fishing, hunting and trading of their forest products like charcoal, wild banana blossoms and wild boar meat. The *Aetas*' swidden crops include the so-called Old World Crops of Southeast Asia such as taro, yams, banana and rice, and the New World (American) crops of sweet potato, corn and cassava (Miclat-Teves, ed. 2004).

The Mangyans

The *Mangyans* are the first to inhabit Mindoro and their existence is mentioned in the Old Chinese Chronicler in 775 AD. Mindoro was already known as a trading center frequented by Arab, Indian and Chinese maritime traders ([http:// en Wikipedia.org](http://en.wikipedia.org)). Mangyans are distributed in the municipalities of Oriental and Occidental Mindoro, making up 15% of the total population of Occidental Mindoro (Lumbo, et al., 2010). There are six major *Mangyan* ethnolinguistic groups distributed in the island of Mindoro: namely, the *Iraya*, *Alangan*, *Tadyawan*, *Buhid*, *Hanunuo* and *Bangon* also known as *Tau-Buid* or *Batangan*, each with its own language, culture, and way of life.

Mangyans are slim and short people. They are nomadic, as they transfer easily from one place to another in search for a living-hunting wild animals in the forest and growing rice and root crops in forest clearings. They have a practice called *tokawan* as a way of transferring their knowledge on how to look for a livelihood to the young *Mangyans*, and also as one way of preserving their culture.



Mangyan communities have fairly well defined territories, the place where one resides called *banwknan*. There are 116 such communities with a total population of about 12,000 people. Recognized ancestral domain of the *Buhids* covers 94,000 ha in 13 municipalities of both provinces Oriental and Occidental Mindoro (IPEX/Anthrowatch 2005: 16). Since 1990s, *Mangyans* who stay in the lowland (*patag*), already go to school or are considered assimilated. They are influenced by those in the lowlands referred to as *tagapatag* or *siganons* and *Mangyan's* culture started to change.

Women who usually stay at home can now work as Barangay Nutrition Scholar (BNS) or Barangay Health Worker, as in the case of the *Buhid-Mangyans* in Monteclaro, San Jose City. The *Buhid-Mangyans* are an egalitarian segmentary society with small kinship-based communities who traditionally live in small hamlets or single households dispersed over their mountainous territories. According to the key informants, their ancestors came from Mount Balinsoso then spread to another place they call Batorina until they became many and spread to other territories where they could live, and thus, the sub-tribes *Danloy*, *Balinga*, *Tiktika*, *Sanga*, *Samboy*, et al.

The Ivatans

William Dampier, an English adventurer, described the *Ivatans* as “short people: generally with round features, small yet bigger than Chinese, hazel eyes that are light reddish brown, usually flecked with green or gray, low foreheads; thick eyebrows; short low noses; white teeth; black thick hair and copper-colored skin.”



They are closely related to the ancient people of Formosa (Taiwan) as well as the Spaniards who came to the island in the 16th century (http://en.wikipedia.org/wiki/Ivatan_people; Omoto, Keiichi 1996). As cited in the Ancestral Domain Sustainable Development and Protection Plan Series of Batanes (DAR-NCIP, 2007), a team of archeologists headed by Dr. Bellwood and Dr. Dizon have evidences to prove that the ancestors of the *Ivatans* were the Austronesians who began their migration from Taiwan to Southern China to Itbayat about 3,500 to 4,000 years ago. At present, there are migrants locally known as *i-pula* present in the locality. Among them are the *Ilocanos* who are mostly employed in government offices while the *Ivatans* are the ones planting rootcrops. The *ipulas* arrived in Batanes after the Martial Law Proclamation in 1972. The *ipulas* usually plant vegetables (MAO, personal communication). About 75% of the *Ivatans* consider farming and fishing an indispensable part on their life. Fifty-three per cent of the *Ivatan* families rely mostly on root crop agriculture (Lim, 2000). Sugarcane is also raised to produce *palek*, a kind of native wine and vinegar.

The Profile of the Selected Majority Ethnolinguistic Group

Also included in the documentation are two non-indigenous or majority ethnolinguistic group, the *Kapampangan* and *Ilocano* rootcrop growers in Central Luzon. The entry of processing markets in the 1980's increased the role of root crops, particularly cassava and sweetpotato, as a cash crop in Central Luzon. Ever since, root crops remained a suitable rotation crop in some fields in Central Luzon, the home of two majority ethnolinguistic group in the Philippines- the *Kapampangans* and the *Ilocanos*.

Kapampangans. The *Kapampangans* are the sixth largest ethnic group in the Philippines, numbering about 2.9 million. The province of Pampanga is the traditional homeland of the *Kapampangans* who now populate some municipalities in the provinces of Tarlac, Bataan, Nueva Ecija and Bulacan. They descended from Austronesian immigrants to Luzon during the Iron Age, with traces of Chinese and Japanese ancestry and intermarriages with other Philippine ethnic groups, especially from the neighboring *Ayta*, *Sambal*, *Aburlin*, *Ilongot* and *Tagalog* (http://en.wikipedia.org/wiki/Kapampangan_people).



Ilocanos. *Ilocano* people are found all over the country from the Ilocos Region to Mindanao. They originate from the coastal and lowland areas of Northern Luzon particularly the provinces of Ilocos Sur, Ilocos Norte, and La Union. *Iloko*, their language, is the third most spoken in the country with more than eight million native speakers. The limited farm lands and vast coastal areas have made the *Ilocano* people resourceful and practical (www.ethnicgroupphilippines.com) and one reason that prompted them to migrate.

Data Gathering Procedure and Analysis

The steps in carrying out the research are shown in Figure 3. It starts with the gathering of secondary data from local government agriculture, planning and development units and from the National Commission on Indigenous Peoples records or libraries, market observation and linking for collaborative research done simultaneously in initially identified municipalities and/ or indigenous communities, namely: *Ibalois, Bagos, Ivatans, Isnags, Kalingas, Tingguians, Applai-kankanaeys, Kankana-eyes, Iyattukas, Kalanguyas, Bugkalots, Aetas and Mangyans*, as well as the *Kapampangan* and *Ilocano* root crops farmers in Central Luzon.

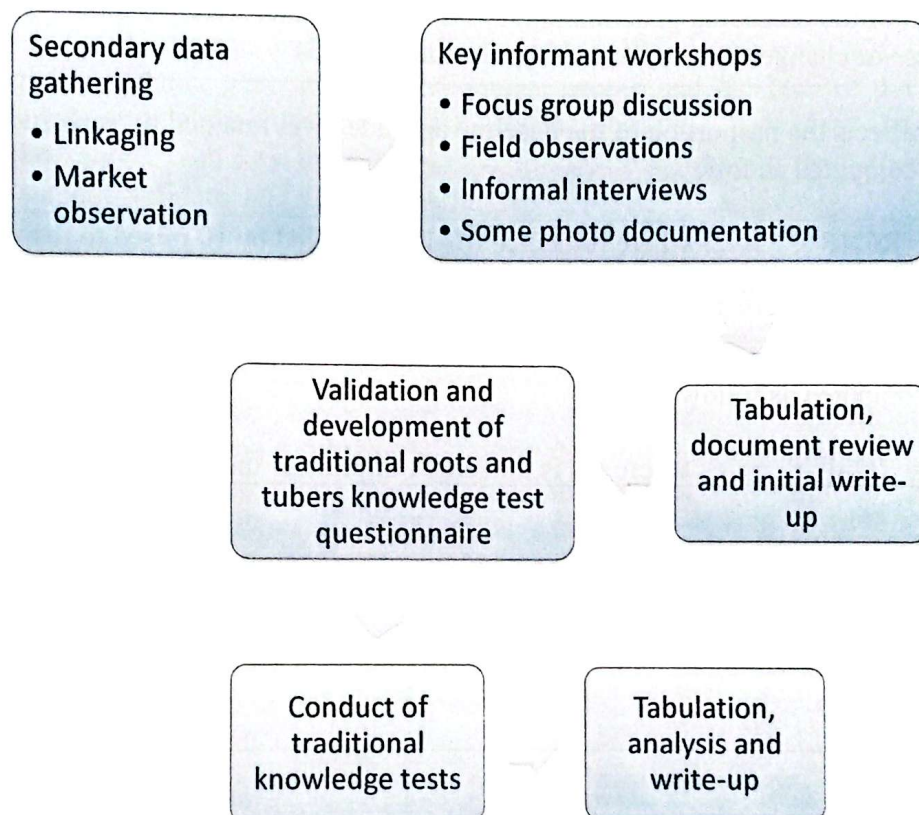


Fig.3. The Research Process

The data gathered from the field work and documents review were presented for validation and as a basis in preparing the traditional knowledge and the aptitude test questionnaire, administered through one-on-one interviews done with local partners more familiar with the dialect and the chosen respondents.

Narrative description, descriptive statistics using the Excel and the SPSS softwares, and the calculation of vitality indices (Zent, 2008) for traditional rootcrop knowledge were used to summarize and analyze data gathered. The vitality indices are: the intergenerational

rate of retention (RG), the cumulative rate of retention (RC), and the annual rate of change (CA). Formulas for calculation are:

RG indicates the rate of retention between any successive pair of age groups, computed as follows:

$$RG_t = \frac{g_t}{g_r} \quad \text{where } g_t - \text{mean score of the target age group (younger age group)}$$
$$g_r - \text{mean score of the reference age group}$$

RG_t of the oldest age group is set at 1 based on the logic that no information about the aptitude level of the preceding generation(s) is available and therefore we cannot assume that any difference or changes have occurred in prior time periods.

RC reflects the proportion of the baseline aptitude level retained by each succeeding age groups, computed as follows:

$RC_t = RC_r 10^{\log(RG_t)}$ where reference RC is multiplied by 10 raised to the power of the logarithm of the target RG. RC of the oldest group is also set at 1.

CA expresses the average rate and direction of change per year reflected by the target age group, computed as follows:

$$CA_t = \frac{RC_t - 1}{y_{gt}} \quad \text{where } y_{gt} \text{ is the length in years of the target age group interval}$$

STUDY 1

DIVERSITY AND KNOWLEDGE TRANSFER ON TRADITIONAL ROOTS AND TUBERS AMONG INDIGENOUS PEOPLE IN NORTHERN PHILIPPINES

B.T. Gayao, D.T. Meldoz, and G.S. Backian

ABSTRACT

The indigenous peoples of Northern Philippines like the *Ivatans*, *Isnegs*, *Kalingas*, *Tingguians*, *Applais*, *Bagos*, *Kankana-eyes*, *Iyattukas*, *Ibalois*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans* consider roots and tubers as their staple in the olden times. With the changing lifestyles of the younger generation of indigenous people and the lack of documentation, indigenous root and tuber crops are at risk of disappearing. Secondary data gathering, interview-workshops with key informants, and follow-up field visits and interviews were done to document, validate, and update information.

More than 20 roots and tubers consisting of 10 cultivated species and more than 10 species of wild roots and tubers were identified by indigenous people in Northern Philippines. The roots and tubers planted are cassava (*Manihot esculenta*), sweetpotato (*Ipomoea batatas*), greater yam (*Dioscorea alata*), taro (*Colocasia esculenta*), tannia (*Xanthosoma sagittifolium*), lesser yam (*Dioscorea esculenta*), arrowroot (*Maranta arundinacea*), potato (*Solanum tuberosum*), yacon (*Smallanthus sanchifolius*) and yambean (*Pachyrhizus spp.*). Wild roots and tubers include nami (*Dioscorea hispida*), elephant yam (*Amorphopallus campanulatus*), giant taro (*Alocasia macrorrhizos*; *Cyrtosperma chamissonis*), canna (*Cannaceae*), wild yam bean and wild species of taro, greater yam, and lesser yam known only by their local names.

The indigenous people's familiarity with the local names is an indication of the number of roots and tubers they have grown or utilized. This number ranged from 6 to 9 kinds among the *Bugkalots*, *Iyattukas*, *Ivatans* and *Mangyans*; 10-13 kinds among the *Kalanguyas*, *Aetas*, *Bagos*, *Kankana-eyes*, *Applai-kankanaeys* and *Isnegs*; 14-15 kinds among the *Kalingas*, *Ibalois* and *Tingguians*. The number or the diversity of roots and tubers once grown or harvested by the indigenous people is a reflection of their food security practices and coping mechanisms during food insecurity situations.

Loss of traditional knowledge on the diversity of roots and tubers known and grown is a reality only among the younger generation, particularly those born starting in the 1980's. There is a retention or little loss of traditional knowledge on the diversity of roots and tubers for those born before the eighties.

INTRODUCTION

The Philippines is a rice growing and rice eating country, but for more than 25 years, rice imports have been filling-up the shortage in production. Broad and Cavanagh (PDI, Oct. 13, 2010) reported that the Philippines still imports 10% of its rice requirement annually. The Philippines is the world's largest importer of rice in 2008 at 1.8 million tons (irri.org/news).

Importation is inevitable because of limitations in rice land, population growth and limited infrastructure on irrigation and roads.

On the other hand, roots and tubers had served as an important alternate staple food in the olden times especially among the hillside, upland and forest dwellers, and the indigenous peoples who are the traditional consumers and producers of root crops. However, past and continuing deforestation, in- and out-migration to urban areas as consequences of population growth, climate change, international and national policies that stress cash and industrial crops production rather than for local household consumption, is putting pressure on the self-sufficiency of indigenous peoples and to the role of root and tuber crops. Nowadays, the rich biodiversity of root and tuber crops for domestic or household consumption is disappearing.

Root and tuber crops is a collective term for plants that are grown for their modified, thickened root or stem which generally develop underground. Special terms for specific types are root crops for modified roots, tuber crops and corm crops for modified stems (Bareja, 2010). A rhizome is a modified stem.

The book 'Roots and Tubers in the Global Food System: A Vision Statement to the Year 2020', identified root and tuber crops as a food crop to feed the world in coming decades. Scott, et al. (2000), pointed out that by Year 2020, well over 2 billion people in Asia, Africa and Latin America will depend on these crops for food, feed, or income. Many of the developing world's poorest and most food insecure households will continuously look up to these crops as contributing, if not the principal, source of food, nutrition, and cash income.

Earlier published and unpublished studies and newspaper articles in the Philippines had mentioned root crops, particularly sweetpotato, as survival crops among resource-poor families to weather the ill-effects of typhoons and food crises: namely, during the World War II in the Cordillera highlands (Solimen, et al., 1998), during the aftermath of the 1990 earthquake in Benguet (Sano, et al., 1991), the swidden farming of marginal farmers in the rice terraces of Ifugao (Balaki and Solimen, 1991; Verdonk, 1991), and the year-round cultivation of sweetpotato (*Ipomeoa batatas*), ubi (*Dioscorea alata*) and tugui (*Dioscorea esculenta*) as subsistence crop in the Batanes island province (Dayo, et al., 1998), the consumption of wild yams 'nami' (*Dioscorea hispida*) by upland farmers in Mindanao due to crop losses resulting from the El Nino drought, and the consumption of wild yam 'kamangeg' (*Dioscorea spp.*) by fishermen and farm laborers in the coastal village of Ilocos Sur before the harvest of the wet rice cropping.

Available information and local literatures are mostly on cassava (*Manihot esculenta*), sweetpotato (*Ipomeoa batatas*) and potato (*Solanum tuberosum*), there are few on yam (*Dioscorea alata*), and inadequate on the lesser known roots and tubers. National crop statistics (PSA, 2013) are also on cassava, sweetpotato, potato, greater yam, lesser yam (*Dioscorea esculenta*), taro (*Colocasia esculenta*) and tannia (*Xanthosoma sagittifolium*). Crop statistics on arrowroot (*Maranta arundinacea*), yambean (*Pachyrhizus erosus*) and yacon (*Smallanthus sanchifolius*) and other roots and tubers are not shown (PSA, 2013).

Hence, this study was conceived to determine an answer to the question of what roots and tubers are still planted, consumed or traded, or already lost. The study also determined erosion or loss of knowledge of traditional roots and tubers planted or consumed among indigenous peoples in Northern Philippines.

METHODOLOGY

Data Gathering Procedure

Phase 1 started with the gathering of secondary data (production statistics on roots and tubers, indigenous groups) from agriculture, local government units and National Commission on Indigenous People, market observation and linking for collaborative research in initially identified municipalities and/ or indigenous communities. Thirteen indigenous people- the *Ibaloi*, *Bago*, *Aeta*, *Ivatan*, *Isneg*, *Buhid-Mangyan*, *Biga-Kalinga*, *Bugkalot*, *Kalanguya*, *Tingguian*, *Kankana-ey*, *Iyattuka* and *Applai-Kankana-ey* were selected for the study.

Phase 2 is the conduct of key informant workshops in the selected communities. Key informants were invited with the assistance of collaborating researchers and agencies based on familiarity in growing and consuming rootcrops and length of residence in the identified indigenous people's community. It was opened up with story-telling about the village (the sitios, the ethnic groups or indigenous people residing in the village, story behind the name of the village, the crops planted and food eaten), and followed-up with the naming of rootcrops growing in their village accompanied with pictures of roots and tubers if needed to aid in their recall of what was and where planted or gathered, or known as once planted or harvested. Information gathered were listed in cue cards or manila paper as guide in further recall of local names, sharing of information, further data gathering and as basis for the assessment on the extent of production (Box 1). Sometimes, the researchers also shared their knowledge of the local names of roots and tubers grown, eaten and special use by other indigenous people to liven up workshop discussions and to steer the informal interview-workshop as per guide questions. This was followed with a field visit to take pictures or collect the identified roots and tubers.

Narrative description, photos or illustrations gave detailed information of the root and tuber crops.

Box 1. Categorization in assessing extent of production and use as perceived by the key informants

- a. Large area- many growers (abundant)
- b. Large area- few growers (abundant)
- c. Small area- many growers/users (occasional)
- d. Small area- few growers/users (rare; need of conservation)

Modified based on understanding extent and distribution of diversity (Sthapit, et al., 2001; IPGRI, 2002)

Phase 3 consisted of the conduct of the traditional roots and tubers knowledge (TRK) test among the four IP's- *the Ibalois*, the *Bagos*, the *Tingguians* and the *Iyattukas* to determine transfer or loss. The selection of four out of the 13 IPs is dictated by time constraints available to the researchers, local partners, and project duration.

Four sets of questionnaire consisting of simple questions answerable by multiple choice, yes-no, or true-false were prepared for the selected groups. After a briefing workshop, the test was administered with the assistance of the local or resident research coordinators. Thirty test subjects were targeted for each of the selected IP groups, divided into three age groups (15-35 years old, 36-56 years old and 57-77 years old) and into male and female subjects when analyzed. The respondents were purposively identified with possible replacements from the available and willing resident IPs at that time of the test administration. The tests were done individually and independently or with assistance of the local coordinators who clarified and/or translated the questions into the vernacular especially for those who cannot read/write or understand the questions. Checking and scoring of the completed questionnaires were done en banc at each site by the project researchers and local partners.

Limitations

Actual area planted and yield of the different roots and tubers in the selected areas and among indigenous peoples are not included in this report, although attempts had been done to gather information and reported separately in the costs and returns publication.

DISCUSSION OF RESULTS

Philippines Statistics on Roots and Tubers

There are seven kinds of roots and tubers included in the Philippine Statistics Authority (PSA) records, namely: cassava, sweetpotato, potato, greater yam (*ubi*), taro (*gabi*), tannia (*galiang/pao*) and lesser yam (*tugui*). The PSA is officially recognized as source of the country agriculture statistics. In terms of volume of production, cassava ranks first in the Philippines at 2.54 million metric tons, followed by sweetpotato at 0.519 million, potato at 0.119 million and taro at 0.110 million as of 2014. Greater yam (0.014 million), tannia (0.011 million) and lesser yam (0.003 million) were less produced (PSA, 2013). Bulk of roots and tubers supply is for food consumption (95% for sweetpotato, *ubi* and *gabi*, 71% for potato, 82% for *galiang* and 86% for *tugui*) except cassava where bulk is for the processing industry (84%) and only 10% is for food consumption. Although the PSA report did not include the harvest data for *ubi* and sweetpotato used for processing, the Department of Agriculture Agribusiness Division listed several yam and sweetpotato processors.

In Northern Philippines (Luzon), the provinces of Isabela, Camarines Sur, Quezon, Albay, Apayao, Pangasinan, Batangas, Pampanga and Cagayan are top producers of cassava while Camarines Sur, Albay, Quezon, and Tarlac are known for sweetpotato. Potato production is concentrated in Benguet and Mountain Province while for taro; the leading producers are Isabela, Albay, Cagayan and Benguet. For greater yam, the leading provinces

are Cagayan, Batanes and Albay of (PSA, 2014). Throughout the country, however, almost all provinces produce roots and tubers.

Table 1. Top 10 roots and tubers producing provinces in Northern Philippines

RANK	CASSAVA		SWEETPOTATO		TARO		GREATER YAM		POTATO	
	Province	MT	Province	MT	Province	MT	Province	MT	Province	MT
	Philippines	2,540,254		519,855		110,365		15,260		119,140
1	Isabela	121,291	Camarines Sur	40,619	Isabela	8,354	Cagayan	1,205	Benguet	89,918
2	Camarines Sur	76,518	Albay	33,582	Albay	5,177	Batanes	566	Mountain Province	12,195
3	Quezon	37,728	Quezon	28,828	Cagayan	4,315	Albay	439	Nueva Vizcaya	446
4	Albay	13,774	Tarlac	21,727	Benguet	4,305	Bulacan	234	Ifugao	142
5	Apayao	10,929	Pangasinan	8,214	Quezon	2,851	La Union	210		
6	Pangasinan	10,685	Ifugao	7,251	Camarines Sur	2,683	Palawan	204		
7	Batangas	9,843	Occidental Mindoro	6,792	Nueva Vizcaya	2,245	Isabela	191		
8	Pampanga	9,757	Sorsogon	5,999	Oriental Mindoro	2,218	Cavite	190		
9	Cagayan	9,339	Benguet	5,670	Pampanga	2,140	Nueva Vizcaya	165		
10	Sorsogon	7,562	Catanduanes	5,349	Sorsogon	1,885	Occidental Mindoro	157		

Source: Philippine Statistics Authority, 2013 and 2014

Diversity of Roots and Tubers Known by Indigenous Peoples

As compared with the seven roots and tubers listed in the country's agricultural statistics, there are more than twenty roots and tubers identified by the selected indigenous people (IPs) in Northern Philippines. These crops consist of five roots, 12 tubers and six corms (Table 2). The root crops like cassava, sweetpotato, yambean, yacon and wild yambean have enlarged or modified roots used for food or feed while the tuber crops have modified underground stems like greater yam, lesser yam, arrowroot, potato, canna, nami, elephant yam, wild lesser yam and three wild species of greater yam. The corms, also a modified stem are taro, tannia, giant taro and 3 wild taro species. Aside from roots, tubers and corms, other plant parts used for human food are the young leaves or shoots of the cassava and sweetpotato, the young stalk, leaves, petioles and runners of taro and tannia, and the young pod of the wild yambean. Roots, tubers, corms, rhizomes, vines, stalks and leaves are also used for animal feed.

Table 2. Roots and tubers known to the indigenous people in Northern Philippines

CROP	SCIENTIFIC NAME*	USE OF PLANT PART	
		Human food	Animal feed
Roots			
Cassava	<i>Manihot esculenta</i>	Roots, young leaves or shoot	Roots
Sweetpotato	<i>Ipomoea batatas</i>	Roots, young leaves or shoot	Roots, vines, leaves
Yambean	<i>Pachyrhizus spp.</i>	Roots	
Wild yambean	<i>Pachyrhizus spp.</i>	Roots, young pod	
Yacon	<i>Smallanthus sanchifolius</i>	Roots	
Tubers			
Greater Yam	<i>Dioscorea alata</i>	Tubers	Tubers
Lesser yam	<i>Dioscorea esculenta</i>	Tubers	
Arrowroot	<i>Maranta arundinacea</i>	Rhizome	Rhizome
Aerial yam	<i>Dioscorea bulbifera</i>	Tubers	
Potato	<i>Solanum tuberosum.</i>	Tubers	
Canna	<i>Cannaceae</i>	Rhizome	
Nami	<i>Dioscorea hispida</i>	Tubers	
Wild greater yam (3 species)	<i>Dioscorea spp.</i>	Tubers	Tubers
Wild lesser yam	<i>Dioscorea papillaris</i>	Tubers	
Elephant yam	<i>Amorphopallus campanulatus</i>	Young stalk or petiole	
Corms			
Taro	<i>Colocasia esculenta</i>	Corms, stalk, leaves, petiole, runners	Corms, stalk, leaves
Tannia	<i>Xanthosoma sagittifolium</i> (white); <i>Xanthosoma violaceum</i> (purple)	Cormels, young stalk & leaves	Corms, stalk, leaves
Wild taro (3 species)	<i>Colocasia spp.</i>	Young stalk, leaves, petiole	Stalk, leaves
Giant taro	<i>Alocasia macrorrhiza</i>		stalk, leaves

*Scott, G.J., R. Best, M. Rosegrant and M. Bokanga. 2000

Cassava, sweetpotato, greater yam, lesser yam, taro and tannia are the roots and tubers planted by all the 13 IPs selected in this study (Figure 1). Arrowroot is not among the crops planted by the *Ivatans*, *Bugkalots* and *Iyattukas*; potato only by the *Ibalois* and *Kankana-eyes*; yacon only by the *Ibalois* and *Kalanguyas*; yambean only by the *Applai-*

Kankana-eyes. Arrowroot, lesser yam and tannia are sometimes volunteer crops while canna, aerial yam and wild species of taro like *bitajon* are domesticated.

The wild roots and tubers like *nami*, elephant yam, giant taro and unknown species of *Dioscorea* and *Colocasia* once harvested because of food and feed scarcity during the war or Japanese occupation when food was scarce, are not known to all of the 13 IPs as they do not have local names for them.

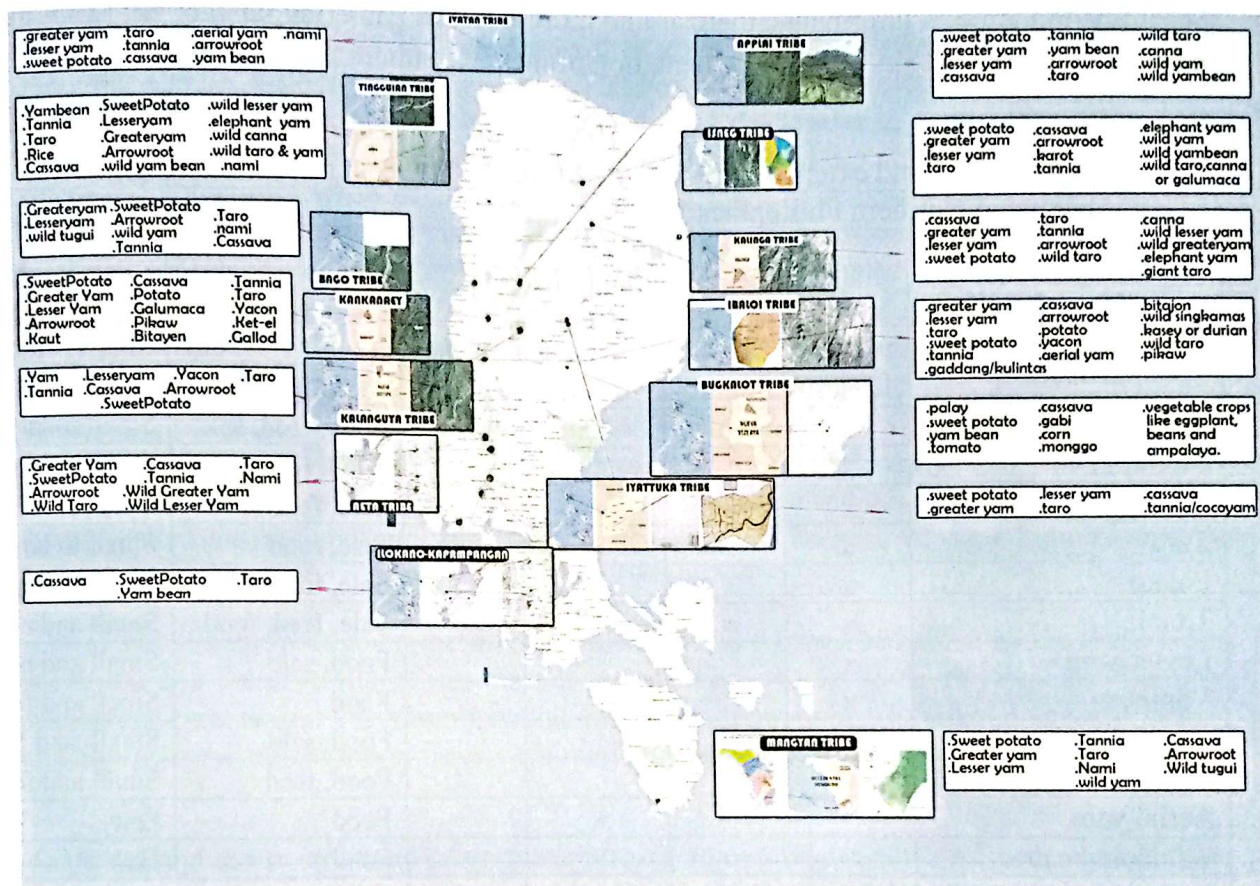


Fig.1. Diversity of roots and tubers known to indigenous people in Northern Philippines

Habitat, Use and Extent of Production

The IP informants categorized these root and tuber crops based on location where these are found. Ten are deliberately planted, three are volunteer plants, three are domesticated wild plants, and more than six are wild roots and tubers (Table 3).

The IP's differ in their assessment of production and use. When the roots and tubers are grown for sale and food like cassava, sweetpotato, greater yam, taro and potato, the perceived extent of production ranged from small to large and many users. When the roots and tubers are mainly for household use as food or feed like for tannia and lesser yam, the

extent of production ranged from small area (as few as five hills/ plants) to many growers and household users. Yacon, yambean, and arrowroot grown in small areas are for food for a few of the IPs although large areas of yambean are grown in Central Luzon. Cultivation of yacon and arrowroot, together with the gathering of wild roots and tubers are now becoming rare. According to the Kalanguya, Ibaloi and other IPs, the wide cultivation of yacon, and/ or the consumption of other roots and tubers became small and less done nowadays because there is no wide market and there are other alternative sources of food or livelihood. According to the Bago informants, there are no more families gathering *nami* or wild yam in the mountains for food since the implementation of the government's 4Ps Program.

Table 3. Habitat, use, and extent of production of roots and tubers known to the indigenous people in Northern Philippines

ROOT/TUBER	HABITAT				USE	EXTENT OF PRODUCTION AND USE
	Planted crop	Volunteer plant	Domesticated wild plant	Wild plant		
Cassava	x				Food, feed, sale	Small to large
Sweetpotato	x				Food, feed, sale	Small to large
Greater Yam	x				Sale, food	Small to large
Taro	x				Sale, food	Small to large
Potato	x				Sale, food	Small to large
Tannia	x	x		x	Sale, feed, food	Small and many
Lesser yam	x				Food, sale	Small and many
Yambean	x				Food	Small and few
Yacon	x	x			Food, sale	Small and few
Arrowroot	x	x			Food, feed	Small and few
Aerial yam			x		Food	Few
Wild yambean			x		Food	Few
Canna			x		Food	Few
Wild taro (3 species)			x	x	Feed, food, sale	Few
Wild yam (3 species)				x	Food, sale, feed	Few
Nami				x	Food	Few
Elephant yam				x	Food	Few
Wild lesser yam				x	Food	Few
Giant taro				x	Feed	Few

- a. Large area- many growers (abundant) c. Small area- many growers/users (occasional)
 b. Large area- few growers (abundant) d. Small area- few growers/users (rare)

Planted crops are found in swidden farms, rainfed farms, irrigated paddies, homegardens and even riverbanks (Table 4); volunteer plants, in old and newly operated farms, pathways and waterways, backyards and riverbanks; and wild plants, in forest, old swidden farms, and along undisturbed lands near farms, pathways and waterways. Sometimes wild plants are maintained in swidden farms or transferred in backyard gardens.

Only few households domesticate or gather wild roots and tubers for food, feeds or sale. For example, the *Aeta* farmers gather wild roots and tubers to sell or to eat as substitute to rice staple, thus, saving the cash needed for buying rice. Gathering is usually done from September to December when they go to their swidden farm or hunt in the forest. The *Iyattukas*, *Isnegs*, *Kalingas*, and *Tingguians* harvest wild taro in summer (April) or anytime of the year as alternate feeds for pigs if sweetpotato is not available. Among the *Tingguians*, the wild taro *pikaw* is harvested for vegetable, sometimes sold or bartered with *bagoong* (fish sauce) and sometimes when people from the capital town of Bangued buy *pikaw* (PhP5-10/ bundle) as *palwad* or token for visitors during weddings. The informants described *pikaw* as growing near the creeks or in rocks and are sensitive to other plants. Wild species of taro are usually gathered as viand and feeds for swine. Otherwise, none or only occasionally do households harvest wild roots and tubers like when children go dig-up the wild yambean (*sagsag-ot*) during summer vacation or when a household would like to cook ubi for a gathering. The *Aeta* informants claimed that only a few of these wild rootcrops remain and thus are endangered. The wild yam called *amakey* by the *Tingguians* was lost because most of the habitat area was converted into rice field. In some swidden farms, volunteer yam locally called *ka-sey* and *kalot* plants are being uprooted because of their thorny stems or vines.

The IPs knowledge on the diversity of roots and tubers, the habitat where these crops are found and the diversity of use reflects the plant adaptation to the physical environment (elevation, climate and vegetation), social conditions (population, livelihood and utilization) and coping mechanisms when faced with food insecurity situations.

Table 4. Land use for root and tuber crops farming among selected IPs in Northern Philippines

IP GROUP	LAND USE/ LOCAL NAME				
	Swidden Farm	Rainfed Paddy	Irrigated Paddy	Homegarden	Riverbank
A. Cordillera Region					
<i>Ibaloi</i>	<i>Uma</i>	<i>Bangkag</i>	<i>Talon or Payew</i>	<i>Baeng</i>	
<i>Kankana-ey</i>	<i>Uma or nom-a</i>	<i>Garden</i>		<i>Baangan</i>	
<i>Applai-Kankana-ey</i>	<i>Nom-a</i>	<i>Bangkag</i>	<i>Payew</i>	<i>Baangan</i>	
<i>Iyattuka</i>	<i>Habal</i>		<i>*Payoh (Tonong, Aping, Lobah)</i> <i>*Dulyah</i>	<i>Ardattan and/ or Ligligan</i>	
<i>Tingguian</i>	<i>Um-uma</i>		<i>Tal-talon</i>		
<i>Isneg</i>	<i>Kuman</i>		<i>Mah-ma</i>	<i>Amwag</i>	
<i>Biga-Kalinga</i>	<i>Uma</i>	<i>Bangkag</i>	<i>Payaw</i>	<i>Galden</i>	

B. Ilocos Region					
<i>Bago</i>	<i>Uma</i>	<i>Bankkag</i>	<i>Talon</i>		<i>Sebba</i>
C. Cagayan Region					
<i>Ivatan</i>		<i>Asakatakey</i>		<i>Homegarden</i>	
<i>Bugkalot</i>	<i>Uma</i>	<i>Imuged</i>	<i>Pajaw</i>	<i>Amtaden</i>	
<i>Kalanguya</i>	<i>Inum-an</i>	<i>Bangkag or Garden</i>		<i>Baangan</i>	
D. Central Luzon					
<i>Aeta</i>	<i>Kaingin, Gasak or Lali</i>				
E. Mimaropa Region					
<i>Buhid-Mangyan</i>	<i>Tamnan</i>				

Local Names of Roots and Tubers

Commonly planted roots and tubers are sometimes called differently among the IPs (Table 3). Local name of the roots and tubers are indicative of the IPs familiarity to the crops. The *Ibalois* and *Tingguians*, followed by the *Kalingas*, *Isnegs* and *Kankana-eyes* knew more of the roots and tubers (13-15 kinds) than the *Bugkalots*, *Ivatans* and the *Iyattukas*.

Kahoy is a more popular name of cassava among the IPs than *katimoro*, *moro*, *dutung*, *balinghoy*, *balangoy*, *padpadli*, *samal*, *hanglay* and *kalasan*. Local names of sweetpotato is more confusing as the *Kalanguyas*, *Iyattukas* and *Aplai-kankana-eyes* call it *ubih*, which is the more popular local name of greater yam (*ube*, *uve*, *ubi*, *uvi*) or the *Ibalois*, *Kankana-eyes* and *Aplais* naming sweetpotato as *dokto*, *lokto* or *tugi* which is again a more popular name of lesser yam (*lokto*, *luktoh*, *lufto*, *tugui*, *tugtugi*). There are also other local names of sweetpotato, greater yam, lesser yam, taro and tannia aside from those aforementioned as shown in Table 5, but as noted potato, yacon and *singkamas* or *yambean* is the same for all IPs.

Table 5. Local names of roots and tubers known to IPs in Northern Philippines

ROOT/ TUBER	IP						
	Ibaloi	Bago	Aeta	Ivatan	Isneg	Mangyan	Kalinga
Aerial Yam	<i>Kafu- ngaw</i>			<i>Batata</i>			
Arrowroot	<i>Sugod</i>	<i>Sago</i>	<i>Araro</i>		<i>Ahoki</i>	<i>Biyas</i>	<i>Wikan</i>
Canna	<i>Kulintas, Gaddang</i>				<i>Galumaca</i>		<i>Bonte-ek</i>
Cassava	<i>Katimoro</i>	<i>Kahoy</i>	<i>Kamoteng Dutung, Moros</i>	<i>Kamoteng kahoy</i>	<i>Kahoy</i>	<i>Balinghoy, Kayo-kayo</i>	<i>Padpadli</i>
Elephant Yam					<i>Tigi</i>		<i>Boton lakay, Bageng</i>
Giant Taro							<i>Bila</i>

Greater Yam	<i>Uve</i>	<i>Ubi</i>	<i>Ubi, Liwet</i>	<i>Uvi</i>	<i>Ubi</i>	<i>Ubi</i>	<i>Ubi</i>
Lesser Yam	<i>Balugan</i>	<i>Tugtugi</i>	<i>Limeng</i>	<i>Dukay</i>	<i>Lufto</i>	<i>Buwang</i>	<i>Lokto, Ontoy</i>
Nami	<i>Kalot</i>	<i>Ka-ot, Karot</i>	<i>Kalot, Ligaw na Liwet</i>	<i>Mintakey</i>	<i>Karot</i>	<i>Karot, Kalot</i>	
Potato	<i>Pafas</i>						
Sweetpotato	<i>Dokto</i>	<i>Tugui, Palay</i>	<i>Kamoteng Gapang, Kamochi</i>	<i>Wakay</i>	<i>Kantila</i>	<i>Baynaw, Kamote</i>	<i>Gaselang</i>
Tannia	<i>Galyang</i>	<i>Bila, Galiang</i>	<i>Galyan, Biga</i>	<i>Canaka, Tanaka</i>	<i>Lusya</i>	<i>Singapor, Bulawan</i>	<i>Galiang lidoy</i>
Taro	<i>Ava</i>	<i>Gamey, Aba, Buyon</i>	<i>Gandus</i>	<i>Sudi</i>	<i>Ateng</i>	<i>Gabi</i>	<i>Lidoy</i>
Wild Greater Yam	<i>Kasey, Durian</i>	<i>Lima-lima, Dimurian</i>	<i>Labit, Diyan, Kabwang</i>		<i>Amakey</i>	<i>Borot, Lugiman</i>	<i>Atap ubi</i>
Wild Lesser Yam		<i>Boga</i>					<i>Atap ontoy</i>
Wild Taro	<i>Pikaw, Bitajon</i>		<i>Lapa</i>		<i>Lanipog or Pikaw, Bileng</i>		<i>Pi-aw or bulagot</i>
Wild Yam bean	<i>Badang dingkamas</i>	<i>Singkamas</i>			<i>Singkamas</i>		<i>Sagsag-ot</i>
Yacon	<i>Yacon</i>						
Yambean							
# known	15	11	10	8	13	9	14

Table 5. Continued.

ROOT/ TUBER	IP						Total (#)*
	Bugkalot	Kalanguya	Kankana-ey	Tingguian	Iyattuka	Applai-Kankana-ey	
Aerial Yam				<i>Ilos</i>			3
Arrowroot		<i>Awing</i>	<i>Lushussi</i>	<i>Kurita</i>		<i>Galumaca</i>	10
Canna			<i>Galumaca</i>	<i>Litogak, Sag-ot</i>		<i>Awwing</i>	6
Cassava	<i>Samal</i>	<i>Hanglay</i>	<i>Kahoy, Balangoy, Kaka-iw</i>	<i>Molo, Kahoy</i>	<i>Kahoy</i>	<i>Kahoy, Kalasan, Padpadli</i>	13
Elephant Yam				<i>Tigi, Pokpoklit</i>			3

Giant Taro							1
Greater Yam	<i>Ubi</i>	<i>Ongo</i>	<i>Ulang</i>	<i>Ubi</i>	<i>Guhhuddan</i>	<i>Ubi</i>	13
Lesser Yam	<i>Tugi</i>	<i>Lokto</i>	<i>Tugui</i>	<i>Tugui</i>	<i>Luktoh, Pukupuk</i>	<i>Lukto</i>	13
Nami			<i>Kaut</i>	<i>Karot, Kalot</i>			8
Potato			<i>Patatas, papas</i>				2
Sweetpotato	<i>Bella</i>	<i>Ubbi</i>	<i>Lokto</i>	<i>Katila, Camote</i>	<i>Ubih</i>	<i>Tugi,</i>	13
Tannia	<i>Galjang</i>	<i>Galyang</i>	<i>Bila</i>	<i>Amasyan</i>	<i>Bilah</i>	<i>Galiang, Bila</i>	13
Taro	<i>Putlo</i>	<i>Pihing, Aba</i>	<i>Gamey, Aba</i>	<i>Lapa, Aba, Gabi, Loko, Rabok</i>	<i>Abah, Pihing</i>	<i>Pising</i>	13
Wild Greater Yam		<i>Dalakit</i>	<i>Gallod</i>	<i>Iyog-iyogan, Kamangeg</i>	<i>Ipoy</i>	<i>Kanapan</i>	11
Wild Lesser Yam				<i>Anayed, Boga</i>			3
Wild Taro		<i>Lubingan, Bilagot</i>	<i>Pikaw, Bitayen</i>	<i>Pikaw, Kalapon</i>	<i>Pihkaw, Wild abah</i>	<i>Pikaw, Sed-ing, Hed-ing, Tayagan</i>	9
Wild Yam bean			<i>Ket-el, Singkamas</i>	<i>Battog</i>		<i>Kitkili, Singkamas ti bantay</i>	7
Yacon		<i>Yacon</i>					2
Yambean						<i>Singkamas</i>	1
# known	6	10	13	15	8	12	

*Number of IPs familiar with the crop

For the wild or less known roots and tubers, pictures or descriptions were gathered from the informants. The *gaddang* is described similarly to *kulintas* (Figure 2) of the *Ibalois* except that the former has maroon color of stalk as compared to green stalk in *kulintas*. This is similar to the *galumaca* of the *Isnegs*, *bonte-ek* of the *Kalingas* and *litogak* or *sag-ot* of the *Tinguigans* and *awwing* of the *Applais*. *Tinguigans* claim that *litogak* has rhizomes that are sticky when roasted.



Fig. 2. *Kulintas* plant and rhizomes

The arrowroot is sometimes interchanged with canna such that it is also called *awing* by the *Kalanguyas* and *galumaca* by the *Aplai-kankanaeys*; or *sugod*, *sago*, *araro*, *ahoki*, *biyas*, *wikan*, *lulussi* and *kurita* (Figure 3) among the other IPs. Once planted, arrowroot grows perennially and voluntarily. Some arrowroot varieties are also grown for ornamental purposes.

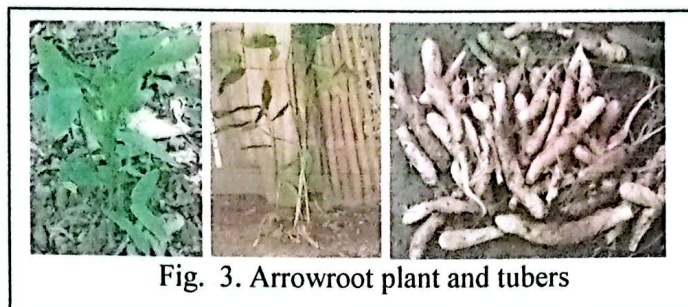


Fig. 3. Arrowroot plant and tubers

The less known *Dioscorea* species growing wild and sometimes domesticated are: the aerial yam (Figure 4) known only among the *Ibaloi*, *Ivatan* and *Tingguian* IPs as *kafu-ngaw*, *batata* and *ilos*. The *ilos* was mentioned as having a smooth outer skin that when boiled is easily removed. Other wild yam species (Figure 5) are *kamangeg* among the *Tingguians*, *ka-sey* among the *Ibalois* and *lima-lima* among the *Bagos*, *durian* or *dimurian* which might be similar to the *labit*, *ipoy* and *dalakit* and maybe different from the *diyan*, *amakey*, *borot*, *lugiman*, *kanapan*, and *gallod* of the other IPs. The *Aetas* described the *labit* as having very long tubers like legs, similar to the *durian* of the *Ilocano* tribe. As described by the *Bagos*, the wild yam '*dimurian*' have elongated white-fleshed tuber. The *liwet* or *kabwang* produces more white tubers. The wild yam *ipoy* has very long, as long as six feet and very big (6 inches diameter) elongated white flesh tuber. It is high yielding and deep rooted that there is a need to use an iron bar or *bareta* to harvest. Sometimes, these are growing voluntarily in the *habal* (swidden farm) of the *Iyattukas*. The *dalakit* tuber also grows deep.

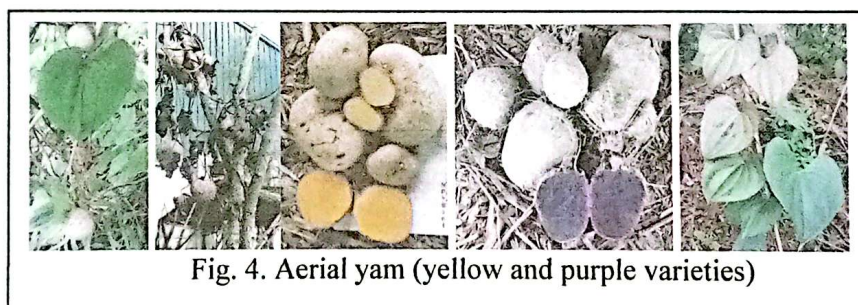
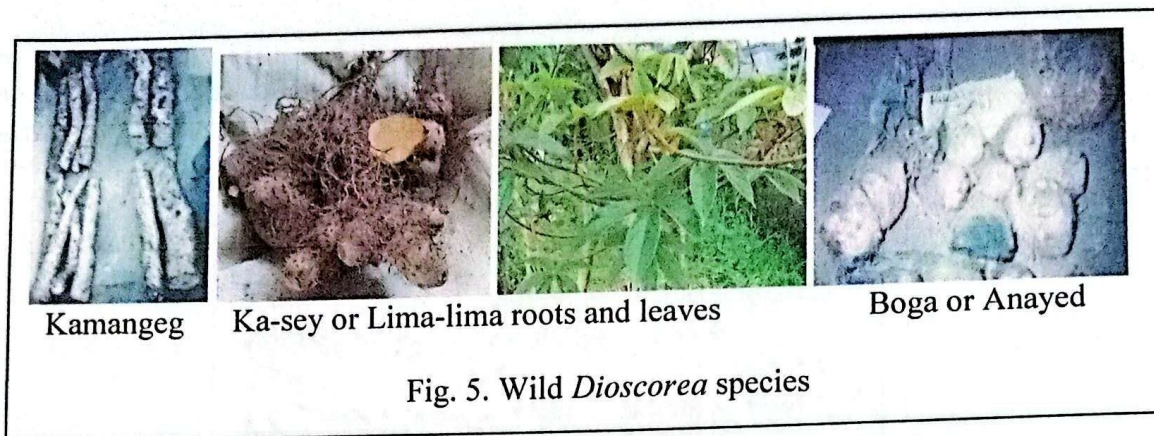


Fig. 4. Aerial yam (yellow and purple varieties)

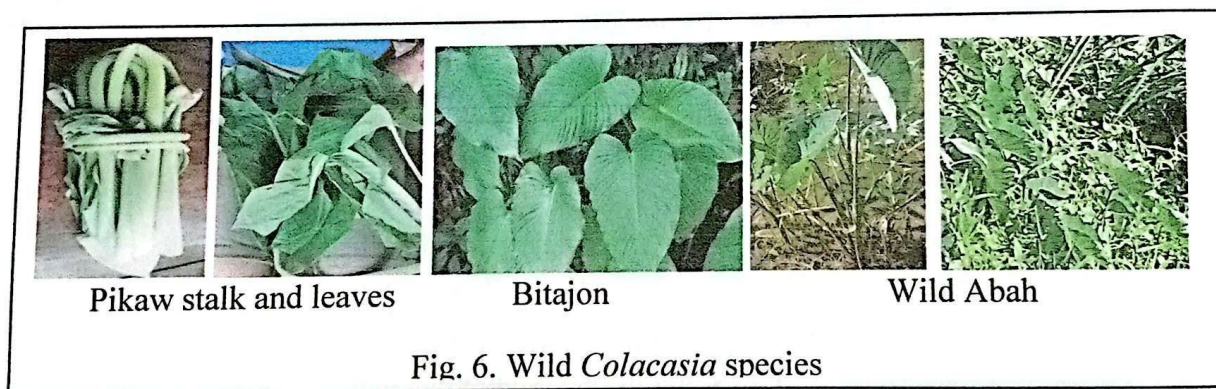
Wild lesser yam is known as *boga* among the *Bagos*, *anayed* among the *Tingguians* and *atap onttoy* among the *Kalingas*. The *Bagos* claimed that *boga* have a tough crunchy texture and that is why it is only given for pigs. *Tingguians* described *anayed* as having long spines in the vine especially those near the ground, and the tuber as having a sweet taste when boiled.

Many of these wild yams hardly exist nowadays, and some already lost just like the purple-fleshed yams of the *Mangyans*.

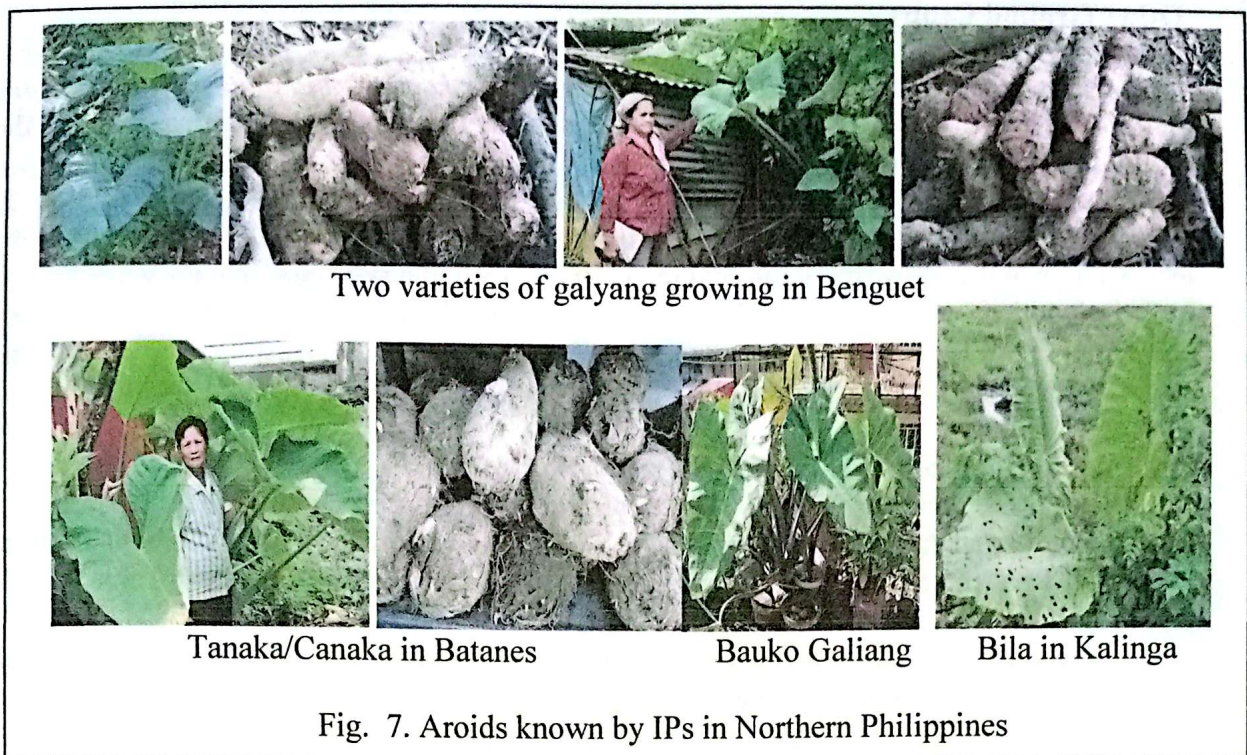


Among the wild taro (Figure 6), the more popular name among the IPs is *pikaw*, *pi-aw*, *pihkaw*, *bilagot/bulagot* or *lanipog*, and closely resembles *bitajon* (*Ibaloi*) or *bitayan* (*Kankana-ey*). According to the IPs, *pikaw* is a sensitive plant growing near the creeks or in moist rocky mountain sides. Stalks and leaves of the *bilagot* growing wild in streams are used for swine feed.

Wild taro that looks similar to the cultivated varieties is identified as *lapa*, *bileng*, *lubingan*, *kalapon*, *wild abah*, *sed-ing/hed-ing* and *tayagan*. The *lapa* which has edible stalk grows in the creek or in swampy areas. *Kalapon*, another wild species of taro, was described as having leaves that resemble that of bitter gourd, and that stalk are gathered and boiled for pig feed. The *lubingan* naturally grows in creeks and has small elongated corms, green stalk and leaves but only the stalk is harvested for home consumption.



Aroids which are oftentimes interchanged by the IPs are the tannia referred to as *galyang*, *galiang*, *galyan*, *bila*, *bilah*, *biga*, *amasyan*, *lusya*, *bulawan*, *singapor* and *gaselang*, and the giant taro called *bila* by the *Kalingas* (Figure 7). *Galyang* is also a cultivated crop but to some IPs, it is a volunteer or a wild plant.



Two varieties of galyang growing in Benguet

Tanaka/Canaka in Batanes

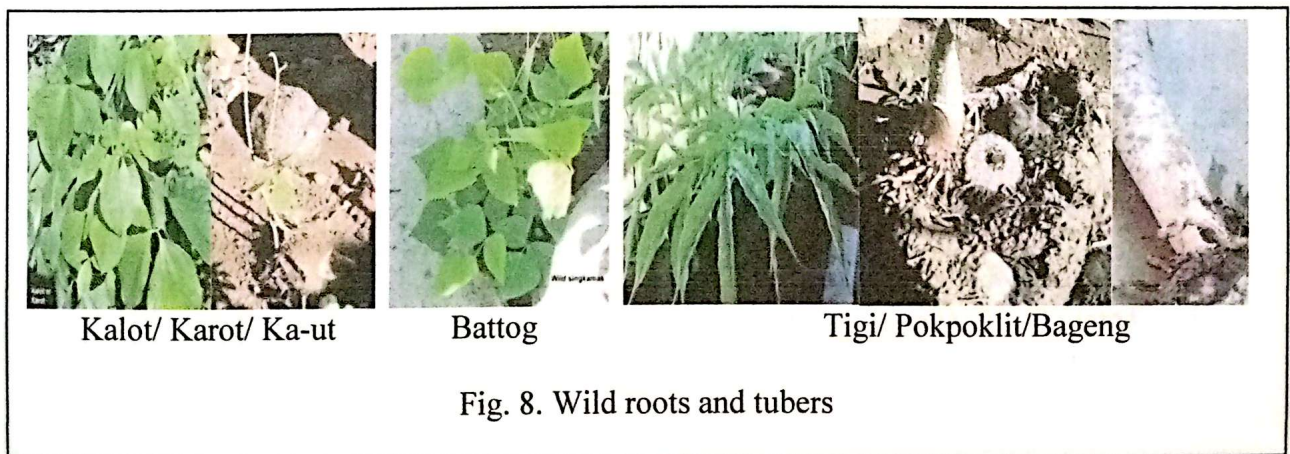
Bauko Galiang

Bila in Kalinga

Fig. 7. Aroids known by IPs in Northern Philippines

Other roots and tubers mentioned are: the *nami* commonly referred to as *kalot*, *karot*, *ka-ut*, *ligaw na liwet* and *mintakey*; the wild yambean called *badang singkamas*, *singkamas ti bantay*, *ket-el*, *battog*, *sagsag-ot*, or *kitkitli*; and the elephant yam known as *tigi* among the *Isnegs* and *Tingguians* or *pokpoklit*, *boton lakay* or *bageng* among the *Kalingas* (Figure 8).

The *kalot* requires thorough processing thus no longer or very seldom gathered from the wild. According to the *Tingguians*, the wild yam bean is aromatic, and there are two kinds of *tigi* plants that are profusely growing in the village even in *um-uma*, borders of the *tal-talon* and along the foot paths to the fields. The kind with the rough (with *budo-budo*) light green and white spotted stalk has tubers that were once fed to pigs but are now considered as weeds in the *um-uma*. The other kind with smooth brownish and white spotted stalk has edible stalks used as vegetable.



Kalot/ Karot/ Ka-ut

Battog

Tigi/ Pokpoklit/Bageng

Fig. 8. Wild roots and tubers

Other Ground Crops

Most IP informants like the *Ibalois*, *Applai-Kankanaeys*, *Kalanguya*, *Mangyans* and the *Kalingas* mentioned the spice crop 'ginger' and the legume 'peanut' as part of their rootcrops and was corrected during the workshop. For information purposes, the *Mangyans* mentioned a loss of their black ginger which they had been using for medicinal purposes. The *Kalingas* also mentioned a wild or native ginger called *laya* or *bosong* which has small leaves and small yellow rhizomes, and the native garlic called *danggo*, that grows voluntarily in their swiddens or homelots. Wild yellow ginger called *basing* and *kunig* (turmeric) is also considered a wild root crop in the area. These are mostly utilized as spices in vegetable and snack food recipes and for medicinal purposes.

Traditional Rootcrop Knowledge (TRK)

Traditional knowledge of rootcrops planted and known (RPK) and wild rootcrops known (WRK) among four IP groups showed highly significant differences (Table 6). With respect to the roots and tubers planted or were once planted, the *Bagos* of Ilocos Sur and La Union and the *Tingguians* of Abra were more knowledgeable (95% and 93%, respectively) than the *Ibalois* of Benguet and the *Iyattukas* of Ifugao (64% and 63%, respectively).

TRK test scores among age groups also differed significantly (Table 6). As validated, there is a declining trend in root and tuber crops knowledge with the elderly group (57-77 years old) having the highest WRK scores (97%), followed by the middle age group (36-56 years) at 91% then the youngest age group (15-35 years) at 50%. With respect to RPK, the younger group scored lower than the middle age group but not between the middle age and the elderly group.

Also as shown in Table 6, TRK test score between males and females is numerically different but not statistically significant.

Table 6. Traditional rootcrop knowledge (TRK) scores among the indigenous people, age groups and gender

IP	n	TRK % SCORE		AGE (years)	TRK % SCORE		SEX	TRK %Score	
		RPK	WRK		RPK	WRK		RPK	WRK
<i>Ibaloi</i>	38	64	76	15-35	66	50	Male	76	78
<i>Bago</i>	42	95	68	36-56	88	91	Female	83	81
<i>Tingguian</i>	42	93	99	57-77	85	97			
<i>Iyattuka</i>	36	63	75						
Total	158								
<i>Kruskal Wallis x2</i>		17.78	10.91		7.25	32.95		0.86	0.1
<i>Sig</i>		0.000	0.012		0.027	0.000		0.355	0.752

Retention or Loss of Traditional Rootcrop Knowledge

In general, there is a loss of TRK between the younger group (15-35 years) and the middle-aged group (36-56 years) especially among the *Tingguians* and *Iyattukas*, the male *Ibalois* with respect to knowledge of roots and tubers planted and both male and female *Ibalois* and *Bagos* with respect to knowledge of wild roots and tubers as shown by the intergenerational rate of retention and the cumulative retention rate (Table 7, red color). The younger *Tingguians* retained only 40-83% of the middle-aged group knowledge of planted and wild roots and tubers and *Iyattukas* retained 80-95% based on the cumulative retention rate.

Between the middle aged group and the elderly group (57-77 years), there is less loss of knowledge on RPK among the male *Bago*, *Tingguian* and *Iyattuka* IPs at a retention rate ranging from 76% to 90%. This result already signifies either decreased root crop cultivation, or a diminished utilization of roots and tubers for household use. The *Ibalois* and *Iyattukas*, and the *Bagos* and *Tingguians* who claim to operate large areas before the eighties for sweetpotato swidden or upland rice, respectively, have now diminished areas, as low as two to 750 hills of any rootcrop planted in a 600-1,000m² swidden farm (Gayao, et al., 2013 and 2014). The intensive usage of spaces near or along the rice terraces (the *lobah*, *tonong*, *aping* and *dulyah*) of the *Iyattukas* also decreased, brought about by preference of the younger generation for off-farm employment, which in turn reduced the dependence on roots and tubers for food security. In fact, the *Bago* village leaders claimed that the government cash subsidy to the poorest of the poor brought about the abandonment of root crop food gathering.

Of course, the reduction in roots and tubers production does not always result to loss of knowledge. Between the younger and middle-aged *Bagos* and female *Ibalois*, there is retention or an increase in the knowledge of roots and tubers planted (blue color). Between the middle-aged group and the elderly group, the female *Ibalois*, *Bagos* and *Tingguians* had gained knowledge on roots and tubers planted (104-149% RGt; 102-119% RCt), and the female *Iyattukas* on the knowledge of wild roots and tubers (104-109%). This was attributed to the fact that it was the women (unemployed mothers, widows and grandmothers) who are at homes in the villages to take care of young children, oversee caretaking of farm and forest lands, and the person in-charge of day to day household food, such that, the women are more knowledgeable on collecting, planting, harvesting, cooking and preserving the different kinds of roots and tubers. Until now, small volume of roots and tubers are exchanged or sold by stay home women and elders for kitchen necessities and cash needs.

The fact that the younger male *Bagos* and the middle-aged male *Ibalois* had higher retention rates (117 and 122%, respectively) than the females (108 and 88%, respectively) could be attributed to the increasing cultivation of greater yam, taro and cassava as cash crops, or the increasing number of women employed in off-farm work.

Table 7. Intergenerational rate of retention (RGt) between successive pair of age groups and cumulative rate of retention (RCt) retained by each succeeding age group of selected IPs in Northern Philippines

AGE (YEARS)	IP	RGt				RCt			
		RPK		WRK		RPK		WRK	
		Male	Female	Male	Female	Male	Female	Male	Female
15-35	<i>Ibaloi</i>	0.75	1.04	0.94	0.29	0.90	1.02	1.00	0.58
	<i>Bago</i>	1.17	1.08	0.68	0.41	1.10	1.03	0.80	0.68
	<i>Tingguian</i>	0.40	0.50	0.14	0.66	0.70	0.74	0.40	0.83
	<i>Iyattuka</i>	0.89	0.89	0.67	0.69	0.90	0.95	0.80	0.85
36-56	<i>Ibaloi</i>	1.22	0.88	0.43	0.80	1.10	0.95	0.70	0.91
	<i>Bago</i>	0.78	1.49	1.04	1.39	0.90	1.19	1.00	1.16
	<i>Tingguian</i>	0.84	1.29	1.02	0.78	0.90	1.12	1.00	0.90
	<i>Iyattuka</i>	0.76	0.85	0.90	1.09	0.90	0.93	1.00	1.04
57-77		1	1	1	1	1	1	1	1



- Loss/ decrease in TRK
- Transfer/ increase in TRK

Table 8 shows the color-coded annualized rate of change to highlight significant negative or positive trends for the younger generation as compared to older generation. Red indicates a very sharp decrease in knowledge (loss rate of $\geq 2\%$ per year), yellow indicates a significant decrease (loss rate of $\geq 1\%$ per year), blue indicates a significant increase in knowledge and black means there is no change. Most of the younger age group failed to identify or recognize the diversity of their root and tuber crops planted or gathered in the wild. There is a faster decline of 2-3% annually in wild rootcrops knowledge among the female *Ibalois* and *Bagos*, the male *Tingguians*. A lesser decrease in knowledge of rootcrops planted is shown among the male *Ibalois*, *Bagos* and *Iyattukas* and among female *Tingguians*.

On the other hand, the middle-aged group retained TRK knowledge or in the case the female middle-aged group had a one percent increase in knowledge of wild rootcrops. This is because most of the middle-aged group had the opportunity to learn from own experience (planting or in eating roots and tubers) and from practices of their parents. This experience also made it easier for them to absorb new knowledge on roots and tubers.

Table 8. Annual rate of change (CA_t) in TRK age groups of selected IP's in Northern Philippines

AGE (YEARS)	IP	CA _t			
		RPK		WRK	
		Male	Female	Male	Female
15-35	<i>Ibaloi</i>	-0.01	0.00	0.00	-0.02
	<i>Bago</i>	0.00	0.00	-0.01	-0.02
	<i>Tingguian</i>	-0.02	-0.01	-0.03	-0.01
	<i>Iyattuka</i>	0.00	0.00	-0.01	-0.01
36-56	<i>Ibaloi</i>	0.00	0.00	-0.02	0.00
	<i>Bago</i>	-0.01	0.01	0.00	0.01
	<i>Tingguian</i>	0.00	0.01	0.00	-0.01
	<i>Iyattuka</i>	-0.01	0.00	0.00	0.00
57-77		0.00	0.00	0.00	0.00

Other Factors Affecting Changes in Traditional Knowledge on Roots and Tubers

The influence of occupation on TRK means scores are significant at 5% level. Old-age pensioners, employees or wage earners, farmers and stay-home wife or husband had higher RPK scores than the businessmen/women and students. Old-age pensioners, farmers and stay-home wife or husband also had higher WRK scores. Statistically, education has no influence on TRK mean scores (Table 9).

Table 9. Traditional root crop knowledge mean scores according to occupation and education and source of knowledge of selected indigenous people in Northern Philippines

OCCUPATION	n	TRK Mean Score (%)		EDUCATION	TRK Mean Score (%)	
		RPK	WRK		RPK	WRK
Stay-home wife/husband	28	78	96	No formal schooling	77	72
Farmer	72	82	88	Reached elementary	71	74
Employee/ wage earner	20	97	66	Reached high school	76	85
Student	22	55	41	Reached vocational	75	86
Businessman /woman	7	67	71	Reached college	89	76
Others- pensioners, etc.	9	98	94			
Total	158					

<i>Kruskal Wallis x2</i>	11.41	24.5	<i>Sig</i>	3.9	1.55
<i>Sig</i>	0.043	0.00		0.42	0.75

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Recent campaign of attaining rice self-sufficiency in the Philippines included encouraging the consumption of roots and tubers, corn and banana as staple food. In the olden times, roots and tubers are staple food of indigenous peoples. Lack of documentation as well as the fear of losing diversity and indigenous knowledge on root and tuber resources prompted this research. Secondary data gathering, group interview workshop, field visits and personal interviews were conducted to establish updated information and knowledge on the roots and tubers grown, collected, exchanged and consumed among indigenous people in Northern Philippines like the *Ivatans*, *Isnegs*, *Kalingas*, *Iyattukas*, *Applai-Kankanaeys*, *Tingguians*, *Bagos*, *Ibalois*, *Kankana-eyes*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans*.

The Northern Philippines IPs identified 20 roots and tubers consisting of 10 cultivated species and more than 10 wild species. The IP's have their own local names for the roots and tubers. In some instances, the IP's have similar local names for the same kind of roots and tubers, but there are also instances that they are referring to a different kind of roots and tubers. Nevertheless, the IPs familiarity with the local names is an indication of the number of roots and tubers they grow or utilize. This ranged from six kinds among the *Bugkalots* to 15 kinds among the *Ibalois* and *Tingguians*. The roots and tubers planted are cassava, sweetpotato, greater yam, taro, tannia, lesser yam, arrowroot, potato, yacon and yambean. Wild roots and tubers include *nami*, elephant yam, giant taro, canna, wild yam bean, and three species of wild taro, three species of wild greater yam and a wild lesser yam. Most of the IPs does not only plant roots and tubers for household food and feeds security but also for trade especially sweetpotato, cassava, greater yam, taro, tannia and potato. However, the planting of yacon and arrowroot and the gathering of wild roots and tubers among the IP households was reduced for lack of market and availability of other sources of income, food and feeds. Thus, it is possible that the continuing reduction of planting and consumption of roots and tubers may compromise food security especially among the younger generation of IPs. Further, the diversity of roots and tubers and their ability to grow in different habitats—the swidden farms, rainfed and irrigated paddies, homegardens, forests, pathways, and waterways as an indicator of the crops' adaptation that must be looked into in climate change mitigation efforts. Roots and tubers with good survival as they are mentioned as volunteer plants are arrowroot, some varieties of sweetpotato and tannia.

Quantifying loss of knowledge is a new methodology in order to substantiate observations and claims that indigenous knowledge systems in roots and tubers are being lost. Results of this study showed that loss of traditional knowledge among the indigenous people who were known to produce and utilize roots and tubers, is a reality only among the younger generation, particularly those born starting in the 1980's. There is no loss or little loss of knowledge for those born before the eighties.

While circumstances may have changed, traditional or local knowledge is still an important consideration in this era of climate change, food and nutrition, and livelihood insecurities. Indigenous knowledge is dynamic and not static. TRK is enhanced by internal and external knowledge and experiences. Building on the traditional root crops knowledge should be considered to improve food security, food diversity, well-being, and the

development and adoption of environment-friendly or organic farming practices and livelihood opportunities. Traditional knowledge resulted from accumulated individual and communal experiences to solve problems which can be a rich source of hypothesis for scientific validation or a spring board for innovations and inventions.

For instance, the Northern Philippines Root Crops Research and Training Center at the Benguet State University could start by publishing this source book of roots and tubers resources in Northern Philippines. The summary of indigenous production and utilization techniques on roots and tubers could guide farmers and future entrepreneurs.

Regardless of ethnicity, age, sex, occupation, and educational attainment, traditional knowledge on roots and tubers diversity, production and utilization techniques, could also be enhanced. One strategy is through continuing promotion and transfer of both traditional and new knowledge on the habitat, production and utilization of the root and tuber resources and sharing information in schools, church, extension services and media as well as from influential elderly, parents and relatives to the younger generation. This strategy can ensure the conservation, sustained production, and the increased consumption of roots and tubers, which in the long run may reduce rice staple importation. Teaching the important role of roots and tubers in household food security and income should start by teaching children to regularly eat roots and tubers in the same manner that rice, vegetables, and fruits are eaten.

STUDY 2
TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON TARO
(*COLOCASIA ESCULENTA*) AMONG INDIGENOUS PEOPLE
IN NORTHERN PHILIPPINES

B.T. Gayao, D.T. Meldoz, and G.S. Backian

ABSTRACT

Taro (*Colocasia esculenta*) is one of the four kinds of aroids in the *Araceae* family. It belongs to the Old World staple crops that indigenous people in Northern Philippines had been eating. Nowadays, diets had changed but without documentation, knowledge on traditional taro varieties is at risk of disappearing. Secondary data gathering, workshops, follow-up field visits, and interviews with key informants were done to document and update information and determine erosion of knowledge on traditional taro varieties.

Taro is known among the indigenous people in Northern Philippines as *gabi*, *aba*, *ava*, *abah*, *pising*, *pihing*, *gandus*, *gamey*, *buyon*, *putlo*, *ateng*, *sudi*, *lidoy*, *lapa*, *loko* or *rabok*.

There were 103 locally-named taro varieties among the 13 indigenous peoples surveyed: *Ibalois*, *Bagos*, *Ivatans*, *Isnags*, *Kalingas*, *Tingguians*, *Aplai-kankanaeys*, *Kankana-eyes*, *Iyattukas*, *Kalanguyas*, *Bugkalots*, *Aetas*, and *Mangyans*, with each naming 2 to 38 varieties. These locally-named varieties were further grouped into 30 variety categories based on their description of stalk, leaf and corm flesh color such as shades of brown, grey, green, violet, white, yellow, with stripes or tinge of pink, red or maroon.

On the extent of diversity, the *Ibalois* had the most number of locally-named varieties at 26, classified as plenty. The *Mangyans* and *Bugkalots* had two widely grown varieties each while the *Bagos* had only one. Moreover, only the *Ibalois* identified one lost variety.

Generally, there was no deterioration of traditional knowledge on taro local varieties among the middle-aged (36-56 years) and elderly group (57-77 years) of respondents but there was erosion of knowledge at one percent per year between the younger (15-35 years) and middle-aged group regardless of IP grouping. There was retention of IK between the middle-aged *Tingguians*, female *Bagos*, and an increase in taro indigenous knowledge among the middle-aged male *Ibalois*, *Bagos* and *Iyattukas* and the elderly groups.

INTRODUCTION

By 2020 root and tuber crops are the food crop to feed the world in the coming decades, as root and tuber crops produce more calories per unit area and time than cereals (Scott et al., 2000). The need to produce more food on finite land area becomes more acute as the world population increases (Rao, 2010). In the Philippines, roots and tubers served as

an important alternate staple food in the olden times especially among the hillside, upland and forest dwellers, and the indigenous peoples who are the traditional consumers and producers of root crops. However, several changes put pressure on food self-sufficiency of indigenous peoples like continuing deforestation, in- and out-migration to urban areas, population growth, climate change, international and national policies that stress cash and industrial crops production rather than for local household consumption. These events plus the lack of documentation and information dissemination led to loss of knowledge and the rich biodiversity of root and tuber resources like taro (*Colocasia esculenta*). As observed and as mentioned by Niehof (2010), the younger generation no longer recognize some traditional foods.

This study was therefore conceptualized that aimed to inventory the traditional varieties of taro planted, consumed or traded, or already lost. The study also aimed to determine erosion of knowledge on traditional taro varieties among the younger generation of indigenous peoples in Northern Philippines.

Colocasia esculenta commonly called taro, cocoyam (Africa), dasheen (Egypt), malanga (Spain) or *gabi* in the Philippines, is one of the four main kinds of taro plants belonging to the family *Araceae* (the aroids), the other three being the *Xanthosoma sagittifolium* (tannia, cocoyam or yautia), *Cyrtosperma chamissonis* (Giant swamp taro) and the *Alocasia macrorrhiza* (Giant taro, elephant ear taro), (Scott, et al., 2000; Pardales, 1997; DAF, 2014; Elfick, 2015).

There are also different genotypes of taro. Dasheen genotypes, the 'true' taro (*Colocasia esculenta* L. Schott), are characterized by a larger central or main corm and smaller side cormels and adapted to flooded conditions. Eddoe genotypes, *Colocasia esculenta* var. *antiquorum*, usually have a relatively smaller central and fibrous corm and well-developed side cormels and always found cultivated in rainfed areas. While the wild forms of taro generally have long stolons, small elongated corms, continuous growth and a predominantly have high concentrations of calcium oxalate (Rao, et al. 2010; DAF, 2014).

Taro ranks fourteenth among the staple vegetable crops with about 12 million tons produced globally from about 2 million hectares with an average yield of 6.5 t/ha (FAOSTAT as cited by Rao, 2010). In the Philippines 0.110 million tons of taro is produced and bulk (95%) of taro supply is for food consumption (PSA, 2014). Taro is one of the oldest crops claimed to have originated in India or Southeast Asia (Barrau 1965; Plucknett 1976; Kuruvilla and Singh 1981 as cited by Rao, 2010). This claim, however, is still debated (Matthews 1990; Yen 1991, 1993; Loy *et al.* 1992 as cited in Rao, 2010).

Earlier published and unpublished studies on taro are on ethnobotanical survey of edible aroids in the Philippines (Pardales, 1997), traditional production practices and socio-economic importance of taro in Benguet (Sim and Gayao 1992), storage, transport and marketing practices of taro (Bayogan, et al., 1989; Sim and Gayao, 1989 and 1992), and some on variety evaluation, crop management techniques, and postharvest diseases.

METHODOLOGY

In carrying out the research, the following methods were employed: gathering of secondary data from local government agriculture, planning and development units and from the National Commission on Indigenous Peoples records and libraries, market observation and linking for collaborative research which was simultaneously done in initially identified municipalities and/ or indigenous communities. Workshops where key informants were invited with the assistance of collaborating researchers and agencies based on familiarity in growing rootcrops and length of residence in the indigenous people's community. Aided with an interview guide, focus group discussion (FGD) using cue cards and pictures, field observation, photo documentation and informal interviews were done. Tabulated results were presented to the collaborating partners and some of the key informants for validation and at the same time review the traditional roots and tubers knowledge (TRK) test questionnaire.

The questionnaire consisted of simple questions answerable by multiple choice, yes-no, or true-false. Thirty test subjects were targeted for each of the selected IP groups, and belonging to the three age groups (15-35 years old, 36-56 years old and 57-77 years old) equally divided into male and female subjects (Table 1). The respondents were purposively identified with possible replacements from the available and willing resident IPs at that time of the test administration. The tests were done individually with the assistance of the local partner-researchers who clarified and/or translated the questions especially for those who cannot read/write or understand the questions. Checking and scoring of the completed questionnaires were done en banc at each site by the project researchers and local partners.

Due to time and funds limitation, however, the TRK test to determine transfer or loss of TRK were conducted only among the *Ibalois*, the *Bagos*, the *Tingguians* and the *Iyattukas*.

Table 1. Number of traditional knowledge test subjects per IP and age groups

GROUP	MALE	FEMALE	TOTAL	%
IP				
<i>Ibaloi</i>	16	22	38	24.1
<i>Bago</i>	20	22	42	26.6
<i>Tingguian</i>	19	17	36	22.8
<i>Iyattuka</i>	19	23	42	26.6
Total	74	84	158	100.1
AGE				
15-35 years	29	23	52	32.9
36-56 years	24	29	53	33.5
57 to 77 years	21	32	53	33.5
Total	74	84	158	
	46.8	53.2		99.9

Encoding and tabulations, calculations for the vitality indices and analysis were done using the EXCEL and SPSS software. Differences in mean scores as influenced by IP and

age groups, gender, education, occupation and source of knowledge was tested using analysis of variance (ANOVA) at 5% level of significance.

For the vitality index on traditional knowledge statistics, i.e. the intergenerational rate of retention (RG), the cumulative rate of retention (RC), and the annual rate of change (CA) based on Zent (2008; 2010) formula were calculated where RG indicates the rate of retention between any successive pair of age groups, RC reflects the proportion of the baseline aptitude level retained by each succeeding age groups and CA expresses the average rate and direction of change per year as reflected by the target age group.

Indigenous knowledge on production and utilization of taro per ethnic or IP grouping (Gayao, et al., 2013-2014) can be accessed in rootcrops-bsu@hostclink.net while this paper is limited only to the varieties of taro grown and known among the 13 IPs selected in Northern Philippines.

DISCUSSION OF RESULTS

Taro is planted, gathered, sold and bought by people who are familiar with the crop and possess the associated culinary knowledge, such that they are still the custodians of taro genetic diversity (Rao, et al. 2010). This statement may well refer to the indigenous people and rural households in the Philippines who depend on the taro as staple food, specialty vegetable dish and animal feed. As shown in Table 2, all the 13 IPs surveyed in Northern Philippines have their own local names for taro which are different from the other aroids.

Gabi, aba, ava, abah, pising and *pihing* are more popular local name of taro than *gandus, gamey, buyon, putlo, ateng, sudi, lidoy, lapa, loko* and *rabok* which are known only among specific IP group.

Table 2. Taro known and grown by indigenous people in Northern Philippines

IP	TARO	TANNIA	WILD TARO/AROID
<i>Aeta</i>	<i>Gandus</i>	<i>Galyan, Biga</i>	<i>Lapa</i>
<i>Aplai-kankana-ey</i>	<i>Pising</i>	<i>Galiang, Bila</i>	<i>Pikaw, Sed-ing, Hed-ing, Tayagan</i>
<i>Bago</i>	<i>Gamey, Aba, Buyon</i>	<i>Bila, Galiang</i>	
<i>Bugkalot</i>	<i>Putlo</i>	<i>Galjang</i>	
<i>Ibaloi</i>	<i>Ava</i>	<i>Galyang</i>	<i>Pikaw, Bitajon</i>
<i>Isneg</i>	<i>Ateng</i>	<i>Lusya</i>	<i>Lanipog or Pikaw, Bileng</i>
<i>Ivatan</i>	<i>Sudi</i>	<i>Canaka, Tanaka</i>	
<i>Iyattuka</i>	<i>Abah, Pihing</i>	<i>Bilah</i>	<i>Pihkaw, Wild abah</i>
<i>Kalanguya</i>	<i>Pihing, Aba</i>	<i>Galyang</i>	<i>Lubingan, Bilagot</i>
<i>Kalinga</i>	<i>Lidoy</i>	<i>Galiang lidoy</i>	<i>Pi-aw or bulagot, Bila</i>
<i>Kankanaey</i>	<i>Gamey, Aba</i>	<i>Bila</i>	<i>Pikaw, Bitayen</i>
<i>Mangyan</i>	<i>Gabi</i>	<i>Singapor, Bulawan</i>	
<i>Tingguian</i>	<i>Lapa, Aba, Gabi, Loko, Rabok</i>	<i>Amasyan</i>	<i>Pikaw, Kalapon</i>

The wild taro that looks similar to the cultivated varieties is identified as *lapa*, *bileng*, *lubingan* and *wild abah*, *sed-ing/hed-ing* and *tayagan*. The *lapa* and *lubingan* have edible stalk that naturally grows in the creek or in swampy areas (Figure 1), and have small elongated corms, green stalk and leaves but only the stalk is harvested for home consumption.

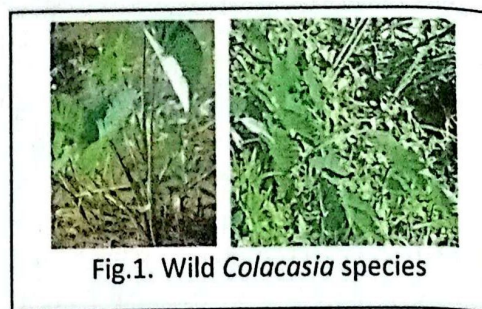


Fig.1. Wild *Colocasia* species

Inventory of Traditional Varieties

There are 103 locally named taro among the 13 IPs surveyed (Table 3). The *Aetas*, *Bugkalots*, *Kalingas* and *Mangyans* named only 2-4 varieties, while the other IPs named five or more, like 38 locally-named varieties of the *Ibaloi* informants where some are shown in Figure 3. The *Chinese* or *Itsina* variety, *Mindanao*, *Violet* and *Shihet* or *Maragkit* are more common names locally given by IPs to distinguish their taro variety collection.

Table 3. Inventory of locally-named varieties of taro among some IPs in Northern Philippines

IP	VARIETY (#)	LOCAL NAME
<i>Aeta</i>	4	<i>Yakat, Galudgud, Tagaytay, Cavite</i>
<i>Aplai-kankanaey</i>	6	<i>Itsina, Gabat, Sigang, Mindanao, Salad gabi, An-anis</i>
<i>Bago</i>	6	<i>Bines, Boyon, Itchina or Chinese, Kinmapasanglay, Loko or Kirig-isan</i>
<i>Bugkalot</i>	2	<i>Apayongan, Lampakan</i>
<i>Ibaloi</i>	36	<i>Afatot, Ampasit-Benguet, Davingan, Delin, Dem-an, Difosnay, Ekdog, Karet, Korak, Katdan, Pang-aabra, Pitik Hapon, Quodivey, Shaopan, Tawa, Aweng, Badang, Itsina/Chinese, Jun, Mindanao, Pulis, Shiket Kiangang. Songsong, Atok, Bataan/Tabaan/ Taroy, Dasjaan, Japanese gabi, Kudivanga, Namnama, Nitz, Rocy, Saigolot, Sailoko, Santi, Shihet, Iowak, Shihet Quirino/Sampero</i>
<i>Isneg</i>	7	<i>Chinese yellow, Chinese violet, Nangila, Bohikan or Burekan, Lampakan, Appog, Sagada Ateng</i>
<i>Ivatan</i>	5	<i>Ketketan, Pasuhen, Tuvayan, Vañagat, Violet</i>
<i>Iyattuka</i>	8	<i>Agibalat, anghiw, Ayongan, Dabao, Impugong, Kagitkit, Molikka, Tumbaga</i>
<i>Kalanguya</i>	5	<i>Pitik violet, Pitik white, Lampacan-violet, Lampacan white, Chinese gabi</i>
<i>Kalinga</i>	3	<i>White, Violet, Garit-garit</i>
<i>Kankana-ey</i>	5	<i>Godgodak, Boyon, Pitik, Mindanao, Itchina</i>
<i>Mangyan</i>	2	<i>Bunotan, Maragkit</i>
<i>Tinguian</i>	14	<i>Kinalajan, Palin or Pali, Balugo, Bangas, Binulos, Makulis, Atap, Sinupot, Gargaritan, Sinal-it, Atta-ata, Dinalipog, Unoy, Taki ti nuang</i>
	103	

Categorization of Locally-named Taro Varieties

The 103 locally-named varieties were further grouped into 30 variety categories based on their description of stalk, leaf and corm flesh color such as shades of brown, grey, green, violet, white, yellow, with stripes or tinge of pink, red or maroon. Table 4 shows the 12 locally-named varieties with violet stalk, green leaves and violet corm flesh (VGV); 10 varieties with green stalk and leaves and white flesh (GGW); 10 varieties with green stalk and leaves but unspecified corm flesh color (GG); 7 varieties with green stalk and leaves and yellow corm flesh (GGY); 5 varieties with violet stalk, leaves and flesh (VVV); 5 varieties with pink stalk, green leaves and dark violet flesh (PGVd); 4 varieties with green stalk and leaves and violet flesh (GGV); 4 varieties with green with brown stripes stalk, green leaves and white or yellow flesh (Gb/sGW/Y); and the rest were with variations in color.

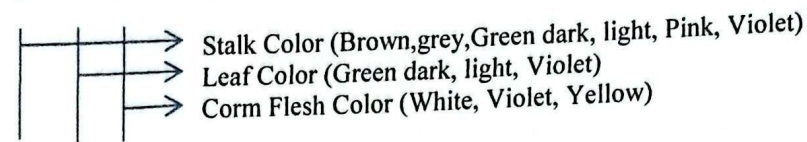
Table 4. Categorization of locally-named taro varieties among some IPs in Northern Philippines

	CATEGORY CODE	VARIETY (#)	LOCAL NAMES
1	BGW	3	<i>Katdan, Quotdivey, Dasjaan</i>
2	BgGW/V	3	<i>Atap, Godgodak, Rocy</i>
3	GGV	4	<i>Sagada Ateng, Chinese violet, Chinese / Itsina, White</i>
4	GGW	10	<i>Sigang, Ketketan, Chinese gabi, Bunotan, Ayongan, Dem-an, Lampakan, Pitik, Lampacan white</i>
5	GGVs	3	<i>Palin or Pali, Bangas, Kinmapasanglay</i>
6	GGY	7	<i>Davingan, Delin, Pasuhen, Tuvayan, Apayongan, Chinese Yellow, Jun</i>
7	GG	10	<i>Boyon, Itchina or Chinese, Lampakan, Ampasit, Pang-aabra, Shaopan, Aweng, Saigolot, Impugong, Nangila</i>
8	Gb/sGW/Y	4	<i>An-anis, Korak, Santi, Sinal-it</i>
9	GdGdW/Y	3	<i>Atta-ata, Difosnay, Unoy</i>
10	GdvGW	2	<i>PitikHapon, Songsong</i>
11	Gd/rGV	3	<i>Shihetlowak, ShihetQuirino or Sampero, Itchina</i>
12	Gd/rGP	1	<i>Kudivanga</i>
13	Gd/rGY	1	<i>Baluga</i>
14	GIGW	2	<i>Sinupot, Tagaytay</i>
15	GIGY	3	<i>Ekdog, Yakat, Japanese gabi</i>
16	Glb/sG	1	<i>Loko or Kirig-isán</i>
17	Glm/sG	1	<i>Vañagat</i>
18	GpGW	2	<i>Namnama, Afatot</i>
19	GvGdW	2	<i>Takitinuang, Pitik</i>
20	Gv/sGW	2	<i>Makulis, Gargaritan</i>
21	Gv/sGV	1	<i>Maragkit</i>
22	Gv/sGYo	2	<i>Dabao, Mindanao</i>
23	Gw/sGY	2	<i>Gabat, Mindanao</i>
24	Gw/sGW	3	<i>Karet, Kinalajan, Tumbaga</i>
25	PGVd	5	<i>Pulis, Atok, Bataan/Tabaan/Taroy, Nitz, Sailoko</i>
26	VGB	1	<i>Boyon</i>

27	VVV	5	<i>Pitik violet, Lampacan-violet, Salad gabi, Violet, Anghiwi</i>
28	VGW	12	<i>Galudgud, Itsina, Bohikan or Burekan, Appog, Shihet, Kiangang, Badang, Tawa, Bines, Molikka, Dinalipog, Violet, Cavite</i>
29	VGW	2	<i>Binulos, Kagitkit</i>
30	VGW	3	<i>Agibalat, Mindanao, Garit-garit</i>

Legend:

B G W



Gb/sGW/Y

Extent of Diversity

Adopted from Sthapit, et al. (2001), the extent of diversity is classified as few (when there is a limited area or few plants planted and few number of growers) and plenty (when there is wide area planted or large number of growers).

The *Ibalois* have the most number (26) of locally-named varieties that are few, followed by the *Tingguians* (8), *Kankana-eyes* and *Bagos* (4) and these are all at risk of disappearing in their localities. In fact, the *Ibaloi* had already lost one variety 'Katdan' (Table 5).

However, the *Ibalois* still have nine varieties grown widely followed by the *Iyattukas* (8), *Isnogs* (7), *Tingguians* (6), *Applai-kankanaeys*, *Kalanguyas* and *Ivatans* (5 each), *Aetas* (4), *Kalinga* (3), *Mangyans* and *Bugkalots* (2 each), and only one variety from the *Bagos*.

Table 5. Extent of diversity according to production area or availability of taro traditional varieties among IP growers in northern Philippines

DIVERSITY EXTENT	IP	LOCAL NAMES
Lost	<i>Ibaloi</i> (1)	<i>Katdan</i>
Few	<i>Bago</i> (4)	<i>Bines, Boyon, Kinmapasangla, Itchina or Chinese</i>
Few	<i>Ibaloi</i> (26)	<i>Afatot, Ampasit Benguet, Pang-aabra, Korak, Pitik Hapon, Atok Bataan/Tabaan/Taroy, Japanese gabi, Saigolot, Davingan, Delin, Dem-an, Difosnay, Ekdog, Karet, Quotdivey, Tawa, Dasjaan, Kudivanga, Namnama, Nitz, Rocy, Sailoko, Santi, Shihet, Iowak, Shihet Quirino/Sampero</i>
Few	<i>Applai-kankanaey</i> (1)	<i>Mindanao</i>
Few	<i>Kankana-ey</i> (5)	<i>Boyon, Godgodak, Itchina, Mindanao, Pitik</i>

Few	<i>Tingguian</i> (8)	<i>Atta-ata, Bangas, Gargaritan, Kinalajan, Makulis, Palin or Pali, Sinal-it, Taki ti nuang</i>
Plenty	<i>Aeta</i> (4)	<i>Cavite, Galudgud, Tagaytay, Yakat</i>
Plenty	<i>Aplai-Kankanaey</i> (5)	<i>Salad gabi, An-anis, Gabat, Itsina, Sigang</i>
Plenty	<i>Bago</i> (1)	<i>Loko or Kirig-isan</i>
Plenty	<i>Bugkalot</i> (2)	<i>Apayongan Lampakan</i>
Plenty	<i>Ibaloi</i> (9)	<i>Shaopan, Aweng, Badang, Chinese / Itsina, Jun, Mindanao, Pulis, Shihet, Kiangnan, Songsong</i>
Plenty	<i>Isneg</i> (7)	<i>Appog, Bohikan or Burekan, Chinese violet, Chinese yellow, Lampakan, Nangila, Sagada, Ateng</i>
Plenty	<i>Ivatan</i> (5)	<i>Pasuhén, Ketketan, Tuvayan, Vañagat, Violet</i>
Plenty	<i>Iyattuka</i> (8)	<i>Agibalat, Anghiwi, Ayongan, Dabao, Impugong, Kagitkit, Molikka, Tumbaga</i>
Plenty	<i>Kalanguya</i> (5)	<i>Chinese gabi, Lampakan white, Lampakan-violet, Pitik violet, Pitik white</i>
Plenty	<i>Kalinga</i> (3)	<i>Garit-garit, Violet, White</i>
Plenty	<i>Mangyan</i> (2)	<i>Bunotan, Maragkit</i>
Plenty	<i>Tingguian</i> (6)	<i>Atap, Baluga, Binulos, Dinalipog, Sinupot, Unoy</i>

Description/ Attributes of Traditional Taro Varieties

In addition to leaf, stalk and corm flesh color description, the IP informants shared specific attributes such as origin (old or new), taste and cooking attributes, growth characteristics and yield potential of some of their traditional varieties. Pictures and descriptions are shown in Figures 2-5 and Table 8.

Out of the 103 locally-named varieties, 23 were identified as new acquisitions or new in their IP community, 20 as old even dating back to their parents farming years and the rest were not specifically identified.

As to favorable taste characteristics, 22 had sticky (*malagkit, diket*) texture (*Atok, Dasjaan, Japanese gabi, Namnama, Shihet Iowak, Shihet Quirino or Sampero, Shihet Kiangnan, Jun, Bines, Delin, Dem-an, Shaopan, Violet, Yakat, Baluga, Difosnay, Gabat, Galudgud, Ketketan, Mindanao, Pitik, Violet*), 3 having mealy texture (*Tawa, Itsina, Palin or Pali*), 5 having good aromatic smell (*Tawa, Itsina or Chinese gabi, Yakat, Difosnay, Tuvayan*), and another 5 without itchy characteristics (*Japanese gabi, Loko or Kirig-isan, Dasjaan, Shihet Kiangnan, Shihet Quirino or Sampero*).

Growth characteristics mentioned are those having many or few runners and cormels, those having big or small corms, spreading growth of corms and corm shape. Most of these varieties mature at 6-8 months; but varieties '*Davingan*' and '*Nangila*' matures in 3-5

Table 7. Vitality indices of traditional rootcrop knowledge on taro among selected IPs in Northern Philippines

AGE	IP GROUP	INTERGENERATIONAL RATE OF RETENTION (RG)		CUMULATIVE RATE OF RETENTION (RC)		ANNUAL RATE OF CHANGE (CA)	
		Male	Female	Male	Female	Male	Female
15-35 years	<i>Ibaloi</i>	0.8	0.7	0.7	0.9	-0.01	-0.01
	<i>Bago</i>	0.5	0.8	0.7	0.9	-0.01	-0.01
	<i>Iyattuka</i>	0.5	0.6	0.8	0.8	-0.01	-0.01
	<i>Tingguian</i>	0.2	0.4	0.5	0.7	-0.02	-0.01
36-56 years	<i>Ibaloi</i>	1.2	0.7	1.1	1.0	0.0	0.0
	<i>Bago</i>	1.2	1.0	1.1	1.0	0.0	0.0
	<i>Iyattuka</i>	1.2	0.5	1.1	0.8	0.0	-0.01
	<i>Tingguian</i>	1.0	1.0	1.0	1.0	0.0	0.0
57-77 years	<i>Ibaloi</i>	1	1	1	1		
	<i>Bago</i>	1	1	1	1		
	<i>Iyattuka</i>	1	1	1	1		
	<i>Tingguian</i>	1	1	1	1		

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Roots and tubers were once considered staple food of indigenous people but circumstances had changed that caused some fear of losing diversity and indigenous knowledge on root and tuber crops such as taro (*Colocasia esculenta*). Thus, this study aimed to inventory the traditional varieties of taro still planted, consumed or traded, or already lost among the *Ivatans*, *Isnegs*, *Kalingas*, *Iyattukas*, *Applai-Kankanaeys*, *Tingguians*, *Bagos*, *Ibalois*, *Kankana-eyes*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans*. Likewise, the study also determined erosion of knowledge on traditional taro varieties.

Secondary data gathering, group interviews, workshops, and field visits were the tools used in the research.

Taro or *gabi*, *aba*, *ava*, *abah*, *pising*, *pihing*, *gandus*, *gamey*, *buyon*, *putlo*, *ateng*, *sudi*, *lidoy*, *lapa*, *loko* or *rabok* in the Philippines, is one of the four main kinds of aroids in the *Araceae* family.

Among the 13 IPs surveyed, there are 103 locally-named taro varieties, each IP naming two up to 38 varieties. Based on the IPs description of stalk, leaf and corm flesh color such as shades of brown, grey, green, violet, white, yellow, with stripes or tinge of pink, red or maroon, the 103 locally-named varieties are further grouped into 30 variety categories. IPs may also have similar taro varieties like in the 12 locally-named varieties with violet stalk, green leaves and violet corm flesh (VGV), the 10 varieties with green stalk and

leaves and white flesh (GGW), the 7 varieties with green stalk and leaves and yellow corm flesh (GGY) or the 5 varieties with violet stalk, leaves and corm flesh (VVV).

On the extent of diversity, the *Ibalois* have the most number (26) of locally-named varieties classified as few (limited planting area or few plants planted and few number of growers) and 9 varieties classified as plenty (wide planting area or large number of growers). The *Iyattukas* have 8 widely grown varieties followed by the *Isnegs* (7); *Tingguians* (6); and the *Aplai-kankanaeys*, *Kalanguyas* and *Ivatans* (5 each). The *Aetas* have four 4; *Kalingas* (3); *Mangyans* and *Bugkalots* (2 each); and only one variety from the *Bagos*. Further, the *Ibalois* had already lost one variety 'Katdan.'

In addition to leaf, stalk and corm flesh color description, the IP informants shared specific attributes such as origin (old or new), taste and cooking attributes (e.g. stickiness, mealiness, aroma, itchiness....), growth characteristics (spreading corms, number and size of runners and cormels, maturity...) and yield potential (<1-3kg/hill or 1-10 cormels/hill) of some of their traditional varieties.

Mean scores on indigenous knowledge (IK) in taro showed highly significant differences in terms of IP grouping with the *Tingguians* of Abra showing the highest test score (52%) followed by the *Ibalois* of Benguet (39%), the *Iyattukas* of Ifugao (31%), and the *Bagos* of Ilocos Sur and La Union (28%). Along age grouping, the younger group of 15-35 years old had lower IK test scores at 23% as compared with the middle-age group of 36-56 years old at 41% and the older-age group of 57-77 years at 46%. Regarding the aspect of occupation, full-time parents, farmers, and the pensioners had higher IK scores than the students, employees, business men/women. Between the male and female IPs, the IK test scores is almost the same at 35 and 39% which means there is no gender bias in IK. Mean scores in terms of educational level and source of IK are not significantly different and with little or no association.

The erosion of traditional knowledge on taro local varieties between the younger and middle-age group is at one percent per year but generally no deterioration of knowledge between middle-age and elderly group. Regardless of IP grouping, the deterioration or loss of IK on taro between the younger (15-35 years) and middle-age (36-56 years) groups, and between the middle-age female *Ibalois* and *Iyattukas* and the elderly group of 57-77 years old is shown by the intergenerational and cumulative retention rates of less than one. There is retention of IK between the middle-age *Tingguians*, female *Bagos* and an increase in taro indigenous knowledge among the middle-age male *Ibalois*, *Bagos* and *Iyattukas* and the elderly group.

This result validated the findings that the bulk of genetic diversity particularly on taro is still maintained and conserved by farmers and indigenous people. However, in this era of climate change, and the felt insecurities on food, nutrition and livelihood, it would be prudent for research organizations like the Northern Philippines Root Crops Research and Training Center at the Benguet State University to continuously maintain *ex-situ* or *in-situ* conservation and crop improvement of the traditional varieties, and to actively share indigenous knowledge.

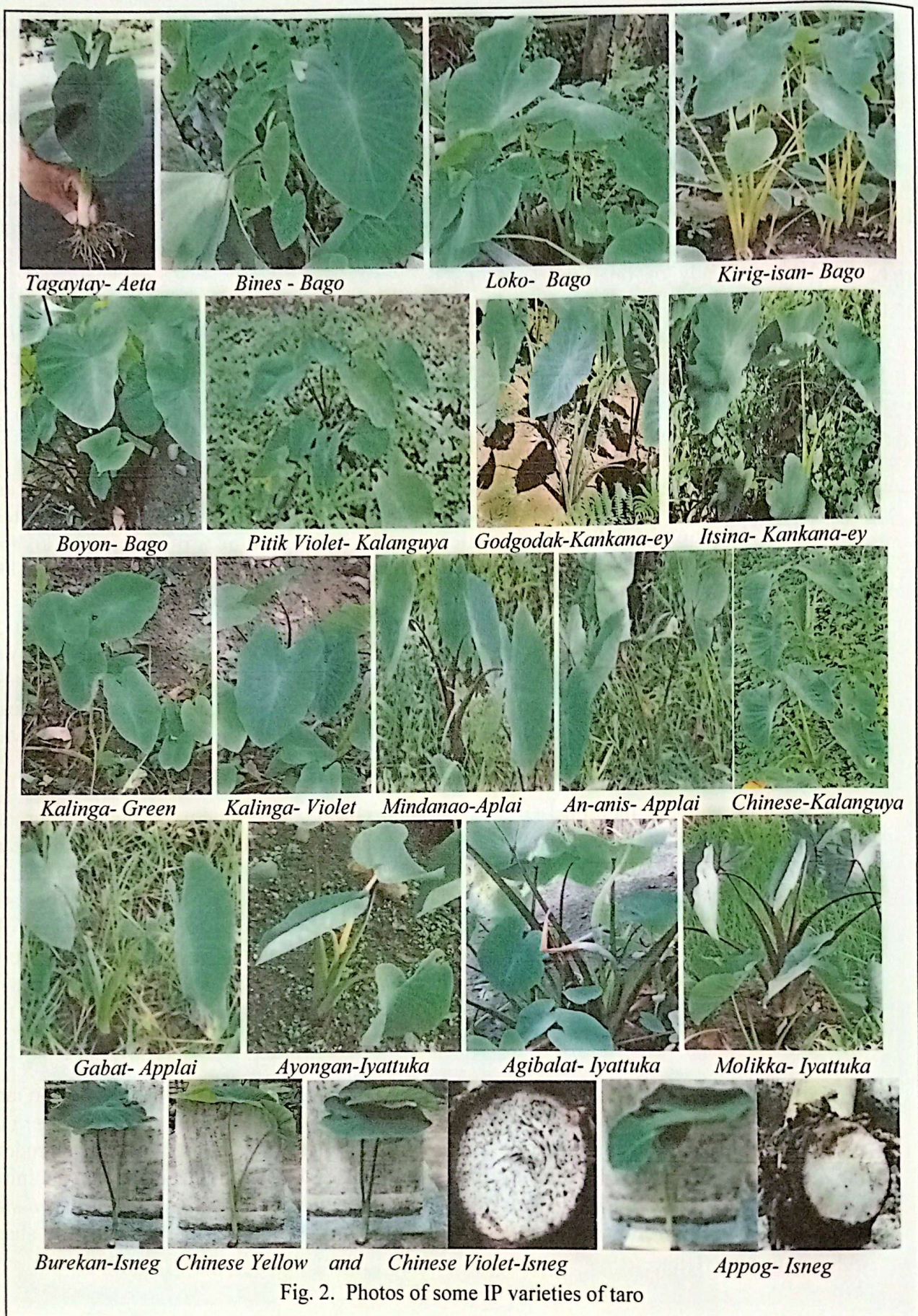


Fig. 2. Photos of some IP varieties of taro

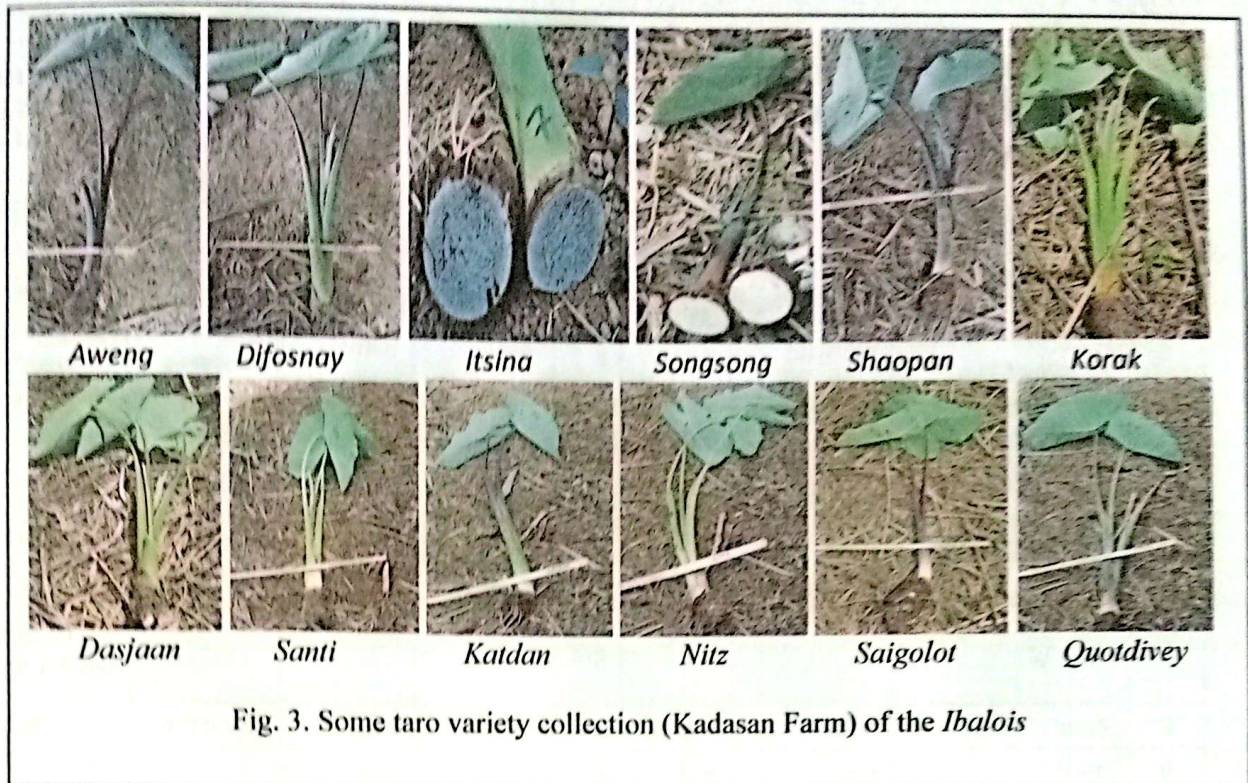


Fig. 3. Some taro variety collection (Kadasan Farm) of the *Ibalois*

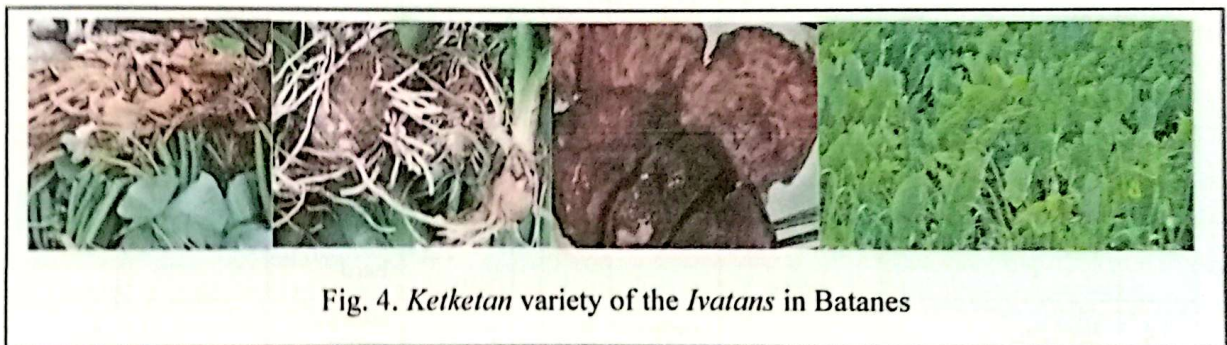


Fig. 4. *Ketketan* variety of the *Ivatans* in Batanes

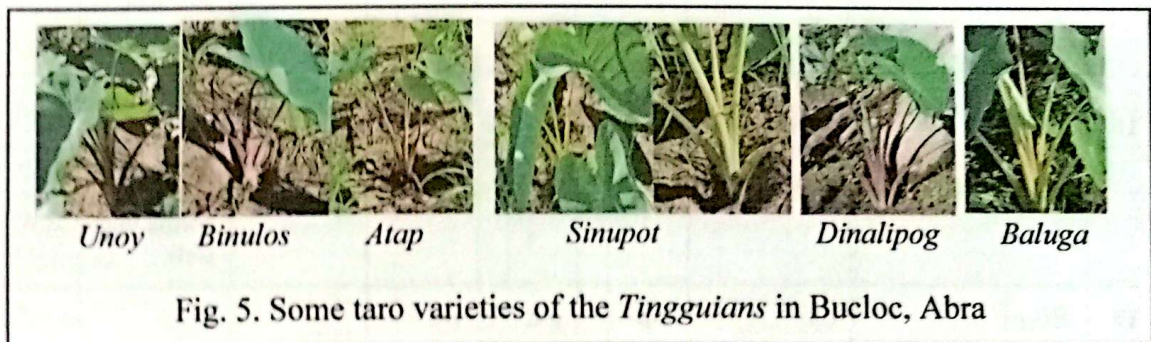


Fig. 5. Some taro varieties of the *Tingguians* in Bucloc, Abra

Table 8. Characteristics of locally named taro varieties according to IP growers in Northern Philippines

#	LOCAL VARIETY NAMES	ORIGIN	STALK COLOR	LEAF COLOR	FLESH COLOR	TASTE /COOKING CHARACTERISTICS	OTHER GROWTH CHARACTERISTICS	MATURITY/POTENTIAL YIELD	USES
1	<i>Afatot</i>	old	g-p/s	g	w-v/s			6-8 mos	
2	<i>Agibalat</i>		v	g	y				
3	<i>Ampasit Benguet</i>	old/wild	g	g		itchy	good runners	6-8 mos, less corm yield	vegetable
4	<i>An-anis</i>		g-b/s	g					
5	<i>Anghiw</i>		v-d	v-d	v				
6	<i>Apayongan</i>		g	g	y		small corms close	6 mos	
7	<i>Appog</i>		v-d	g-d	v			big roots will not dry up	
8	<i>Atap</i>	wild-semi	b-g	g		itchy	few corms	6-7 mos	
9	<i>Atok</i>	new	p-d	g	p-d	sticky		6-8 mos	home use
10	<i>Atta-ata</i>		g-d	g-d			plenty cormels	6-7 mos	
11	<i>Aweng</i>	new, Palina	g	g			hallow if over	9 mos, 21 runners/hill	
12	<i>Ayongan</i>		g	g	w				
13	<i>Badang</i>	new	v	g-d	v-d	itchy, sweet, delicious hard			baksay, medicine
14	<i>Baluga</i>		g-r/b	g	y	sticky, sweet		6-7 mos	
15	<i>Bangas</i>		g	g	w-v/pmt			6-7 mos	
16	<i>Bataan/Tabaan/Taroy</i>	new	p-l	g	p-d	not easily cooked	tall, with and without runners, 1 big & many small corms, big stalk	(+/- 1 kg/tuber)	
17	<i>Bines</i>	old	v-p	g-d	v-p	sticky, tasty			
18	<i>Binulos</i>		v	g	w			6-7 mos	

19	<i>Bohikan or Burekan</i>		v	g-d	v			6 mos	
20	<i>Boyon</i>	old	g	g			1 big & many small corms		
21	<i>Boyon</i>		v	g-d	b		round shape	8 mos	
22	<i>Bunotan</i>		g	g	w				
23	<i>Cavite</i>		v	g-d				10-20 corms/ hill	
24	<i>Chinese / Itsina</i>	new	g	g	v-w	aromatic	no runners		
25	<i>Chinese gabi</i>		g	g	w	aromatic	big corm	8 mos, 0.5-2kg/hill	
26	<i>Chinese violet</i>		g	g	v			6 mos	
27	<i>Chinese yellow</i>		g	g	y	sweet		3 mos	
28	<i>Dabao</i>		g-v/s	g	y				
29	<i>Dasjaan</i>	new	b	g		not itchy, sticky	few corms		home use
30	<i>Davingan</i>	old	g	g	y		big dry roots	4-5 mos	
31	<i>Delin</i>	old	g	g	y	sticky	small corms		
32	<i>Dem-an</i>	old	g	g	w	sticky	jar shape	1 yr	
33	<i>Difosnay</i>		g-d	g-d	w	sticky, aromatic, sweet			
34	<i>Dinalipog</i>		v	g-d			smooth skin corms	6-7 mos	
35	<i>Ekdog</i>	old	g-l	g-l	y-o				
36	<i>Gabat</i>		g-w/s	g	y	sticky			
37	<i>Galudgud</i>		v	g-d	v	sticky			calamay
38	<i>Gargaritan</i>		g-v/s	g	w			6-7 mos	roasted stalk
39	<i>Garit-garit</i>		v-w/s	g-d	y			high yield	
40	<i>Godgodak</i>		b-gy-y/s					12 mos	
41	<i>Impugong</i>		g	g				many corms	
42	<i>Itchina</i>		g-r/t	g				10mos	
43	<i>Itchina or Chinese</i>	new	g	g					
44	<i>Itsina</i>		v	g-d	v	mealy, aromatic			
45	<i>Japanese gabi</i>	new	g-l	g		not itchy	few long runners		

46	<i>Jun</i>	new, Tabaan Sur	g	g	y-o	sticky, soft(hot), hard (cold)			home use
47	<i>Kagitkit</i>		v-w/s	g	w				
48	<i>Karet</i>	old	g-w/s	g	w				
49	<i>Katdan</i>	old	b	g-d	w		many corms		good for pigs
50	<i>Ketketan</i>		g	g	w	sticky, salty			dried stalks are sold
51	<i>Kinalajan</i>		g-w/s	g	w			6-7 mos	vegetable
52	<i>Kinmapasang- lay</i>	old	g	g	w-v/s	itchy stalk	big corms/ sturdy		
53	<i>Korak</i>	old	g-b/s	g	w				
54		new	g-red sap	g	p-o	easily cooked			
55	<i>Kudivanga</i>								
56	<i>Lampacan white</i>		g	g	w		spreading corms	1.5kg/hill, 6 mos	
57	<i>Lampacan- violet</i>		v	v	v		spreading corms	1.5kg/hill,	
58	<i>Lampakan</i>		g	g			close cormels /wide leaves	6 mos	
59		old	g-l-b/s	g		not itchy			viand
60	<i>Loko or Kirig- isan</i>								
61	<i>Makulis</i>		g-v/s			tasty		6-7 mos	
62	<i>Maragkit</i>		g-v/s	g	v				
63	<i>Mindanao</i>	new	g-v-d/s	g-d	o		big corms, many runners, easy to multiply		
64	<i>Mindanao</i>		g-y/s	g	y	sticky			
65	<i>Mindanao</i>		v-d	g-d	y	sticky			
66	<i>Molikka</i>		v-p	g-d	v-r				
67	<i>Namnama</i>	new	g-p	g	w	sticky	more corms, resistant		
68	<i>Nangila</i>		g	g				3 mos	
69	<i>Nitz</i>	new	p-l	g	p				
70	<i>Palin or pali</i>		g	g	w-v/ pgmt	mealy, sticky		6-7 mos	

71	<i>Pang-aabra</i>	old/wild in Abra	g	g		less itchy		tall	
72	<i>Pasuhén</i>		g	g	y		corms harvested during rainy season are not mealy		
73	<i>Pitik</i>		g-v	g-d	w	sticky	small corms	8-12mos, 5kg/hill,	guinataan
74	<i>Pitik Hapon</i>	old	g-d-v	g	w	itchy, sweet	no runners		cormels 4 sinigang, big corms for pig feed
75	<i>Pitik violet</i>		v	v	v			2-3kg/hill	
76	<i>Pitik white</i>		g	g	w			2-3kg/hill	
77	<i>Pulis</i>	new	p-b	g	w-v				
78	<i>Quotdivey</i>	old	b	g	w				
79	<i>Rocy</i>	new	b-m	g	v-p				
80	<i>Rocy</i>	new	g	g					
81	<i>Sagada Ateng</i>		g	g	vio	sweet stalk/lvs	big stalk		
82	<i>Saigolot</i>	new	g	g				less tubers, big stalk, runners & flowers	veg./ home use/stalk prodn
83	<i>Sailoko</i>	new	p-red	g-d		itchy			for pig, cormels & runners for home use
84	<i>Salad gabi</i>		v	v	v		big base, no runners		
85	<i>Santi</i>	new	g-b/s	g	y-l				
86	<i>Shaopan</i>	old	g	g		sticky		2-4 yrs	home use
87	<i>Shihet Iowak/ Quirino</i>	new	g-d r/t	g-d	v	sticky	thin, tall	7-9 mos	home use
88	<i>Shihet Kiangán</i>	new	v-d	g-d	v	not itchy, sticky		6-8 mos	candy
89	<i>Shihet Quirino/Sampe ro</i>	new	g-d-r/t	g-d	v	not itchy, sticky		7-9 mos, thin, tall	home use

90	<i>Sigang</i>		g	g	w		many cormels & runners	
91	<i>Sinal-it</i>		g-d	g-d	y		with runners/flowers	
92	<i>Sinupot</i>		g-l	g-l	w			6-7 mos
93	<i>Songsong</i>	new	g-d-v	g-d	w	itchy, sweet		no runners cormels for vegetable, for pig feed
94	<i>Tagaytay</i>		g-l	g				3-10 cormels/hill
95	<i>Taki ti nuang</i>		g-v	g-d			cormels in clusters	
96	<i>Tawa</i>	old	v-d	g	v	mealy, aromatic	few cormels	
97	<i>Tumbaga</i>		g-w/s	g	w			
98	<i>Tuvayan</i>		g	g	y	aromatic		
99	<i>Unoy</i>		g-d	g-d			elongated cormels are neatly arranged downward like fingers, 6-7 mos	
100	<i>Vañagat</i>		g-m/s	g				
101	<i>Violet</i>	old	v	g-d	v	sticky		saleable roots
102	<i>White</i>		g	g	v			
103	<i>Yakat</i>	old	g-l	g-l	y	sticky, aromatic	many cormels	vegetable

STUDY 3
TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON TANNIA
(*XANTHOSOMA SAGITTIFOLIUM*) AMONG INDIGENOUS PEOPLE
IN NORTHERN PHILIPPINES

B.T. Gayao, D.T. Meldoz, and G.S. Backian

ABSTRACT

Tannia (*Xanthosoma sagittifolium*) also called yautia, cocoyam and malanga is among the roots and tubers indigenous people (IP) in Northern Philippines have been eating. Indigenous knowledge on this crop is at risk of disappearing especially nowadays that diets had changed. Secondary data gathering, workshops, field visits and follow-up interviews with key informants were done to document, update information and determine erosion of knowledge on tannia traditional varieties.

The following IPs: the *Ibalois*, *Bagos*, *Ivatans*, *Isnegs*, *Kalingas*, *Tingguians*, *Applai-kankanaeys*, *Kankana-eyes*, *Iyattukas*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans* in Northern Philippines knew and called tannia as *galyang*, *galiang*, *galyan*, *bila*, *bilah*, *biga*, *amasyan*, *lusya*, *bulawan* and *singapor*.

The 33 locally-named varieties of the IPs were grouped into five variety categories based on leaf, stalk and corm flesh color. These are GGW-V (green leaf, green stalk and white with violet corm flesh), GGY (green leaf, green stalk and yellow corm flesh), GVV-W (green leaf, violet stalk and violet with white corm flesh), GVV (green leaf, violet stalk and violet corm flesh) and VVW (violet leaf, violet stalk and white corm flesh). The green or white and even yellow (GGWV and GGY) variety category are the same to some IPs. The green-violet-white colored variety category (GVV and VVW) may also be similar.

Among the IPs, the *Iyattukas* of Ifugao are more familiar with their tannia varieties (78% test score) than the *Bagos* of Ilocos Sur and La Union (64%), the *Ibalois* of Benguet (50%) and the *Tingguians* of Abra (11%). Furthermore, there is retention of knowledge between the younger (15-35 years) and the middle-aged (36-56 years) group of *Ibalois* and *Iyattukas*. But there is loss of knowledge among the younger groups of *Tingguians* and *Bagos*.

INTRODUCTION

By 2020, root and tuber crops are the food crop to feed the world as root and tuber crops produce more calories per unit area and time than cereals (Scott, et al. (2000). The need to produce more food on finite land area becomes more acute as the world population increases (Rao, 2010).

In the Philippines, roots and tubers served as an important alternate staple food in the olden times especially among the hillside, upland and forest dwellers, and the indigenous

peoples who are the traditional consumers and producers of root crops. However, several changes are causing pressure on food self-sufficiency of indigenous peoples like continuing deforestation, in- and out-migration to urban areas, population growth, climate change, international and national policies that stress cash and industrial crops production rather than for local household consumption. Consequently, these events led to loss of knowledge and the rich biodiversity of root and tuber resources. Likewise, the lack of documentation and information dissemination for indigenous roots and tubers like tannia (*Xanthosoma sagittifolium*) exacerbated the situation. In 2010, Niehof claimed that the younger generations no longer recognize some traditional foods.

This study, therefore, was conducted to inventory the traditional varieties of tannia that are still planted, consumed or traded, or already lost. Likewise, the study determined erosion of knowledge on traditional tannia varieties among the younger generation of IPs in Northern Philippines.

Tannia or yautia or cocoyam (*Xanthosoma sagittifolium*), taro (*Colocasia esculenta*), giant taro or elephant ear taro (*Alocasia macrorrhiza*) and the giant swamp taro (*Cyrtosperma chamissonis*) are the four main kinds of taro belonging to the aroids *Araceae* family (Scott, et al., 2000; Pardales, 1997; DAF, 2014; Elfick, 2015). Tannia popularly known as *galyang*, *galiang*, *galyan*, *bila*, *bilah*, *biga*, *amasyan*, *lusya*, *bulawan* and *singapor* among the IPs in Northern Philippines or *yutia*, *takudo*, *pakudo*, *butig*, *istaring*, *karlang* and *lutya* in other parts of the Philippines (Pardales, 1997) is often interchanged with taro or *gabi*.

In the Philippines 0.011 million tons of tannia are produced. Bulk of tannia (82%) supply is for food consumption (PSA, 2013).

Earlier published and unpublished studies on tannia are on ethnobotanical survey of edible aroids in the Philippines (Pardales, 1997) and economic importance, production and utilization practices of *galiang* in Northern Philippines (Sim and Gayao, 1989; Salda, 1989).

METHODOLOGY

In the conduct of research, the use of secondary data was employed. These data were gathered from local government agriculture, planning and development units, the National Commission on Indigenous People records or libraries, and market observation, simultaneously linking for collaborative research in initially identified municipalities/communities, populated by indigenous peoples, namely: *Ibalois*, *Bagos*, *Ivatans*, *Isnags*, *Kalingas*, *Tingguians*, *Applai-kankanaeys*, *Kankana-eys*, *Iyattukas*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans*.

Key informant workshops were also conducted with the assistance of collaborating researchers and agencies based on familiarity in growing and consuming rootcrops and length of residence in the indigenous people's community. Aided with an interview guide, focus group discussion using cue cards and pictures, field observation, some photo documentation and informal interviews were done.

Results were presented to the collaborating partners and some of the key informants for validation and at the same time review the traditional roots and tubers knowledge (TRK) on the tannia test questionnaire. The questionnaire consisted of simple questions answerable by multiple choice, yes-no, or true-false. Thirty test subjects were engaged for each of the selected IP groups and belonging to the three age groups (15-35 years old, 36-56 years old and 57-77 years old) divided into male and female subjects (Table 1).

Table 1. Number of traditional knowledge test subjects per IP groups and age groups

IP Group	Male	Female	Total	%
<i>Ibaloi</i>	16	22	38	24.1
<i>Bago</i>	20	22	42	26.6
<i>Tingguian</i>	19	17	36	22.8
<i>Iyattuka</i>	19	23	42	26.6
Total	74	84	158	100.1
Age Group				
15-35 years	29	23	52	32.9
36-56 years	24	29	53	33.5
57 to 77 years	21	32	53	33.5
Total	74	84	158	
	46.8	53.2		99.9

Data encoding and tabulations as well as calculations for the vitality indices and analysis were done using the EXCEL and SPSS software. Differences in mean scores as influenced by IP and age groups, sex, education, occupation and source of knowledge were tested using analysis of variance (ANOVA) at 5% level of significance.

For the vitality index on traditional knowledge statistics, i.e., the intergenerational rate of retention (RG), the cumulative rate of retention (RC), and the annual rate of change (CA) based on Zent (2008; 2010) formula were calculated where RG indicates the rate of retention between any successive pair of age groups, RC reflects the proportion of the baseline aptitude level retained by each succeeding age groups and CA expresses the average rate and direction of change per year as reflected by the target age group.

This paper is limited only to the varieties of tannia grown and known among the 13 IPs selected in Northern Philippines. Other indigenous knowledge on production and utilization of tannia per IP grouping can be accessed in rootcrops-bsu@hostelink.net.

DISCUSSION OF RESULTS

Most roots and tubers like tannia are planted, gathered, sold, and bought by people who are familiar with the crop and possess the associated culinary knowledge, such that they are still the best custodians of tannia genetic diversity (Rao et al. 2010). This statement refers to the IPs and rural households in the Philippines who depend on the roots and tubers as staple food, specialty vegetable dish and animal feed. All the 13 IPs surveyed in Northern Philippines have their own local names for tannia, which are differentiated from taro, the wild taro and other aroids (Table 2).

Tannia (*Xanthosoma sagittifolium*) is locally called as *galyang*, *galiang*, *galyan*, *bila*, *bilah*, *biga*, *amasyan*, *lusya*, *bulawan* and *singapor*. Tannia is a cultivated crop but to some IPs, it is a volunteer or a wild plant.

Table 2. Tannia known and grown by the IPs in Northern Philippines

IP	TANNIA	TARO	WILD TARO/AROID
<i>Aeta</i>	<i>Galyan, Biga</i>	<i>Gandus</i>	<i>Lapa</i>
<i>Aplai-Kankana-ey</i>	<i>Galiang, Bila</i>	<i>Pising</i>	<i>Pikaw, Sed-ing, Hed-ing, Tayagan</i>
<i>Bago</i>	<i>Bila, Galiang</i>	<i>Gamey, Aba, Buyon</i>	
<i>Bugkalot</i>	<i>Galjang</i>	<i>Putlo</i>	
<i>Ibaloi</i>	<i>Galyang</i>	<i>Ava</i>	<i>Pikaw, Bitajon</i>
<i>Isneg</i>	<i>Lusya</i>	<i>Ateng</i>	<i>Lanipog or Pikaw, Bileng</i>
<i>Ivatan</i>	<i>Canaka, Tanaka</i>	<i>Sudi</i>	
<i>Iyattuka</i>	<i>Bilah</i>	<i>Abah, Pihing</i>	<i>Pihkaw, Wild abah</i>
<i>Kalanguya</i>	<i>Galyang</i>	<i>Pihing, Aba</i>	<i>Lubingan, Bilagot</i>
<i>Kalinga</i>	<i>Galiang lidoy</i>	<i>Lidoy</i>	<i>Pi-aw or bulagot, Bila</i>
<i>Kankana-ey</i>	<i>Bila</i>	<i>Gamey, Aba</i>	<i>Pikaw, Bitayen</i>
<i>Mangyan</i>	<i>Singapor, Bulawan</i>	<i>Gabi</i>	
<i>Tingguian</i>	<i>Amasyan</i>	<i>Lapa, Aba, Gabi, Loko, Rabok</i>	<i>Pikaw, Kalapon</i>

Inventory of Traditional Varieties

There are 30 locally-named tannia among the 13 IPs surveyed but each mentioned 2-4 distinct kinds of tannia (Table 3). IPs named their varieties based on leaf, stalk and corm-flesh color such as green (G), white (W), violet (V), and yellow (Y). Using the leaf, stalk and corm-flesh color, the locally-named varieties are classified further into five categories (Table 4), namely: GGW-V referring to green leaf, green stalk, white-violet corm flesh, GGY (green leaf, green stalk, yellow corm flesh), GVV-W (green leaf, violet stalk, violet-white corm flesh), GVV (green leaf, violet stalk, violet corm flesh) and VVW (violet leaf, violet stalk and white corm flesh).

The green-type to some IPs may also be the same as the white-type or the yellow-type of the other IPs because of the caledon-green and yellow-green color of the leaves and stalk (Figure 2). The violet-type is further named into three types, namely: semi-violet, all-violet and sticky or *malagkit* (Figure 3).

Table 3. Inventory of locally-named varieties of tannia among some IPs in Northern Philippines

LOCAL NAME	IP												
	1	2	3	4	5	6	7	8	9	10	11	12	13
Bila green		x											
Lusya green						x							
Green							x	x					x
Galyan puti	x												
Bila white			x										
White				x									
Galyang white- Itsina					x								
Giant white									x				
White										x	x		
Malagkit /tahe-yellow	x												
Bila yellow			x										
Galudgud galyan	x												
Malagkit /tahe-violet	x												
Bila Violet		x	x										
Violet				x									
Galyang violet					x								
Lusya violet						x							
Violet							x	x	x	x	x		
Batik-batik/ malagkit												x	
Violet or San Fernando													x
Galyang semi-violet					x								
Bulawan/ singapor												x	
# of varieties = 30	4	2	3	2	3	2	2	2	2	2	2	2	2

1. Aeta
2. Applai-Kankanaey
3. Bago
4. Bugkalot
5. Ibaloi

6. Isneg
7. Ivatan
8. Iyatukka
9. Kalanguya
10. Kalinga-Biga

11. Kankanaey
12. Mangyan-Buhid
13. Tinggutan

Table 4. Categorization of locally-named tannia varieties among some IPs in Northern Philippines

CATEGORY (#)	CODE	LOCAL NAME	IP (#)
1	GGW-V	<i>Galyan puti, bila green, bila white, white, galyang itsina, lusya green, green, giant white, malagkit /tahe-violet</i>	13
2	VVW	<i>Violet, bila violet, lusya violet, san fernando</i>	8
3	GVVV	<i>Bila violet, violet, batik-batik, malagkit, galudgud galyan, galyang violet</i>	5
4	GVVW	<i>Bulawan/ singapor, galyang semi-violet</i>	2
5	GGY	<i>Malagkit /tahe-yellow, bila yellow</i>	2

Legend: GGW- green leaf, green stalk & white flesh
 VVW- violet, violet white
 GVVV- green-violet violet violet
 GVVW- green-violet violet white
 GGY- green green yellow



Fig. 2. The different shades of green leaf and stalk

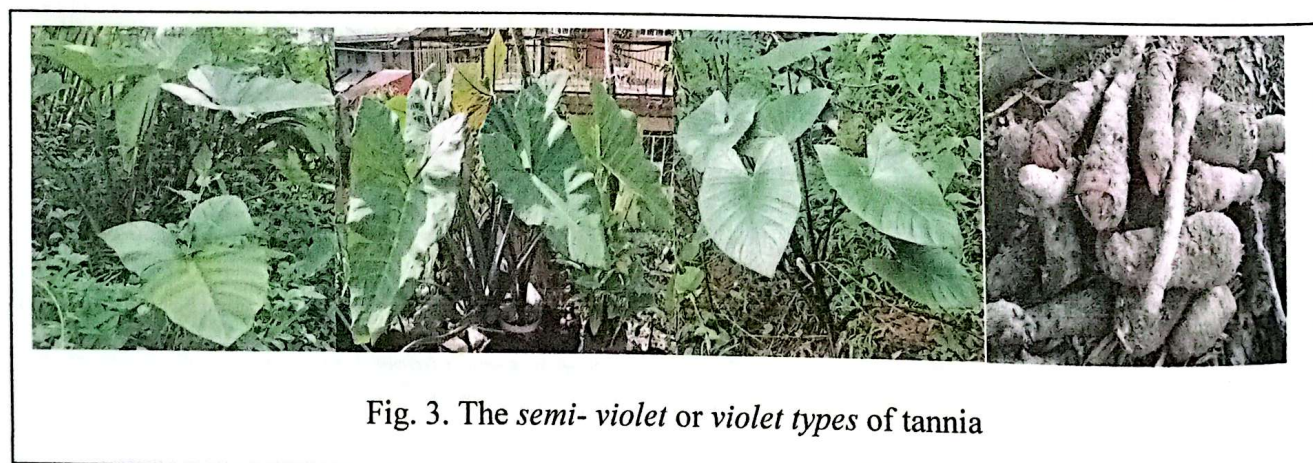


Fig. 3. The semi- violet or violet types of tannia

Extent of Diversity

As to the extent of diversity (Sthapit, et al., 2001), the violet-colored varieties are few in terms of area planted and number of growers among the *Applai-kankana-ey*, *Bago*, *Ibaloi*, *Ivatan* and *Kankana-ey* IPs. The green or white-colored varieties are plenty based on area planted and/or number of growers (Table 5).

The yellow-colored variety is few and only available among the *Bago*, *Mangyan* and *Aeta* IPs, and therefore at risk of disappearing. Shown further in Table 5, fewer *Applai-Kankanaey* and the *Kankana-ey* IPs are growing tannia. This could be attributed to their observed preference for sweetpotato herbage as pig feeds and the shift to chayote crop, respectively.

Table 5. Extent of diversity according to tannia production area or availability as perceived by the IPs in Northern Philippines

EXTENT OF DIVERSITY	IP	LOCAL NAMES/ COLOR		
		Green or white	Violet	Yellow/ others
Few	<i>Applai-kankanaey</i>	Bila green	Bila violet	
	<i>Bago</i>		Bila violet	Bila yellow
	<i>Ibaloi</i>		Galyang violet, semi-violet	
	<i>Ivatan</i>		Violet	
	<i>Kankana-ey</i>	White	Violet	
	<i>Mangyan</i>			Batik-batik/ malagkit
Plenty	<i>Aeta</i>	Galyan puti	Galudgud galyan	Malagkit yellow
	<i>Bago</i>	Bila white		
	<i>Bugkalot</i>	White	Violet	
	<i>Ibaloi</i>	Galyang white or itsina		
	<i>Isneg</i>	Lusya green	Lusya violet	
	<i>Ivatan</i>	Green		
	<i>Iyattuka</i>	Green	Violet	
	<i>Kalanguya</i>	Giant green	Violet	
	<i>Kalinga</i>	White	Violet	
	<i>Mangyan</i>		Bulawan/ singapor	
<i>Tinguian</i>	Green	Violet/ San Fernando		

Note: Few - small area and few growers

Plenty- small or large area but many growers,

Description/ Attributes of Traditional Tannia Varieties

In addition to leaf, stalk and corm flesh color, the IP informants mentioned specific attributes of some of their traditional varieties as shown in Table 6.

The *batik-batik* and *bulawan* tannia varieties of the *Mangyans* and the *galyang semi-violet* of the *Ibalois* are similarly described as green with tinge of pink or violet in the stalk and shoot, delicious sticky white-violet flesh cormels and suitable for flour/ chips processing. The yellow-flesh variety is described as sticky by the *Aetas* and a new variety to the *Bagos*.

The white-named varieties are described as having edible cormels that are white fleshed, round shape and sticky. The *Ibalois* and *Bagos* use the cormels as viand, *nilubian* snack food and for flour processing. The main corm, stalk and leaves are cooked for swine feeds.

The green-named varieties are tall with wide leaves, the leaves and stalks are for swine feeds, and the white-fleshed cormels are sold, sweet and soft when cooked, and the plant can be continuously harvested for three years.

On the other hand, the violet-named varieties have slightly sticky violet-white fleshed cormels. The stalks and leaves are used for salad dish by the *Applai-Kankanaeys* and the shoot as viand by the *Kankana-eyes*. The *Kalingas* only harvest the plant for swine feed. The violet-colored tannia is also susceptible to drought.

Table 6. Description/ attributes of tannia varieties as observed by the IP informants

LOCAL NAME	DESCRIPTION/ ATTRIBUTES	IP
<i>Batik-batik/ malagkit</i>	Pinkish center/shoot, sticky when cooked, suitable for boiling, white-violet, delicious	<i>Mangyan</i>
<i>Bulawan/ singapor</i>	White flesh, sticky, violet center/shoot, yields plenty of small cormels, good for vegetable	<i>Mangyan</i>
<i>Galyang semi-violet</i>	Has green-violet stalk/leaves, big corms and cormels sticky cormels, the flavor of galyang is not noticeable and good for flour/ chips	<i>Ibaloi</i>
<i>Take yellow</i>	Yellow flesh, green leaves and stalk, sticky	<i>Aeta</i>
<i>Bila yellow</i>	Yellow flesh, can be used for salad, variety from Isabela new in Sudipen (2007), none in Sugpon	<i>Bago</i>
<i>Galyang white-Itsina</i>	Has white-light green stalk/leaves and sticky 'mansokjot' cormels that is good for flour and 'nilubian', shoots as viand	<i>Ibaloi</i>
<i>Giant white</i>	White flesh corm, green leaves and stalk, up to 3 kg/hill	<i>Kalanguya</i>
<i>Bila white</i>	White flesh, native in Sugpon, cormels are good as viand, for feeds of swine,	<i>Bago</i>
<i>Galyan puti</i>	White flesh, green stalk, cormels are edible	<i>Aeta</i>
<i>White</i>	Smaller size of cormels, green stalks and leaves	<i>Bugkalot</i>
<i>White</i>	Green stalk and leaves, delicious cormels	<i>Kalinga</i>
<i>White</i>	White fleshed tubers, and round shape tubers, green leaves	<i>Kankana-ey</i>

<i>Bila Green</i>	Green stalks and leaves, no cormels, tall growth	<i>Applai-Kankana-ey</i>
<i>Green</i>	Leaves and stalks are good for swine, white-fleshed cormels	<i>Ivatan</i>
<i>Green</i>	3-years continuous gathering of white flesh aba-like cormels, can be harvested and sold anytime, mother corm elongates	<i>Tinggulan</i>
<i>Green</i>	Green stalk and leaves	<i>Iyattuka</i>
<i>Lusya green</i>	White fleshed roots, green stalk and leaves, wide leaves, brown skin roots, sweet and soft when cooked, planted in the month of March to May	<i>Isneg</i>
<i>Galyang violet</i>	Has dark violet stalk/leaves and big cormels, slightly white and not so sticky flesh	<i>Ibaloi</i>
<i>Tahe-violet</i>	Violet flesh, green leaves and stalk, and only the mother corms are edible	<i>Aeta</i>
<i>Galudgud galyan</i>	Violet flesh and stalk, green leaves, grow as tall as 4 ft., cormels are edible	<i>Aeta</i>
<i>Lusya violet</i>	<i>Batik-batik</i> or violet and white fleshed roots, Violet stalk, brown root skin, wide leaves	<i>Isneg</i>
<i>Bila Violet</i>	Green with purple leaves, purple stalks which can be used for salad and corms are violet	<i>Applai-Kankana-ey</i>
<i>Bila violet</i>	Violet stalk and leaves	<i>Bago</i>
<i>Violet</i>	Commercially grown, cormels are good for vegetable, usually planted in borders, susceptible to drought and sensitive to strong sunlight	<i>Ivatan</i>
<i>Violet</i>	White fleshed tubers, round shape tubers, produce many cormels, young shoots can be cooked as vegetable	<i>Kankana-ey</i>
<i>Violet</i>	Bigger size cormels, violet leaves and stalks	<i>Bugkalot</i>
<i>Violet</i>	Violet stalk and leaves found only in <i>uma</i> , gathered for feeds only	<i>Kalinga</i>
<i>Violet</i>	White flesh corm, violet leaves and stalk, 0.5 kg/hill	<i>Kalanguya</i>
<i>Violet</i>	Violet stalk and corms	<i>Iyattuka</i>
<i>Violet or San Fernando</i>	Violet stalk, big leaves, erect stand of plant, white flesh	<i>Tingguian</i>

Traditional Rootcrop Knowledge (TRK) on Tannia

Traditional knowledge on tannia showed significant differences (*sig 0.00*) only among the IP groups though the association between knowledge and ethnic grouping is weak (Table 7). There were insignificant differences among age groups, gender, occupation, educational attainment and source of indigenous knowledge, and likewise, there is no association with indigenous knowledge (IK) test scores.

The *Iyattukas* of Ifugao showed the highest TRK test score (78%) which means that their familiarity with the local name of tannia (*bilah*) and the types or varieties grown in the

locality is higher than the the *Bagos* of Ilocos Sur and La Union (64%) , the *Ibalois* of Benguet (50%) and the *Tingguians* of Abra (11%).

As expected the younger group of 15-35 years old had lower TRK test scores at 50% as compared to the middle-aged group of 36-56 years old at 60%. Surprisingly, the elderly group of 57-77 years old had lower TRK test scores at 47% out of the expected 100% test score. This could be attributed to forgetfulness or disuse of knowledge and practices. This could also be the reason for the failure to transfer knowledge to the younger generation, thus, may have contributed to the decreasing production and utilization of tannia.

Between the male and female IPs, the TRK test scores is almost the same at 52 and 53%, respectively, an indication that gender bias on learning traditional knowledge does not exist among the indigenous people.

While occupation and educational attainment has no statistical influence (Eta= 0.01 to 0.02) on TRK test scores, the source of learning indigenous knowledge (Eta= 0.42) like learning from school, media and kin, had somehow influenced test scores at 100, 75 and 52%, respectively. This result indicates the importance of sharing and learning indigenous knowledge from the schools, churches, extension services and media and not exclusively from kin, relatives and friends.

Table 7. Traditional root crop knowledge scores on tannia along IP and age groups, sex, occupation, educational attainment and IK source

GROUP	VARIABLE	TRK MEAN SCORE (%)	F-VALUE	SIG	ETA
IP group	<i>Ibaloi</i>	50	16.603	0.000	.244
	<i>Bago</i>	64			
	<i>Iyattuka</i>	78			
	<i>Tingguian</i>	11			
Age group (years)	15-35	50	1.020	0.363	.013
	36-56	60			
	57-77	47			
Sex	Male	52	0.016	0.900	.000
	Female	53			
Occupation	Stay-home wife/husband	57	0.306	0.909	.010
	Farmer	53			
	Employee/ wage earner	55			
	Student	41			
	Businessman/woman	57			
	Others- pensioners, etc.	56			

Educational attainment	No formal schooling	33	0.812	0.520	.021
	Reached elementary	52			
	Reached high school	48			
	Reached vocational	78			
	Reached college	55			
Source of IK knowledge	1- Kins, relatives, friends	52	1.344	0.249	.420
	2- School, church, extension services	100			
	3- Media (print, radio, TV)	75			
	4- 1,2 and 3	61			
	5- 1 and 2	56			
	6- 1 and 3	27			

Retention or Loss of Traditional Knowledge

In general, there is retention of traditional rootcrop knowledge (TRK) on tannia among the younger (15-35 years) and middle-aged (36-56 years) group of *Ibalois* and female *Iyattukas*, and among the middle-aged *Bagos* and *Tingguians* as shown by the intergenerational and cumulative retention rates of one and above (Table 8). In fact, both male and female younger *Iyattukas* and middle-aged *Ibalois*, the male middle-aged *Bagos* and *Tingguians* showed an increase in knowledge (RG and RC greater than one) as compared to the elderly group of 57-77 years old at RG and RC equal to one. As observed during the documentation of indigenous knowledge, it was mostly the middle-aged groups who shared their knowledge and experience in rootcrop farming and utilization.

However, there is a loss of TRK on tannia among the younger *Tingguians* retaining zero of the middle-aged knowledge unlike the younger *Bagos* who retained up to 80% of the middle-aged knowledge (RG and RC= 0 to < 1).

Further, the erosion of traditional knowledge is shown by the annual rate of change at one to five percent (CA= -0.01-0.05) among both male and female younger group of *Ibalois*, *Bagos*, *Tingguians* and male middle-aged *Iyattukas*. Among the elderly groups and middle-aged male *Ibalois*, *Bagos* and *Tingguians*, traditional knowledge is improving slowly at a positive one percent annual rate of change.

Table 8. Vitality indices of traditional rootcrop knowledge on tannia among selected IPs in Northern Philippines

AGE GROUP	IP GROUP	RG		RC		CA	
		Male	Female	Male	Female	Male	Female
15-35 years	<i>Ibaloi</i>	1	1	0.8	0.5	-0.01	-0.03
	<i>Bago</i>	0.6	0.2	0.8	0.5	-0.01	-0.03
	<i>Iyattuka</i>	2	1.2	1.35	1.08	0.02	0
	<i>Tingguian</i>	0	0	0	0	-0.05	-0.05
36-56 years	<i>Ibaloi</i>	3.32	1.52	1.1	1	0.01	0
	<i>Bago</i>	1.24	1	1.1	1	0.01	0
	<i>Iyattuka</i>	0.78	1	0.9	1	-0.01	0
	<i>Tingguian</i>	1.33	1	1.13	1	0.01	0
57-77 years	<i>Ibaloi</i>	1	1	1	1		
	<i>Bago</i>	1	1	1	1		
	<i>Iyattuka</i>	1	1	1	1		
	<i>Tingguian</i>	1	1	1	1		

CONCLUSIONS AND RECOMMENDATIONS

Roots and tubers were once considered staple food of indigenous peoples like the *Ivatans*, *Isnags*, *Kalingas*, *Iyattukas*, *Applai-Kankanaeys*, *Tingguians*, *Bagos*, *Ibalois*, *Kankana-eyes*, *Kalanguyas*, *Bugkalots*, *Aetas* and *Mangyans*. Circumstances, however, changed their outlook. Thus, the fear of losing diversity and indigenous knowledge on root and tuber crops such as tannia. Tannia or yautia or cocoyam (*Xanthosoma sagittifolium*) is one of the four main kinds of taro plants belonging to the aroids *Araceae* family.

This study inventoried the traditional varieties of tannia that are still planted, consumed or traded, or already lost. It also determined erosion of knowledge on traditional tannia varieties. Secondary data gathering, group interview workshop, field visits and personal interviews were conducted.

Tannia (*Xanthosoma sagittifolium*) is locally called *galyang*, *galiang*, *galyan*, *bila*, *bilah*, *biga*, *amasyan*, *lusya*, *bulawan* and *singapor*. Each of the 13 IPs surveyed mentioned 2- 4 distinct kinds of tannia differentiated based on leaf, stalk and corm-flesh color. Thus, the 30 locally named tannia varieties are grouped into five variety categories, namely: GGW-V referring to green leaf, green stalk, white-violet corm flesh; GGY (green leaf, green stalk, yellow corm flesh); GVV-W (green leaf, violet stalk, violet-white corm flesh); GVV (green leaf, violet stalk, violet corm flesh); and VVW (violet leaf, violet stalk and white corm flesh).

As to the extent of diversity, the violet-colored varieties (GVV-W, GVV and VVW) are fewer than the green or white-colored varieties considered plenty based on area planted and/or number of growers. The yellow-colored variety is rare.

Knowledge on traditional tannia varieties among the IPs significantly varied. The *Iyattukas* of Ifugao gave highest test score (78%), which means that their familiarity with the local name of tannia (*bilah*) and the types or varieties grown in the locality is higher than the *Bagos* of Ilocos Sur and La Union (64%), the *Ibalois* of Benguet (50%) and lastly, the *Tingguians* of Abra (11%).

As validated, the younger group of 15-35 years old had lower traditional knowledge test scores of 50% as compared to the middle-aged group of 36-56 years old at 60%. On the other hand, the elderly group of 57-77 years old had lower traditional knowledge test scores at 47% out of the expected 100% test score and this could also be the reason for the failure to transfer knowledge to the younger generation.

There is no gender bias in learning traditional knowledge since traditional knowledge test scores is almost the same between the male and female IPs at 52 and 53%, respectively.

While occupation and educational attainment have no statistical influence, the source of learning indigenous knowledge like learning from school, media and kin, had somehow influenced test scores at 100, 75 and 52%, respectively; and thus, the importance of sharing and learning indigenous knowledge from various modes of communication.

On retention or loss of traditional knowledge on tannia, results showed that between the younger (15-35 years) and middle-aged (36-56 years) groups of *Ibalois* and *Iyattukas*, and between the middle-aged *Bagos* and *Tingguians*, there is retention of knowledge as shown by the intergenerational and cumulative retention rates. Between the male and female younger *Iyattukas* and middle-aged *Ibalois*; and between the male middle-aged *Bagos*, female *Iyattukas* and *Tingguians* and the elderly group of 57-77 years old, there is an increase in knowledge. However, there is a higher loss of traditional knowledge on tannia between the younger *Tingguians* retaining zero of the middle-aged knowledge, than between the younger *Bagos* retaining up to 80% of the middle-aged knowledge.

In this era of climate change, food and nutrition, and livelihood insecurities, it would be prudent for research centers like the Northern Philippines Root Crops Research and Training Center at the Benguet State University to continuously maintain *ex-situ* or *in-situ* conservation and crop improvement of the traditional varieties. It is also imperative to be pro-active in sharing indigenous knowledge and experiences in schools, church, extension services, and media.

STUDY 4
TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON GREATER
YAM (*DIOSCOREA ALATA*) AMONG INDIGENOUS PEOPLE
IN NORTHERN PHILIPPINES

G.S. Backian, B.T. Gayao, and D.T. Meldoz

ABSTRACT

Greater yam and its wild species are among the root crops that served as the principal source of food and nutrition for many of the world's poorest and undernourished households. Yam was once an important alternate staple food of some indigenous people in the Philippines. The tubers are generally valued for its high yields even if left alone to grow for some years in fallowed farms. However, changing diets brought about by changes in livelihood, economic, environmental and climatic conditions, traditional greater yam varieties are at risk of disappearing. Hence, this documentation utilizing group interview, workshop, field observation, and secondary data gathering was done and documented cultivated as well as wild species of greater yam known among selected indigenous people in Northern Philippines as well as determined transfer of such knowledge to the younger generation.

Seventy-seven indigenous greater yam varieties were known or grown within the domains of the indigenous people in Northern Philippines. Of this number, 64 are indigenous or old varieties, 13 are new introductions, 50 were perceived as common or plenty, 22 are few or occasionally available, one is rare or endangered and four were already lost. These varieties were classified as to tuber shape and flesh colour, the characteristics commonly remembered by the indigenous people and industry buyers. The *Ivatans* had named the highest with 18 varieties, followed by the *Ibalois* at 17 varieties, *Bagos* (9), *Aeta* and *Isnags* (6 each), *Kalanguya* (4), *Kalinga*, *Bugkalot*, *Tingguian* and *Mangyan* (3 each), *Iyattuka* and *Applai* -kankanaeys (2) and the Benguet *Kankanaeys* (1). Sixteen wild species were named and gathered from the forest in times of food and feed scarcity.

Traditional rootcrop knowledge (TRK) on yam varieties significantly differed according to age group, occupation and information source. The oldest (55-77) group scored the highest TRK score at 70%, followed by middle-aged (36-56) group (58%) with the lowest TRK score from the younger (15-35) group at 41%. The farmers had the highest TRK mean score of 72% and the students had the lowest, 40%. Vitality index scores, however, did not validate that younger generation has higher loss of TRK. In fact, a higher TRK index, meaning the retention of knowledge of greater yam varieties, was noted among the female younger group of the *Iyattukas* and the male middle-aged group of the *Bagos*.

INTRODUCTION

Greater yam (*Dioscorea alata* Linn.), belongs to the family Dioscoreacea with approximately 600 species worldwide mostly wild and mainly in a tropical environment. It is locally named as *ube*, *ubi*, *uvi*, *guhhudan*, *ongo* or *ulang* among ethnolinguistic groups. The commercial potential of greater yam (*D. alata* Linn.) has been recognized in the country despite its being a minor commodity (PCARRD, 1998). Greater yam or *ubi* is a promising and high value crop because of its growing demand in the industry food sector in both local and export markets.

In Southeast Asia, yams are mainly produced in the Philippines and Japan (FAO, 2006), grown primarily for its underground tubers in a variety of shape, size, flesh-colour and aroma. Consumption is mainly as source of carbohydrates because this is eaten as an alternate to rice especially among the indigenous people. It is also important as source of industrial food products. Important species of yams are the *Dioscorea alata* where the processing purple yams belong. Yam thrives anywhere in the Philippines and in a wide range of soil type because it can tolerate adverse conditions such as droughts and pest infestation. It thrives best in sandy loam and silt loam, fertile, well-drained soil and at temperature ranging from 25° to 30° C and needs ample moisture throughout the growing season.

There are 110 indigenous people in the Philippines with an estimated population of 14-17 million, 33% of which is concentrated in Northern Luzon particularly within the Cordillera Administrative Region and 61% in Mindanao, with some groups in the Visayas (UNDP Fast Facts *Lagom*, 2010). Greater yam is among the root crops that had served as an important alternate staple food in the olden times especially among the minority indigenous people.

This study inventoried known or cultivated varieties and wild yam species and determined traditional loss of knowledge among selected indigenous people in Northern Philippines.

METHODOLOGY

Selection of Site and Key Informants

Selection of site and indigenous people as key informants was based on secondary data and the willingness of collaborating agencies and partner researchers. Secondary data on production statistics of root and tuber crops (RTC), published and unpublished literatures on indigenous groups and yam production and utilization studies from records of provincial and municipal agriculture units and regional offices, Bureau of Statistics (BAS) now Philippine Statistics Authority (PSA) and National Commission on Indigenous Peoples (NCIP) covering the communities of the selected indigenous people (IP) and majority ethnic group where root crops are grown. Thirteen IP groups were selected, namely: *Aeta*, *Bago*, *Biga-Kalinga*, *Bugkalot*, *Buhid-Mangyan*, *Ibaloi*, *Isneg*, *Ivatan*, *Iyattuka*, *Kalanguya*, *Kankana-ey*, *Applai-Kankana-ey*, and *Tingguian*, including two major ethnic groups, the *Kapampangans* and *Ilocanos* (Table 1).

Table 1. Selected IP/ ethnic groups, location of study areas and collaborating partners

GROUP	SITE	CONTACT PERSON/PARTNER
<i>Aeta</i>	Villamaria in Porac, Pampanga, and Sta. Rosa in Sto. Nino, Bamban, Tarlac	Edwin C. Paningbatan Department of Agriculture- Region 3
<i>Bago</i>	Banga, Sugpon, Ilocos Sur, and Malikliko, Sudipen, La Union	Victoria Sumagca Municipal Agriculture Officer
<i>Biga-Kalinga</i>	Dupligan, Tanudan, Kalinga	Marilyn Tombali Kalinga State College
<i>Bugkalot</i>	Tamuyan, Belance, Dupax del Norte, Nueva Vizcaya.	Lasin P. Osingat Nueva Vizcaya National Commission on Indigenous People
<i>Buhid-Mangyan</i>	Monteclaro, San Jose City, Occidental Mindoro	Perlita C. Esperanza City Agriculture Officer
<i>Ibaloi</i>	Taloy Sur, Tuba, Benguet Province	Elesia Alilis, Sonia Loquitan and Ricardo Loquio
<i>Isneg</i>	Talifugo, Conner, Apayao	Satur Bangyad and Stephen Bulalin Apayao State College
<i>Ivatan</i>	Basco, Mahatao, Ivana, Uyugan, Batanes Province	Rita H. Cultura Batanes State College, Basco, Batanes
<i>Iyattuka</i>	Amduntog, Asipulo Ifugao	Escolastica Dulnuan Amduntog Barangay Council
<i>Kalanguya</i>	Tiblac, Ambaguio, Nueva Vizcaya	Gregorio G. Singangan National Commission on Indigenous Peoples, Nueva Vizcaya
<i>Kankana-ey</i>	Sagpat, Kibungan, Benguet	Celio Bitayan and Keith Pantaleon Village Officials
<i>Applai-Kankana-ey</i>	Bila, Lagawa, Banao and Guinzadan Sur, Bauko, Mountain Province	Carolyn B. Wandalen, Marina Sapdoy and Ely Rose Payacda Bauko Municipal Agriculture Office, Mountain Province
<i>Tingguian</i>	Labaan, Bucloc, Abra	Elsa D. Bagioan Abra State Institute of Science and Technology (ASIST)
<i>Kapampangan</i>	Babu Pangulo, Porac, Pampanga	Edwin P. Paningbatan Department of Agriculture Region III
<i>Ilocano</i>	Paniqui, Tarlac	

Data Gathering Tools and Analysis

Informal interviews based on a detailed interview guide, story-telling, vivid pictures, and cue cards to record responses and to further encourage participatory discussion were used. Field visits and community walk were done after the workshop. Data gathered were tabulated, sorted, and summarized according to inventory listing, extent of variety availability and descriptive listing of variety attributes. For the transfer of knowledge, the SPSS software using analysis of variance (ANOVA) at 5% level of significance, and the vitality index on traditional knowledge statistics (VITEK) tool (Zent, 2010) were used.

DISCUSSION OF RESULTS

Classification of Greater Yam Varieties

Greater yam (*Dioscorea alata*) is popularly called *ubi* sometimes pronounced *uvi* or *uve* among the IPs except the *Iyattukas* who call it *guhhudan*, the *Kalanguyas* as *ongo* and the *Kankana-eyes* as *ulang*. From among the 77 cultivated varieties or species of yam named by the IPs, 64 are indigenous or old varieties, and 13 are new introductions (Table 2). The informants classified the varieties as indigenous or old if it had been grown in the locality for 50 years or more; and introduced if varieties were from outside source. The possibility of the 77 varieties to be similar but named differently is high. The 27 wild species were reduced to 16 species because of the similarity in local names or description especially for the *Dioscorea hispida* and the air potato species. These wild yams were gathered from the forest (*bakir/ kabakiran*) in times of food and feed scarcity and as additional source of cash income.

Table 2. Local names and number of cultivated and wild greater yam varieties known among IPs in Northern Philippines

IP	LOCAL NAME	CULTIVATED			WILD
		Indigenous	Introduced	Total	
<i>Aeta</i>	<i>Ubi</i>	6		6	3
<i>Applai-Kankana-ey</i>	<i>Ubi</i>	2		2	1
<i>Bago</i>	<i>Ubi</i>	5	4	9	3
<i>Biga-Kalinga</i>	<i>Ubi</i>	3		3	1
<i>Bugkalot</i>	<i>Ubi</i>	3		3	1
<i>Buhid-Mangyan</i>	<i>Ubi</i>	3		3	2
<i>Ibaloi</i>	<i>Uve</i>	13	4	17	4
<i>Isneg</i>	<i>Ubi</i>	5	1	6	2
<i>Ivatan</i>	<i>Uvi</i>	14	4	18	2
<i>Iyattuka</i>	<i>Guhhudan</i>	2		2	1
<i>Kalanguya</i>	<i>Ongo</i>	4		4	2
<i>Kankana-ey-Benguet</i>	<i>Ulang</i>	1		1	1
<i>Tingguian</i>	<i>Ubi</i>	3		3	4
Total		64	13	77	27

The *Ivatans* and *Ibalois* named the highest number of cultivated varieties, 18 and 17, respectively, validating the common knowledge that they are really growers and consumers of yam for staple food. Yam varieties of *Ivatans* are mostly white fleshed and grown in Mahatao, Batanes (Dayo, et al., 1988).

The *Bagos* named nine varieties four of which were introduced from Benguet just after the earthquake and volcanic disasters where they need replacement for their diseased banana cash crop. Today, they consider greater yam as the number one cash crop from swidden farms.

The *Aetas* and *Isnegs* named six of greater yam varieties, each which are purposely for food and occasional sale. The *Kalanguyas* knew only four greater yam varieties previously planted as cash crop but replaced by preference to short maturing cash crops (3-4 months) like pole snap beans.

The *Biga-Kalingas*, *Bugkalots* and *Buhid-Mangyans* named three varieties each; the *Applai-Kankana-eyes* and *Iyattukas* named two varieties each; and the *Kankana-ey* knew only one variety. These yam varieties mentioned are only harvested and consumed occasionally. The *Biga-Kalingas* even claim that varieties are domesticated wild yam that are just replanted whenever encountered in the swiddens or those that grew from tubers and trimmings thrown in the ground after household use. The major ethnic group, the *Kapampangans* and *Ilocanos* are not familiar with the local name of greater yam varieties as these are mostly planted by the neighbouring *Aetas*.

Extent of Production and Availability

Out of the 77 cultivated greater yam varieties, 50 were perceived as common or plenty, 22 are few or occasionally available, one is rare or endangered and four were already lost (Table 3). Varieties perceived as common or plenty are either planted in a large area by few farmers or planted in a small area by many farmers, and those perceived as few are planted by few farmers and in small areas. Those observed rare can hardly be found and may be endangered.

Table 3. Extent of production and availability of the cultivated greater yam varieties

IP	EXTENT OF PRODUCTION AND AVAILABILITY			
	Common/ plenty (#)	Few (#)	Rare (#)	Lost (#)
<i>Aeta</i>	6			
<i>Applai-Kankana-ey</i>				2
<i>Bago</i>	2	7		
<i>Biga-Kalinga</i>	3			
<i>Bugkalot</i>	1			2

<i>Buhid-Mangyan</i>	2		1	
<i>Ibaloi</i>	8	9		
<i>Isneg</i>	6			
<i>Ivatan</i>	18			
<i>Iyattuka</i>	2			
<i>Kalanguya</i>		4		
<i>Kankana-ey-Benguet</i>		1		
<i>Tinguian</i>	2	1		
Total	50	22	1	4

Local Names of Cultivated Greater Yam Varieties

The *Aetas* in resettlement areas of Tarlac, Pampanga, Zambales and Bataan grew the following greater yam varieties after the 1991 Mount Pinatubo eruption: *Ubing-ubi*, *Ubing bisaya*, *Kagunaw*, *Ubing barak*, *Ubing anito* and *Ubing kamana* (Table 4). Previously greater yam was gathered from the wild.

There are no local names of greater yam varieties among the *Applai-Kankana-eyes* of Mt. Province except by distinguishing these as white and purple as the colour of the flesh. The *Applai-Kankana-eyes* greater yam varieties have been lost because of the preference for cash crops in the growing areas.

Table 4. Local names of cultivated greater yam among IPs in Northern Philippines

IP	TRADITIONAL VARIETY	INTRODUCED VARIETY
<i>Aeta</i>	<i>Ubing-ubi, Ubing-bisaya, Ubing-kagunaw, Ubing barak, Ubing anito, Ubing kamana</i>	
<i>Applai-Kanakana-ey</i>	<i>White, Violet</i>	
<i>Bago</i>	<i>Liken, Mayyas, Tebek-white, Tebek-violet, Sappido, Baloktot or Tuwiran</i>	<i>Sablan-Mindoro, Mindoro, Rapang or Kamay-kamay</i>
<i>Biga-Kalinga</i>	<i>Uleg-yellow, Uleg-violet, Ima</i>	
<i>Bugkalot</i>	<i>Yellow, Violet, White</i>	
<i>Buhid-Mangyan</i>	<i>Abuha, Dungon, Unnamed</i>	
<i>Ibaloi</i>	<i>Dimdima white, Dimdima violet, Tungkol, Sampero, Biscong, Shiket-white, Shihet-violet, Majas or Madjas, Maube, Padihot, Padinse, Tuwiran or Tohiran, Unnamed</i>	<i>Daking, New Tuwiran, Kinampay-sampero, Mindoro-tungkol</i>
<i>Isneg</i>	<i>Baha-ong, Tulad, Bussaya, Sanglay, Violet</i>	<i>Esther ubi</i>

<i>Ivatan</i>	<i>Pagadji, Cabrera or Kabrera, Pagad or Kalabaw, Talapuyo, Galas, Lagan-white, Lagan-violet, Lacon-white, Lacon violet, Marianas or Maryanan, Namay, Paranan, Tucod, Unnamed</i>	<i>Nayingles, Nayvisaya, Bataan, Palisin/Hawaii</i>
<i>Iyattuka</i>	<i>Guhhudan1, Guhhudan 2</i>	
<i>Kalanguya</i>	<i>Amputi, Kinumpay 1, Kinumpay 2, Kinumpay 3</i>	
<i>Kankana-ey- Benguet</i>	<i>Ulang</i>	
<i>Tingguian</i>	<i>Ab-abit or ub-ubing, Violet long, Bekbeklat</i>	

The *Bago* varieties are *Baloktot* or *Tuwiran*, *Mindoro*, *Rapang* or *Kamay-kamay*, *Sablan* or *Mindoro-Tungkol*, *Sappido* or *Round*, *Tebek-white*, *Tebek-violet* and *Mayyas*. The *Bago* IPs have been planting and consuming a white-fleshed and spiral-shaped greater yam since time immemorial but it was only in the 1990's (in Sugpon) and 2007 (in Sudipen) that new varieties of greater yam were introduced as cash crops. Today, greater yam is the number one cash crop displacing bananas as source of income from swidden farms. Two villages of Sugpon, Ilocos Sur (Badang and Banga) have a strong *Ubi* farmers' organization under contract since 2012 to supply 35-40 tons to one food processor based in Baguio City. Varieties *Baloktot* or *Tuwiran* and *Mindoro* (Figure 1) are commonly planted by the *Bagos* because the former is short maturing and the latter is market preferred. Few of *Rapang* or *Kamay-kamay*, *Sablan* or *Mindoro Tungkol*, *Sappido* or *Round*, *Tebek-white* and *Tebek-violet*, and *Mayyas* are planted. *Rapang* is less preferred by contract buyers, *Mayyas* have a bland taste, and the *Tebek* are deep rooted and grown for home consumption only.

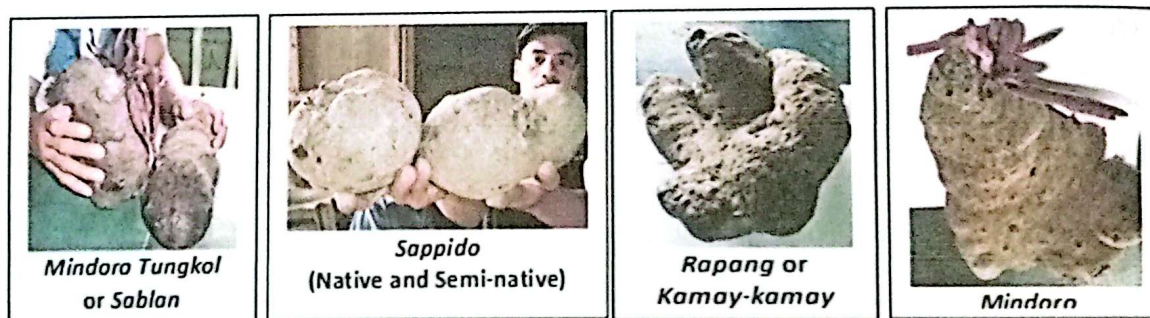


Fig. 1. Cultivated yam varieties of the *Bagos* in Sugpon, Ilocos Sur

The *Biga-Kalingas* variety names were based on the shape of the tubers, the *Uleg white*, *Uleg violet* and *Ima*. Locally, *Uleg* means snake-shaped tubers and differed according to the flesh color. *Ima* means hand with branched tuber (+/-5 fingers) joined at the middle.

The *Bugkalots* who roam the mountain ranges of Sierra Madre, cultivate short maturing yellow, white and violet-fleshed yam varieties harvested six months after planting

(6 MAP) instead of the usual maturity of 7- 9 MAP. Preference for the violet variety caused the loss of the *Bugkalots* yellow and white varieties. The violet variety is still widely planted in designated parts of their *uma* yielding three shapes of tubers namely: *round*, *rapang* (flat palm-like) and elongated. The *Bugkalots* grow greater yam for food and for sale.

The *Ibalois* of Benguet particularly in Taloy Sur, Tuba had been growing these varieties for more than 50 years: *Biscong*, *Shihet* white, *Shihet* violet, *Dimdima* white, *Dimdima* violet, *Majas* or *Madjas*, *Maube*, *Padihot*, *Padinse*, *Sampero*, *Tungkol*, *Tuwiran* or *Tohiran* and one unnamed (Figure 2). Varieties *Daking*, *Kinampay-Sampero*, *Mindoro-Tungkol*, and *New Tuwiran* considered as new introductions have been grown for less than 50 years. In the 1980's, Bayogan and Quindara (1989), mentioned that variety *Padinse* is grown by a majority of farmers in Tuba and Sablan. Commonly planted by many farmers are the varieties *Dimdima* white and violet, *Sampero*, *Kinampay*, *Tungkol*, *Mindoro*, and *Daking*.

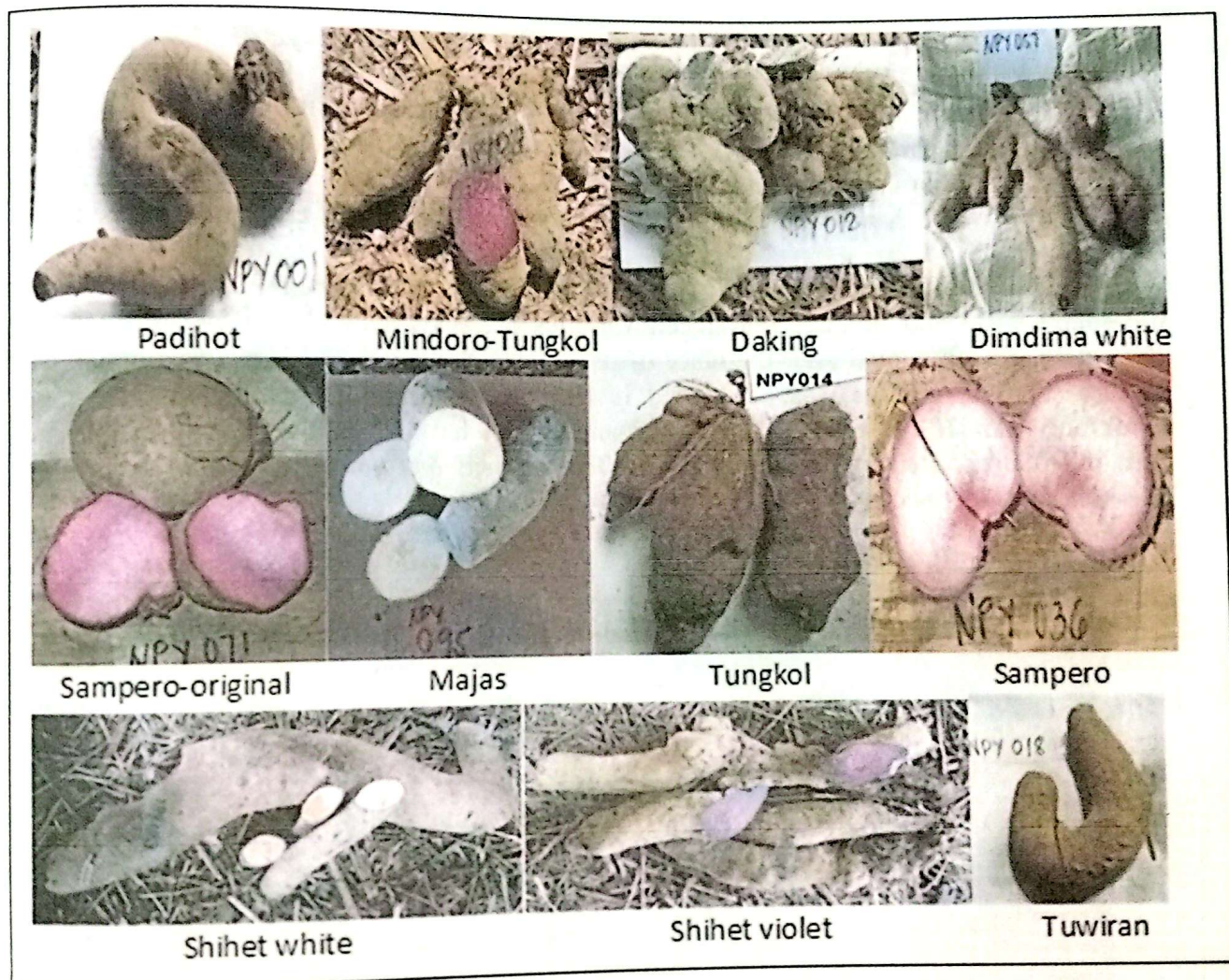


Fig. 2. Yam varieties grown by the *Ibalois* of Benguet

The *Buhid-Mangyans* of Occidental Mindoro have only three varieties of greater yam, namely: *Abuhay*, *Dungon* and one unnamed. The *Dungon* variety is similar to the *Dimdima*

variety in Benguet. Meanwhile, the *Isnegs* of Apayao have five long maturing (12MAP) varieties of greater yam, namely: *Baha-ong*, *Bussaya*, *Sanglay*, *Violet* and *Esther ubi*, and one variety named *Tulad* (Figure 3) that can be harvested in 8 months.

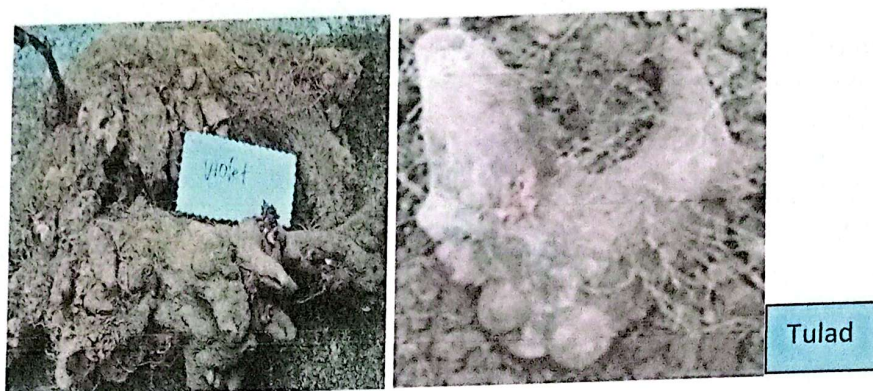


Fig. 3. Greater yam varieties of the *Isnegs* in Apayao

The *Ivatans* in Batanes cultivate the following 18 greater yam in their rainfed parcels of land called *asakatakey*: *Bataan*, *Cabrera* or *Kabrera*, *Nayingles*, *Nayvisaya*, *Pagad* or *Kalabaw*, *Palisin* or *Hawaii*, *Pagadji*, *Talapuyo*, *Galas*, *Lagan-white*, *Lagan-violet*, *Lacon-white*, *Lacon-violet*, *Mariana* or *Maryanan*, *Namay*, *Paranan*, *Tucod* and one unnamed.

The white-fleshed *Talapuyo* (Figure 4) is claimed as a first class variety because of the shape, taste and texture. Introduced varieties are *Nayingles*, *Nayvisaya*, *Bataan*, and *Palisin* or *Hawaii* named after the place of its origin. *Nayingles* and *Nayvisaya* had existed since 1915, and *Bataan* was introduced in the 1990's. These 18 yam varieties are still commonly planted mostly in Mahatao, Batanes. Each farmer usually plant three varieties. Lim in 2000 as cited by Gayao et al. in 2014 claimed that some yam (*Dioscorea alata*) varieties were lost because of low yield and low utilization.



Fig. 4. Traditional greater yam varieties of the *Ivatans*
(L-R: *Lacon*, *Talapuyo* and *Nayvisaya*)

The *Iyattukas* of Ifugao have two unnamed varieties of greater yam planted in their locality. Sometime in 2002-2003, yam varieties from Quirino and Nueva Vizcaya were distributed by the Asipulo Municipal Government to 30 growers as possible cash income source. These were planted in gardens near the *payoh* (terraced ricefield) and in the *umah* (swidden farm). All were presumed lost because there was no mention of the variety introductions. Greater yam is a less priority crop among the *Iyattukas* because they are a rice eating community.

The *Kalanguyas* in Ambaguio, Nueva Vizcaya identified four locally-grown varieties of greater yam: the *Amputi*, a variety planted for home consumption only while *Kinumpay 1*, *Kinumpay 2* and *Kinumpay 3*, all with different shape or tuber growth and branching in the upper part with sickle shape tubers, the round shape and branching in lower part like fingers (*rapang*) are suitable for ice cream making because of the violet-fleshed tubers.

The southern *Kankana-eyes* of Benguet have only one variety of greater yam but less preferred as compared to sweetpotato because of its bland taste. Meanwhile, the *Masadiit - Tingguians* commonly plant two local varieties, the high yielding white-fleshed *ubi* called *Ab-abit* or *Ub-ubing* and the other variety called violet long which is preferred by buyers because of its deep purple flesh.

Local Names of Wild Greater Yam Species

The wild yam nami (*Dioscorea hispida*) is commonly known among eight IPs as *Kalot*, *Karot*, *Kaut* and *Mintakey*, and the aerial yam as *Kafungaw*, *Batata* and *Ilos* of the *Ibaloi*, *Ivatan* and *Tingguian*, respectively. Local names of the other 14 wild species of yam (Table 5) known to the IPs were *Ipuy* or *Ipoy* of the *Iyattukas* and *Kalanguyas*; *Labit* or *Diyan* and *Kabwang* of the *Aetas*; *Kanapan* of the *Applai-Kankana-eyes*; *Lima-lima* and *Dimurian* of the *Bagos*; *Atap-ubi* of the *Biga-Kalingas*; *Lugiman* of the *Buhid-Mangyans*; *Kasey* and *Durian* of the *Ibalois*; *Amakey* of the *Isnegs*; *Dalakit* of the *Kalanguyas*; *Gallod* of the *Kankana-eyes* of Benguet; and *Iyog-iyogan* and *Kamangeg* of the *Tingguians*. These wild species are still growing in the forest and usually harvested in October. The *Aetas* gather the wild yams from September to December when they go to their swidden farm or to the forest to hunt especially if the *Aetas* do not want to spend their cash for buying rice. The *kalot* specie is also gathered and sold as pre-processed in local markets. The wild yam (*Atap-ubi*) and the wild canna (*Bonte-ek*) of the *Biga-Kalingas* are harvested by mothers who would use them in preparing native delicacies during special occasions.

Table 5. Local names of wild greater yam species known by the IPs in Northern Philippines

IP	NUMBER	LOCAL NAME
<i>Aeta</i>	3	<i>Labit</i> or <i>Diyan</i> , <i>Liwet</i> or <i>Kabwang</i> , <i>Kalot</i> or <i>Nami</i>
<i>Applai-Kanakana-ey</i>	1	<i>Kanapan</i>
<i>Bago</i>	3	<i>Lima-lima</i> , <i>Karot</i> or <i>Kaut</i> , <i>Dimurian</i>
<i>Biga-Kalinga</i>	1	<i>Atap ubi</i>
<i>Bugkalot</i>	1	<i>Kalot</i> or <i>Karot</i>
<i>Buhid-Mangyans</i>	2	<i>Lugiman</i> , <i>Kalot</i> or <i>Karot</i>

<i>Ibaloi</i>	4	<i>Ka-sey, Durian, Kalot, Kafungaw</i> (Air potato)
<i>Isneg</i>	2	<i>Amakey, Karot</i>
<i>Ivatan</i>	2	Aerial ubi or <i>batata</i> , <i>Mintakey</i> or <i>Nami</i>
<i>Iyattuka</i>	1	<i>Ipuy</i>
<i>Kalanguya</i>	2	<i>Ipoy, Dalakit</i>
<i>Kankana-ey- Benguet</i>	1	<i>Gallod</i>
<i>Tingguian</i>	4	<i>Kalot or Karot, Iyog-iyogan, Ilos</i> (aerial yam), <i>Kamangeg</i>

The *Applai-Kankana-ey*s gather their wild yam from the same forest where the *Bagos* gather the *Lima-lima*. The wild yam of the *Ibalois* generally named as *Durian* (*Dioscorea spp.*) are of two kinds: the *Durian* whose green heart-shape leaves/vine is similar to the cultivated yam but with elongated white flesh tuber, and the *Ka-sey* with its five-lobed leaves and very long hairy roots on its irregular-ovate shaped tubers (Figure 5).



Fig.5. Some wild yam of the IPs, *Ka-sey* of the *Ibalois* (a) and *Kamangeg* of the *Tingguians* (b)

The wild yam or *lugiman*, of the *Buhid-Mangyans* are volunteer plants within the perimeters of the *kaingin* farm and are harvested primarily for sustenance while waiting for the harvest season for the other crops. These are among the wild roots and tubers that are harvested during lean or difficult months they call *tigkiwiri*.

The wild aerial yams of the *Ivatans* in Batanes locally known as *Batata* is a newly introduced self-supporting crop planted in backyards underneath trees and in rocky areas adaptable to any type of soil. These are of two kinds, one utilized as food coloring for *ubi* jam, and the other utilized as vegetable. The wild yam *Ipuy* of the *Iyattukas* is known as survival food of the first settlers in Ifugao.

Description of Commonly Grown Greater Yam Varieties

Characteristics of the traditional yam varieties that the IPs could easily mention are the flesh colour and tuber shape as follows: the round shape, cylindrical, flattened or the

palm-hand shape, irregular which is classified as short and long, and the elongated shape tubers classified also as C-shaped, reniform or falcate and slightly spiral or S-shaped tubers. Others mentioned specific attributes like early maturity, taste, tuber size, skin color and cooking quality.

Round-shaped. There are eight round-shaped varieties among the IPs; three are white-fleshed and five are purple-fleshed (Table 6). The *Baha-ong* of the *Isnegs* might be the same as the *Sampero* (NPY003) of the Ibaloi or *Sappido* of the *Bagos* or the violet variety of the *Bugkalots* which are also described as aromatic. NPY is Northern Philippines Yam, the code name given to BSU-NPRCRTC yam germplasm collections. The *Kinampay sampero* which might be the same as NPY034 or NPY036 cannot be primed and thus are harvested at one-time. Varieties *Palisin* or *Hawaii* of the *Ivatans*, *Sampero* of the *Ibalos*, and *Sanglay* of the *Isnegs* tastes sweet. The violet variety of the *Bugkalot* matures in six months after planting, a short-maturing variety with respect to yam. The *Paranan* variety of the *Ivatan* is purposely given as food for pigs. The *Pagadji* of the *Ivatans* is a native variety similar to *Kinampay* of Bohol.

Table 6. Round-shaped greater yam varieties known among the IPs in Northern Philippines

NAME	SHAPE	FLESH COLOR	MAP	TASTE	OTHER ATTRIBUTE	IP
<i>Paranan</i>	1	1		1	Brown skin, tubers given to pigs in Mahatao	<i>Ivatan</i>
<i>Palisin/Hawaii</i>	1	1		1	Smooth texture	<i>Ivatan</i>
<i>Baha-ong</i>	1	1			Aromatic	<i>Isneg</i>
<i>Pagadji, Kinampay Sampero*</i> (NPY034, NPY036)	1	5		0	Can not be primed	<i>Ivatan, Ibaloi</i>
<i>Sampero*/Sappido</i> (NPY003)	1	6		1	Aromatic	<i>Ibaloi, Bago</i>
<i>Violet</i>	1	6	1			<i>Bugkalot</i>
<i>Sanglay</i>	1	6	3		Large brown skin with aerial tubers and good for candy	<i>Isneg</i>

*These varieties were also mentioned by Bayogan and Quindara (1989) and Gayao, et al. (2015)

Tuber shape	Maturity	Flesh Color	Taste
1 – Round	1 – Up to 6 months	1 – White	0 – Not sweet
2 – Oval	2 – 7 months	2 – Yellowish White or Off-white	1 – Not so sweet
3 – Oval-oblong	3 – Greater or equal to 8 months	3 – Yellow	2 – Sweet
4 – Cylindrical		4 – Orange	3 – Very sweet
5 – Flattened (palm-hand shape)		5 – Light Purple	
6 – Irregular		6 – Purple	
6.1 – Short		7 – Purple with white	
6.2 – Long		8 – White with purple	
7 – Elongated		9 – OuterPurple/Inner Yellowish	
7.1 – C-shaped, reniform, falcate			
7.2 – Slightly spiral (S-shaped)			

Cylindrical-shaped. There are 12 yam varieties cylindrical in shape (Table 7, seven are white-fleshed, four are purple-fleshed and one with unspecified flesh colour. The *Lagan-violet* of the *Ivatan* might be the same as the *Mindoro Sablan* of the *Bago* and *Mindoro Tungkol* of the *Ibaloi*, or the NPY016, NPY014 or NPY008 of the NPRCRTC germplasm collection. *Mindoro* and *Mindoro Tungkol* are both sweet although the latter is preferred by the *Ibalois* because of its large heavy tubers attributed to its many roots that are efficient in absorbing nutrients from the soil. The *Pagad* or *Kalabaw* variety of the *Ivatan* is also purposely given as food for pigs.

Table 7. Cylindrical-shaped greater yam varieties of the IPs in Northern Philippines

NAME	SHAPE	FLESH COLOR	TASTE	OTHER ATTRIBUTE	IP
<i>Bataan</i>	4			Yields 25kg/hill, introduced from Bataan in 1990	<i>Ivatan</i>
<i>*Majas/ Madjas (NPY095)</i>	4	1	0		
<i>Nayingles</i>	4	1		Old variety of brown skin, introduced in Batanes	<i>Ivatan</i>
<i>Nayvisaya</i>	4	1		Introduced in 1915, hard when cooked, with outer black/brown skin and yellowish inner skin	<i>Ivatan</i>
<i>Pagad/ Kalabaw</i>	4	1		Not for human food, but feed for animals in Mahatao	<i>Ivatan</i>
<i>Galas</i>	4	1		First class variety, pink inner skin	<i>Ivatan</i>
<i>Lagan-white</i>	4	1		Bohol variety	
<i>Tucod</i>	4	1		Outer skin is brown and inner skin is pink	<i>Ivatan</i>
<i>Sablan or Mindoro *Tungkol(NPY016)</i>	4	6	1	Large heavy tubers with many roots	<i>Bago, Ibaloi</i>
<i>Mindoro Tungkol* (NPY014, NPY008)</i>	4	6	1		<i>Ibaloi</i>
<i>Lagan-violet</i>	4	6			<i>Ivatan</i>
<i>*Daking (NPY079)</i>	4	6	0	Introduced in the 1980's	<i>Ibaloi</i>

*Refer to Table 6.

Flattened palm-hand-shaped. The three flattened yam varieties of the *Ibalois* and *Bugkalots* vary in flesh colour from purple, purple with white to white with purple (Table 8). Two are irregular in shape, the *Maube* variety described by the *Ibalois* as elongated with big tubers, deep purple flesh and mealy; the same characteristics as the NPY084. The purple flesh *Padinse* variety might also be the same as NPY092. The *Dimdima white* of the *Ibalois* was mentioned as good for dried chips called '*buku*' and the tuber has longer dormancy thus, longer storage period.

Table 8. Flattened and irregularly-shaped yam varieties of the IPs in Northern Philippines

NAME	SHAPE	FLESH COLOR	MAP	TASTE	OTHER ATTRIBUTE	IP
<i>Violet</i>	5	6	1			<i>Bugkalot</i>
<i>Dimdima violet*</i> (NPY007)	5	7		0		<i>Ibaloi</i>
<i>Dimdima white*</i> (NPY057)	5	8		0	Heavy tuber good for <i>buku'</i> , longer storage period	<i>Ibaloi</i>
<i>Maube*</i> (NPY084)	6.1	6		2	Deep purple, mealy and high yield	<i>Ibaloi</i>
<i>Padinse*</i> (NPY092)	6.2	6				<i>Ibaloi</i>

*Refer to Table 6.

Elongated-shaped. There are 13 elongated yam varieties among the *Buhid-Mangyans*, *Ivatans*, *Isnegs*, *Bagos*, *Bugkalots* and *Ibalois*. Six of these are white flesh, one is light purple flesh and six are purple flesh (Table 9). The *Talapuyo* of the *Ivatans* is considered a first class variety in Batanes. The *Cabrera/Kabrera* is a white flesh variety with secondary pink colour if stored, difficult to harvest in flat areas thus preferably planted in rolling areas for easier harvesting. The *Shihet-violet* or NPY022 of the *Ibalois* may be the same as the *Lacon-violet* of the *Ivatans*. The *Baloktot* of the *Bagos* may also be the same as the *Tuwiran* (NPY018), *Tohiran* or *Pagui-it* of the *Ibalois*. The *Baloktot* or *Tuwiran* varieties are high yielding and tolerant to typhoon but sensitive to bruising and mechanical damage.

Likewise, *Baloktot* or *Tuwiran* tubers have the tendency to have black or hallow heart. The *Baloktot* variety was introduced from Benguet in Sugpon, Ilocos Sur in the 1990's and later in Sudipen, La Union in 2007. 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 tail of the tuber of the *Tulad* variety has carabao horn-like shape coming out from the soil. The *New Tuwiran* variety of the *Ibalois* which might be the same as NPY064 and NPY065, has watery flesh with hardened dark violet-black pigments in the flesh if over matured; hence harvested when the leaves are still green. This variety was introduced after the earthquake in 1990. The *Violet long* of the *Tingguians* is preferred by the bakery proprietors in Abra.

Four other varieties have unspecified shapes but three of these are white flesh named as *Ubing anito* or *Ubing Kamana* of the *Aeta*, *Bussaya* and *Ab-abit* or *Ububing* of the *Isnegs*. *Bussaya* matures at 12MAP and *Ab-abit* or *Ub-bing* is high yielding.

Table 9. Elongated-shaped greater yam varieties of the IPs in Northern Philippines

NAME	SHAPE	FLESH COLOR	MAP	TASTE	OTHER ATTRIBUTE	IP
1. <i>Shihet-White*</i> (NPY023)	7	1		0		<i>Ibaloi</i>
2. <i>Abuhay</i>	7	1			Yields 4-6kg/hill	<i>Mangyans</i>
3. <i>Talapuyo</i>	7	1			First class variety	<i>Ivatan</i>
4. <i>Lacon-white</i>	7	1			Bohol variety	<i>Ivatan</i>
5. <i>Namay</i>	7	1				<i>Ivatan</i>
6. <i>Cabrera/Kabrera</i>	7	5			White flesh with secondary pink color, since 1980	<i>Ivatan</i>
7. <i>Violet</i>	7	6	1			<i>Bugkalot, Ivatan</i>
8. <i>Esther Ubi</i>	7	6	3		Acquired from Tuba	<i>Isneg</i>
9. <i>Shihet-Violet*</i> (NPY022)	7	6				
10. <i>Tulad</i>	7.1	1	3		Tail of tuber has carabao horn-like shape (coming out from the soil)	<i>Isneg</i>
11. <i>Lacon violet</i>	7.1	6				<i>Ivatan</i>
12. <i>Baloktot or Tuwiran*</i> (NPY018) also known as <i>Tohiran, Pogui-it</i>	7.1	6	1	2	Has tolerance to typhoon, high yielding	<i>Bago, Ibaloi</i>
13. <i>New Tuwiran*</i> (NPY064, NPY065)	7.1	6		0	Flesh has hardened violet pigments if over matured	<i>Ibaloi</i>
14. <i>Ubing Anitol/Ubing Kamana</i>		1		2	sticky	<i>Aeta</i>
15. <i>Bussaya</i>		1	3		Yields more tuber/hill	<i>Isneg</i>
16. <i>Ab-abit or Ub-ubing</i>		1			High yielding	<i>Isneg</i>
17. <i>Violet</i>		6				<i>Isneg</i>
18. <i>Pagadji</i>		6			Native variety like Kinampay	<i>Ivatan</i>
19. <i>Violet long</i>		6			With aerial tubers preferred by bakeries	<i>Tingguians, Isnegs</i>
20. <i>Marianas/Maryanan</i>					Smooth texture, large/lush foliage (Lim, 2000)	<i>Ivatan</i>

*Refer to Table 6.

Traditional Rootcrop Knowledge (TRK)

Test scores among the *Bago*, *Ibaloi*, *Iyattuka* and *Tingguian* IPs on knowledge of traditional varieties of greater yam showed significant differences along age group, occupation, and knowledge source not on ethnicity, sex, and educational attainment (Table 10). As expected, the elderly group (55-77 years) scored the highest test result at 70% followed by middle-age group (36-56 years) at 58%. The younger group (15-33 years) had 41%. The decelerating scores among age groups signify less consumption, less production, or simply disinterest in knowing more of traditional foods, which can be attributed to the changing lifestyles.

Table 10. Traditional root crop knowledge (TRK) scores on greater yam varieties

GROUP	VARIABLE	TRK MEAN SCORE (%)	F- VALUE	SIGNIFICANCE
IPs	<i>Ibaloi</i>	64	1.592	0.179
	<i>Bago</i>	59		
	<i>Tingguian</i>	55		
	<i>Iyattuka</i>	49		
Age (years)	15-35	41	7.112	0.000**
	36-56	58		
	57-77	70		
Sex	Male	61	2.316	0.101
	Female	53		
Occupation	Stay home	52	3.057	0.007**
	Farmer	67		
	Employee	44		
	Student	40		
	Businessman/woman	53		
	Others-pensioners etc.	60		
Educational attainment	No formal education	58	1.973	0.101
	Reached elementary	63		
	Reached high school	53		
	Reached vocational	84		
	Reached college	51		
Source of IK knowledge	1-Kins, relatives, friends	49	2.712	0.015*
	2-School, church, extension services	100		
	3-Media (print, radio, TV)	75		
	1,2 and 3	73		
	1 and 2	50		
	1 and 3	62		

** highly significant at 1% level, *-significant at 5% level

As validated, the farmer had the highest TRK mean score of 72% while the lowest was recorded from the students at 40%. This data indicate that the IP farmers plant greater yam but the farmer themselves, the stay-home spouse or relatives, and their children are not interested enough to transfer and to learn the kinds or names of yam. The results further show that school, church and extension services were more effective in disseminating information on indigenous knowledge followed by media which suggests their important role in influencing kin and relatives to teach indigenous knowledge.

Retention or Loss of Traditional Rootcrop Knowledge

Vitality indices of the elderly group (57-77 years) is one, which indicates that they knew more of the greater yam varieties that were grown in the community and that the younger generation knew less. However, as shown in Table 10, this assumption is not always true because there is retention of knowledge and even an increase in knowledge of greater yam varieties among the male middle-aged group (36-56 years old) of the *Bagos* with RG (intergenerational rate) value of 1.19 and RC (cumulative rate) value of 1.08. Greater yam is a cash crop of the *Bagos* and it is the male group that is mostly involved in the production and marketing of this crop.

Table 10. Vitality indices of traditional rootcrop knowledge (TRK) on greater yam among IPs in Northern Philippines

AGE	IP	RG		RC		CA	
		Male	Female	Male	Female	Male	Female
15-35	<i>Ibaloi</i>	0.67	0.50	0.79	0.69	-0.02	-0.03
	<i>Bago</i>	0.67	0.76	0.91	0.88	-0.01	-0.01
	<i>Iyattuka</i>	0.83	2.50	0.84	0.77	-0.02	-0.02
	<i>Tingguian</i>	0.39	0.66	0.60	0.77	-0.04	-0.02
36-56	<i>Ibaloi</i>	0.87	0.85	0.94	0.93		
	<i>Bago</i>	1.19	0.98	1.08	0.99		
	<i>Iyattuka</i>	0.80	0.22	0.91	0.52	0.00	-0.02
	<i>Tingguian</i>	0.78	0.85	0.90	0.93	-0.01	
57-77	<i>Ibaloi</i>	1	1	1	1		
	<i>Bago</i>	1	1	1	1		
	<i>Iyattuka</i>	1	1	1	1		
	<i>Tingguian</i>	1	1	1	1		

Between the middle-aged and younger groups, the assumption that there is further decrease in knowledge is validated except among the *Iyattukas* where there is even increase in knowledge among the younger female *Iyattukas* at RG of 2.5 and a higher RC of 0.77 than the middle-aged at 0.22 RG and 0.52 RC, respectively. There is retention of knowledge between the male younger and middle-aged *Iyattukas* at RG of 0.83 and 0.80, respectively. This result may be explained by the fact that the younger group had consulted their elders

during the test, and that most of the middle-aged who took the test were involved in off-farm job.

Differences in RG and RC vitality index between male and female, and among the *Ibalois*, *Bagos*, *Iyattukas*, and *Tingguians* is small, validating the statistical insignificance of the TRK test results.

Based on the annual rate of change indices, results show that between younger and middle-aged groups, knowledge in greater yam varieties is decreasing at 1-4% annually. Between the elderly and middle-aged groups, there is 0-2% decrease in knowledge.

SUMMARY, CONCLUSION AND RECOMMENDATION

Greater yam and its wild species are among the root crops that had once served as an important alternate staple food and nutrition for many of the world's poorest and undernourished households may eventually disappear because of changing lifestyles, diet and climate. Reference data are nil, hard to find, or may be non-existent. Hence, this study was conceived to inventory species/varieties of cultivated and wild yam and to determine traditional loss of knowledge on greater yam varieties of selected IPs in northern Philippines.

There were 77 indigenous varieties or species of yam known and grown by the *Ivatans*, *Ibalois*, *Bagos*, *Aetas*, *Isnags*, *Tingguians*, *Kalanguyas*, *Biga-Kalingas*, *Bugkalots*, *Buhid-Mangyans*, *Applai-Kankana-eyes*, *Iyattukas* and the *Kankana-eyes*. The *Ivatans* and *Ibalois* had named the most with 18 and 17 varieties, respectively. The *Bagos* who consider greater yams are the number one cash crop had nine varieties. The *Aetas*, *Isnags* and *Tingguians* cultivate three greater yam varieties purposely for food and for sale. The *Kalanguyas* named four varieties, and the *Kankana-ey* named only one variety, and both IPs prefer to grow short maturing (3-4 months) cash crops like pole snap beans. The two major groups, the *Kapampangans* and *Ilocanos* were not familiar with greater yam varieties. Sixteen wild species of yam were likewise named by the IPs since these have been used in times of calamities and are sold just like the *kamangeg* of the *Tingguians*.

Of the 77 known and grown varieties, 50 were commonly planted, 22 are few or less planted, one is endangered and four were already lost. The *Bagos* commonly plant the *Baloktot* or *Tuwiran* varieties because of its purple flesh; early maturity (6MAP) harvested by 'kapon method'; are high yielding; and tolerant to typhoon. These are, however, sensitive to bruising and mechanical damage and are also prone to physiological disorders like hollow heart that turns black when stored. Varieties *Baloktot* and *Tuwiran* originated from the *Ibalois* of Benguet.

These 77 varieties are further classified as to shape and flesh color, which indicate similarities among varieties but differently called. From among the eight round-shaped varieties, 5 are purple-fleshed, 3 white-fleshed and 2 aromatic; among the 12 cylindrical-shaped, 4 are purple and 7, white-fleshed; are flat-shaped like a palm of a hand; and 14 elongated either C-shaped or S-shaped. The *violet-round* of the *Bugkalots*, the *Tuwiran* of the *Ibalois* and the *Bataan* variety of the *Ivatans* are early maturing that can be harvested six

months after planting. Regular shape, flesh colour and texture are qualities preferred by processing industries. In addition to short maturity, farmers preferred big tubers, the characteristics commonly considered in variety research and development.

Based on the TRK test, knowledge about greater yam varieties and attributes was not affected by ethnicity, gender and educational attainment but were significantly different by age group, occupation and knowledge source. Along age, the elderly group scored the highest at 70%, followed by the middle-aged group at 58%, and the younger group at 41%, with the lowest score. The farmers had the highest TRK mean score of 72% and the students had the lowest TRK score of 40%. Vitality index scores, however, did not prove that younger generation have higher loss of TRK. In fact, a higher TRK index, meaning the retention of knowledge of greater yam varieties, was noted among the female younger group of the *Iyattukas* and the male middle age group of the *Bagos*.

The existence of greater yam variety diversity among the IPs could mean the availability of varieties that may answer the quality requirements of the different yam processing industry demands. Hence, there is an urgent need for R and D intervention to fast track the clean-up and mass propagation of the traditional varieties suitable for processing. This can be done through strengthened participation of farmers; improved traditional seed system; sustained availability of relatively clean seed tubers to ensure higher productivity; and continuous government support to explore the potentials of other cultivated and wild species for the nutraceuticals and food industry.

STUDY 5
TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON LESSER YAM
(*DIOSCOREA ESCULENTA*) AMONG INDIGENOUS PEOPLE
IN NORTHERN PHILIPPINES

G.S. Backian, B.T. Gayao, and D.T. Meldoz

ABSTRACT

Lesser yam (*Dioscorea esculenta*), popularly known as *tugui* is a perennial crop grown and cultivated to supplement human food and cash needs. Reference data on indigenous varieties is limited if not lacking. Hence, this documentation was undertaken utilizing secondary data, key informant interviews, and field observation to determine varieties known or cultivated and document the retention or loss of this traditional knowledge among the selected 13 IPs and two major ethnic groups in Northern Philippines.

The 13 selected IPs named 25 cultivated and four wild species, 12 of which were classified as plenty, 11 as few and two as rare or endangered. Most of the lesser yam varieties mature in eight months; six were classified sweet; and four with bitter taste. Wild lesser yam is only known among the *Aetas*, the *Kalingas*, the *Buhid-Mangyans* and the *Tingguians*, respectively called *Limeng*, *Atap-ontoy*, *Borot* and *Anayed* or *Boga*.

The *Bago* group had the highest traditional knowledge mean scores of 90% and the least was among the *Ibaloi* group with a score of 34%. There is not only retention but also an increase in traditional knowledge on lesser yam between the middle-aged (36-56 years) and the elderly groups (57-77 years) of male and female *Iyattukas*, and male *Tingguians*. There is a loss of knowledge on lesser yam between the younger (15-35 years) and middle-aged groups of male and female *Ibalois* and *Iyattukas*. The decrease in knowledge on lesser yam was 1-3 % annually between the younger and the middle-aged groups.

INTRODUCTION

One of the species of the genus *Dioscorea*, commonly used for human food, is *Dioscorea esculenta*, generally known as lesser yam. Among the IPs selected in this study, lesser yam is locally called *Lukto*, *Loktoh* or *Luktoh*, *Tugui* or *Tugtugi*, *Ontoy*, *Buwang*, *Balugan*, *Lufto*, *Dukay*, and *Pukupok*. Lesser yam is an important staple crop among the *Ivatans* of Batanes. It is a perennial crop grown, or harvested in the wild to supplement food and cash needs among other ethnoscapes.

Lesser yam is also known as Chinese yam, as it is mostly grown in Asia. It is among the most ancient species of *Dioscorea*. Today, it is widely distributed throughout the tropics, but is little used except in Southeast Asia where it ranks third in production and utilization after *D. rotundata*, *D. cayenesis* and *D. alata* (<http://www.nzdl.org/gsdllmod>).

Tugui is widely cultivated in Northern Philippines specifically in the Ilocos Region accounting for more than 50% of *tugui* production in the country (Legaspi and Malab, 2013).

It is a vine that seldom climbs to more than 3m, with thin stem, usually 1-3 mm in diameter, and vary from smooth to prickly. Vines twine clockwise (to the left) in climbing. Tubers produced are smaller than most other yams, usually borne in clusters and may produce 5-20 tubers per plant. The tubers are cooked and eaten as a source of carbohydrates and minerals. They may be boiled or baked, or fried as slices of chips and fries.

Literature on lesser yam in the Philippines is very limited and there is no available database on lesser yam varieties cultivated specifically by the IPs or indigenous peoples. Lesser yam is among the root and tuber crops (RTC) often grown on marginal soil with limited output and these RTC have contributed to food security and even employment generation among IPs especially in the countryside. The IPs is the small farmers that dominate the 35.1 % of the country's total agricultural workforce in the countryside (Dar, 2017).

There is a risk in the production and consumption of this lesser yam that may be due to challenges in agriculture brought about by changing physical and social environment. Hence, this study was undertaken to inventory lesser yam varieties known, grown, or cultivated and to determine retention or loss of traditional knowledge among the IPs selected in Northern Philippines.

METHODOLOGY

Research Process

Lesser 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' and likewise followed the same phases in conducting the study, namely: Phase 1- gathering of secondary data and partnering with local research individuals and organizations; Phase 2- the conduct of key informant workshops where focus group discussion; story-telling; cue cards; detailed interview guide; farm visits; community walk to take pictures; and observations; Phase 3- the tabulation, presentation and validation of data; Phase 4- the conduct of the traditional knowledge test; and Phase 5- writing up of the results (Gayao et al. 2013-14), which can be accessed at rootcrops-bsu@hostclink.net website followed by the integrated write-up per subject like this paper on lesser yam.

Selection of Respondents

Selection of sites and IPs/ ethnic groups was based on secondary data and the endorsement and willingness of collaborating agencies or partner researchers. Selected were 13 IPs: the *Aetas*, *Bagos*, *Biga-Kalingas*, *Bugkalots*, *Buhid-Mangyans*, *Ibalois*, *Isnegs*, *Ivatans*, *Iyattukas*, *Kalanguyas*, *Kankana-eyes*, *Applai-Kankana-eyes* and *Tingguians* with the addition of two majority ethnic groups, the *Kapampangans* and *Ilocanos*. Key informants were selected based on their experience and knowledge in root crop farming and utilization, though there are other walk-in locals who attended the workshop.

Secondary data on root crop growing areas, production and utilization statistics, and background of the IPs/ ethnic groups were gathered from regional, provincial and municipal

offices, the Bureau of Statistics (BAS) now Philippine Statistics Authority (PSA), the National Commission on Indigenous Peoples (NCIP) and the internet.

Key Informants

The indigenous knowledge and resources on lesser yam were gathered from 184 rootcrop farmers. There were 83 males (45%) and 101 females (54%) belonging to three age-groups: the 15-35 year-old (younger group), the 36-56 year-old (middle-aged group) and the 57-77 year-old (the elderly group). Incidentally, it was the middle-aged group (36-56 years) that comprised the majority (51.36%) of participants (Table 1).

Table 1. The age group and number of the selected IPs and majority ethnic groups

IP/ GROUP	SITE	MALE	FEMALE	AGE GROUP		
				15-35	36-56	57-77
<i>Aeta</i>	Villamaria in Porac, Pampanga, and Sta. Rosa in Sto. Nino, Bamban, Tarlac	18	12	10	16	4
<i>Bago</i>	Banga, Sugpon, Ilocos Sur, and Malikliko, Sudipen, La Union	8	3	0	11	0
<i>Biga-Kalinga</i>	Tanudan, Kalinga	1	13	5	7	2
<i>Bugkalot</i>	Tamuyan, Belance, Dupax del Norte, Nueva Viscaya.	9	3	0	9	3
<i>Buhid-Mangyan</i>	San Jose City, Occidental Mindoro	11	2	9	3	1
<i>Ibaloi</i>	Taloy Sur, Tuba, Benguet Province	1	2	0	3	0
<i>Isneg</i>	Talifugo, Conner, Apayao	2	13	0	3	12
<i>Ivatan</i>	Batanes Province	1	4	0	1	4
<i>Iyattuka</i>	Amduntog, AsipuloIfugao	0	4	0	1	3
<i>Kalanguya</i>	Tiblac, Ambaguio, Nueva Viscaya	8	24	8	17	7
<i>Benguet-Kankana-ey</i>	Sagpat, Kibungan, Benguet	3	7	0	6	4
<i>Applai-Kankana-ey</i>	Bauko Municipal Agriculture Office, Mountain province	0	5	0	1	4
<i>Tingguian</i>	Bucloc, Abra	3	7	0	5	5
<i>Kapampangan</i>	Porac, Pampanga	10	1	1	6	4
<i>Ilocano</i>	Paniqui, Tarlac	8	1	0	6	3
Total=184		83	101	33	95	56
%		45	55	18	52	30

Data Analysis

Narrative description of summarized data gathered in the first phase was done followed by encoding the aptitude test scores of traditional knowledge on lesser yam in EXCEL to facilitate the calculation of Traditional Rootcrop Knowledge (TRK) vitality

indices as adopted from Zent (2010; 2008) to determine the retention or loss of traditional knowledge. SPSS software was used for the analysis of variance (ANOVA).

DISCUSSION OF RESULTS

Cultivated and Wild Lesser Yam

Cultivated. Among the IPs, the *Ibalois* knew of seven varieties they had or once planted; the *Bagos* knew of four varieties, the *Biga-Kalingas*, *Isnegs*, *Ivatans*, *Iyattukas*, *Kalanguyas* and *Tingguians* grew two varieties each, and the *Buhid-Mangyans* and the *Bugkalots* cultivated only one variety. The *Benguet-Kankana-eyes* and the *Applai-Kankana-eyes* did not mention any lesser yam varieties grown.

The seven kinds of lesser yam grown and known by the *Ibalois* were among the 14 indigenous lesser yam collections from Taloy Sur, Tuba, Benguet, which were characterized and maintained by the Northern Philippines Root Crops Research and Training Center (Gayao, et al, 2015). These are the *Luspak* or *Dampiray*, *Ulsod*, *Mores*, *Semi-mores*, *Anajed*, *Bacvag* and *Shihet-Iloko* (Figure 1), which are smaller in tuber size as compared with the lesser yam varieties of the *Ivatans*, especially the *Ulong* variety that could weigh to two kilos or more per tuber (Figure 2), or the *Bagos* native variety, *Bayag tugtugui*.

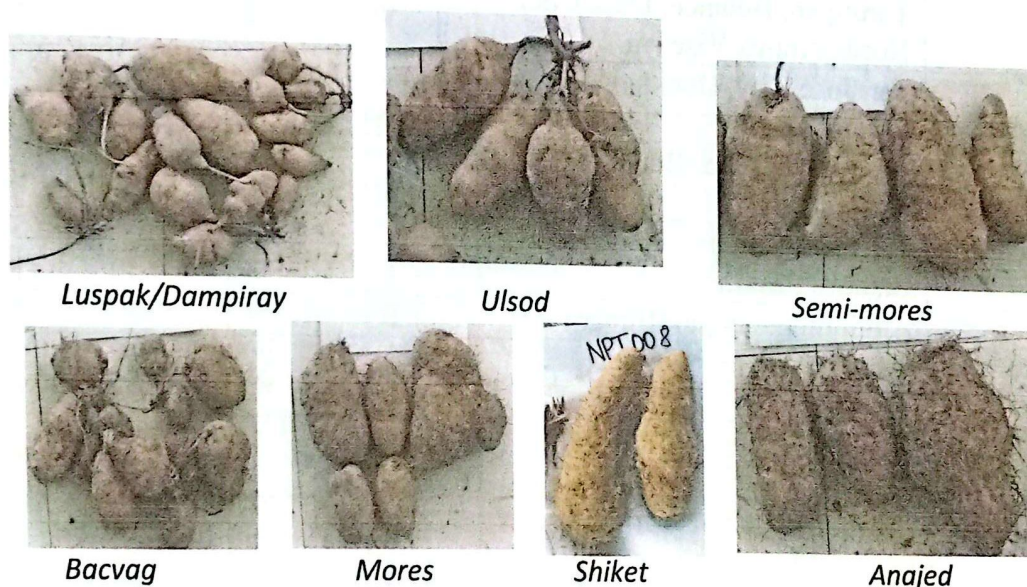


Fig. 1. Cultivated lesser yam varieties of the *Ibalois* in Tuba, Benguet

Wild. The *Aetas*, the *Kalingas*, the *Buhid-Mangyans* and the *Tingguians* knew the existence of wild lesser yam, respectively called *Limeng*, *Atap-ontoy*, *Borot* and *Anayed* or *Boga* (Table 2). The wild species are found in the forest and in undisturbed lands near the creeks and river banks. The *Limeng* of the *Aetas* was considered endangered as only few of these wild lesser yams is now found in the wild. The *Buhid-Mangyans* harvest only the *Borot* during period of *tigkiwiri* or lean months.

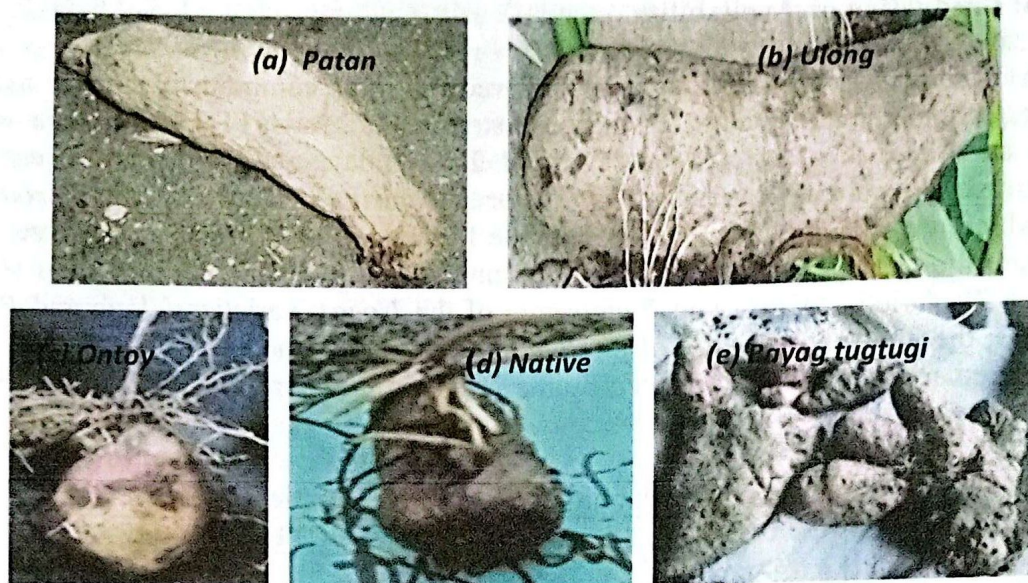


Fig. 2. Lesser yam of the *Ivatans* (a & b), *Biga-Kalingas* (c), *Isnegs* (d) and *Bagos* (e)

Table 2. Number and names of cultivated and wild lesser yam varieties identified by indigenous people in Northern Philippines

IP	NAME	NUMBER	VARIETY
A. Cultivated			
<i>Applai-Kankana-ey</i>	<i>Lokto</i>	-	-
<i>Bago</i>	<i>Tugtugi</i>	4	<i>Bayag, Biit, Native Tugtugi</i> <i>Unnamed</i>
<i>Benguet-Kankana-ey</i>	<i>Tugui</i>	-	-
<i>Biga-Kalinga</i>	<i>Ontoy</i>	2	<i>Ontoy1, Ontoy2</i>
<i>Bugkalot</i>	<i>Tugui</i>	1	<i>Unnamed/round type</i>
<i>Buhid-Mangyans</i>	<i>Buwang</i>	1	<i>Buwang</i>
<i>Ibaloi</i>	<i>Balugan</i>	7	<i>Luspak or Dampiray, Semi-mores, Ulsod, Anajed, Bacvag, Mores, Shihet-Iloko</i>
<i>Isneg</i>	<i>Lufto</i>	2	<i>Native, Pangasinan</i>
<i>Ivatan</i>	<i>Dukay</i>	2	<i>Ulong, Patan</i>
<i>Iyattuka</i>	<i>Luktoh/pukupuk</i>	2	<i>Luktoh 1, Luktoh 2</i>
<i>Kalanguya</i>	<i>Lokto</i>	2	<i>Native, Commercial</i>
<i>Tingguian</i>	<i>Tugui</i>	2	<i>Gawisan, Powegan</i>
B. Wild			
<i>Aeta</i>		1	<i>Limeng</i>
<i>Biga-Kalinga</i>		1	<i>Atap ontoy</i>
<i>Buhid-Mangyans</i>		1	<i>Borot</i>
<i>Tingguian</i>		1	<i>Anayed or Boga</i>

Extent of Production or Availability

Availability of the varieties was perceived either as common, plenty, or available; few, rare, or endangered. Of the 25 indigenous varieties grown (Table 3), there were 12 varieties classified as plenty, 11 as few, and 2 as endangered. Among the lesser yam classified as plenty are the varieties *Luspak* or *Dampiray*, *Semi-mores* and *Ulsod* of the *Ibalois* which are still grown by majority of the farmers and are preferred because of their sweet taste; the variety *Biit* of the *Bagos*; two unnamed varieties of the *Kalingas* (*Ontoy 1* and *Ontoy 2*); varieties *Native* and *Pangasinan* of the *Isnegs*; varieties *Ulong* and *Patan* of the *Ivatans*; the unnamed varieties of the *Iyattukas* (*Luktoh 1* and *Luktoh 2*); and the *Biit* as the only one variety commonly planted by the *Bagos* in Sudipen, La Union and in Sugpon, Ilocos Sur.

Table 3. Extent of production or availability of lesser yam varieties

IPs	VARIETY	PRODUCTION/ AVAILABILITY*		
		Plenty	Few	Rare
<i>Bago</i>	<i>Bayag</i> ,		/	
	<i>Biit</i>	/		
	<i>Native Tugtugi</i>		/	
	Unnamed		/	
<i>Biga-Kalinga</i>	<i>Ontoy1</i>	/		
	<i>Ontoy2</i>	/		
<i>Bugkalot</i>	<i>Unnamed/round type</i>		/	
<i>Buhid-Mangyans</i>	<i>Buwang</i>		/	
<i>Ibaloi</i>	<i>Luspakor Dampiray</i>	/		
	<i>Semi-mores</i>	/		
	<i>Ulsod</i>	/		
	<i>Anajed</i>		/	
	<i>Bacvag</i>		/	
	<i>Mores</i>		/	
	<i>Shihet-Iloko</i>		/	
<i>Isneg</i>	<i>Native</i>	/		
	<i>Pangasinan</i>	/		
<i>Ivatan</i>	<i>Ulong</i>	/		
	<i>Patan</i>	/		
<i>Iyattuka</i>	<i>Luktoh 1</i>	/		
	<i>Luktoh 2</i>	/		
<i>Kalanguya</i>	<i>Native</i>			/
	<i>Commercial</i>			/
<i>Tingguian</i>	<i>Gawisan</i>		/	
	<i>Powegan</i>		/	
TOTAL	25	12	11	2

* *Plenty* – when grown by more farmers and can be made available during harvest period

Few – when grown by few farmers and may not be available during harvest period

Rare or endangered – grown before and rarely seen

Planted only by a few are the *Native Tugtugui*, the *Bayag* and one unnamed variety of the *Bagos*; one unnamed variety of the *Bugkalots*; *Buwang* of the *Buhid-Mangyans*; *Anajed*, *Bacvag*, *Mores*, and *Shihet-Iloko* of the *Ibalois*; and *Gawisan* and *Powegan* of the *Tingguians*. According to one *Ibaloi* informant, the *Bacvag* variety is suitable for production in warmer areas otherwise small tubers called *diteng* are produced if planted in cooler areas. The *Kalanguyas* claimed that their introduced *native* and *commercial* lesser yam varieties are endangered.

Variety Description

Maturity, eating quality and yield are considered by farmers in deciding whether to continuously plant and conserve the lesser yam. The common attributes of lesser yam the IPs mentioned were maturity, presence of spines in the vines, tuber shape, and taste. Maturity varied from six to 12 months and the presence of spines is described as sparse and dense. The described shapes include round, oval-oblong, elongated and irregular. The taste of the tubers is either sweet or bitter described to be in the second skin. Other attributes include direction of tuber growth (upward and sideward) and presence of hair or smoothness of the tuber.

The *Native tugtugi* of the *Bagos* is tolerant to environmental stress like typhoon but has small tubers; the *Bayag* introduced to the *Bagos* from Nueva Vizcaya produce big tubers branching in the middle but the vine stem is spiny; the *Biit* that matures at 5-6 months is considered short maturing but produce smaller tubers; and the unknown variety similar to *Bayag* with upward and sideward tuber formation termed is called *agpogit*.

The *Ivatans' Ulong* and *Patan* varieties are also claimed as suitable substitute of macaroni in the preparation of salad. *Ivatans* lesser yam is high yielding and produce 15 kg/hill in 9 months. The unnamed lesser yam variety of the *Benguet-Kankana-eyes* matures in 10 months after planting (MAP). The *Buwang* variety cultivated by the *Buhid-Mangyans* yields 5kg/hill, has a sweet taste, and sometimes considered wild since it is hardly taken-care of. The *Gawisan* and *Powegan* varieties of the *Tingguians* mature in eight months. One *Biga-Kalinga* lesser yam variety (*Ontoy 1*) is characterized as having spreading tuber growth, with bitter outer skin, high yielding and round to oblong shape tubers. The other variety, *Ontoy 2*, is deep rooted, sweet, and produces bigger tubers.

The *Bugkalots' tugui* has hairy tubers and matures at six MAP. The *Iyattukas'* two varieties are the branching type and the non-branching type. The *Native* variety of the *Kalanguyas* has small round tubers similar to potato tubers and the *Commercial* variety has elongated tubers with thorny skin.

Table 4. Description and other attributes of indigenous lesser yam varieties

NAME	IP	MATURITY (months)	TASTE	YIELD & SIZE	SHAPE	OTHER TRAIT
<i>Biit</i>	<i>Bago</i>	1		Small		Light weight
<i>Unknown</i>	<i>Bugkalot</i>	1			1	Hairy tubers
<i>Gawisan</i>	<i>Tingguian</i>	3			1	
<i>Native</i>	<i>Isneg</i>	3	3		1	Smooth skin Upward tuber growth
Unnamed	<i>Bago</i>	3			6	Upwards/ sideward tuber formation
<i>Powegan</i>	<i>Tingguian</i>	3		Big	7	
<i>Ulong</i>	<i>Ivatan</i>	3		Big 15kg/hill	7	Smooth skin
<i>Patan</i>	<i>Ivatan</i>	3		Big tubers	7	Cracked skin
<i>Pangasinan</i>	<i>Isneg</i>	3	1		7	Hairy/thorny tuber Downward tuber growth
<i>Ontoy2</i>	<i>Biga-Kalinga</i>		1	Big	7	
<i>Luspak or Dampiray</i>	<i>Ibaloi</i>		1			Short stolon
<i>Buwang</i>	<i>Buhid-Mangyan</i>		1	5kg/hill		Wild type
<i>Ulsod</i>	<i>Ibaloi</i>		1	Many small tubers	7	Thick skin but cooks easily No spines,
<i>Bacvag</i>	<i>Ibaloi</i>		1	Clustered		Hairy tubers Slightly bitter Preferably planted in warmer areas
<i>Bayag,</i>	<i>Bago</i>	3	3	Large	6	Spiny
<i>Shihet-Iloko</i>	<i>Ibaloi</i>		3			Long spines that is difficult to rot Suitably to warm areas
<i>Ontoy1</i>	<i>Biga-Kalinga</i>		3	Big	3	
<i>Semi-mores</i>	<i>Ibaloi</i>		3			With bitter second skin
<i>Native Tugtugi</i>	<i>Bago</i>			Small tubers		Spiny High tolerance to stress
<i>Anajed</i>	<i>Ibaloi</i>			Big tubers		Easy to multiply Yields many runners
<i>Mores</i>	<i>Ibaloi</i>			3-4 big		With long spines

				tubers/ hill		Bitter or if not skinned Original variety (best)
Luktoh 1	Iyattuka					Produces many tuberlets
Luktoh 2	Iyattuka					Without tuberlets
Native	Kalanguya			Small tubers	1	
Commercial	Kalanguya				7	Thorny

Legend:

Maturity

1-Up to 6 months

2-7 months

3-Greater or equal to 8 months

Taste

1-Sweet

2-Not sweet

3-Bitter

Shape

1- Round

2-Oval

3-Oval-oblong

4-Cylindrical

5-Flattened (palm-hand-shape)

6-Irregular

7-Elongated

Traditional Rootcrop Knowledge (TRK)

The TRK scores on lesser yam varieties were affected by ethnicity. The *Bago* group knew 90%, followed by the *Tingguians*, *Iyattukas* and the *Ibalois* at 83, 54 and 34%, respectively (Table 5).

The TRK scores among age groups and between genders are not statistically different. As validated, the elderly group knew more (70%) of the different kinds of lesser yam. TRK scores in males are higher (68%) compared to the females (63%). The male *Tingguians*, *Iyattukas* and *Bagos* are the ones engaged mostly in farming activities while some of the female household members are engaged in off-farm activities or employed overseas.

Table 5. Traditional root crop knowledge scores on lesser yam according to IP groups, age groups and sex of indigenous people in Northern Philippines

GROUP	VARIABLE	TRK MEAN SCORES (%)	F-value	Sig	Eta
IP	<i>Ibaloi</i>	34	14.918	0.00**	0.529
	<i>Bago</i>	90			
	<i>Tingguian</i>	83			
	<i>Iyattuka</i>	54			
Age (years)	15-35	57	2.185	0.092	0.202
	36-56	58			
	57-77	70			
Sex	Male	68	1.435	0.241	0.134
	Female	63			

**highly significant

Differences in TRK mean scores by source of knowledge and occupation are significant at 1 and 5% level (Table 6). Indigenous knowledge (IK) on lesser yam is mostly acquired from kin, relatives and friends (66%), and when amplified by media, TRK mean scores increased to 86%. IK is never learned formally i.e. from school, church and extension

services of agencies/ organizations. Kin, relatives, friends and media are considered immediate environment that plays a significant role in influencing people's attitudes and behaviour. The students who have greater access to information from kin and media, followed by the farmer, the stay-home household members in the village and the elderly are more knowledgeable on lesser yam than the employees or businessmen/women.

TRK scores is not influenced by educational attainment though those who have not attended any formal schooling are more knowledgeable on lesser yam since they are the ones engaged in farming or stay home in the village.

Table 6. Traditional root crop knowledge scores on lesser yam according to source of knowledge, occupation and educational attainment

VARIABLE	DESCRIPTION	TRK Mean Scores (%)	F-value	Sig	Eta
Source of IK	1- Kin Relative Friend	66	3.654	0.002**	0.356
	2- School Church Extension Services	0			
	3- Media (print, radio, TV)	50			
	1,2 and 3	76			
	1 and 2	45			
	1 and 3	86			
Occupation	Stay home	69	2.32	0.035*	0.290
	Farmer	71			
	Employee	46			
	Student	76			
	Businessman/woman	33			
	Others (pensioners)	67			
Educational attainment	No formal education	75	0.394	0.813	0.100
	Elementary	62			
	High school	50			
	Technical/Vocational	57			
	College/ University	43			

**highly significant

*significant at 5%

Retention or Loss of TRK

The computed vitality indices as shown in Table 7 invalidated the assumption that the elderly group of 57-77 years knew more than the middle-aged group (36-56 years). There is not only retention but also an increase in intergenerational rate of retention (RG) and cumulative retention rate (RC) in both the middle age group male and female *Iyattukas*, and *Tingguians* with a vitality index of greater than one. Most of the middle-aged are the ones doing the farming activities or sourcing out food. Between the middle-aged and the younger

group (15-35 years), there is loss of knowledge, which may be due to their less involvement in farming activities because they are in school or employed in non-agriculture jobs.

The annual rate of change indicates that there was a 1-3 percentage decrease on lesser yam knowledge between the middle-aged and the younger group. This percentage shows the importance of vertical transmission of knowledge from the older generation to the young generation. However, in the case of the middle-aged group and the elderly group, there is an increase in knowledge at 1-2 % annually, an indication of a horizontal transmission of knowledge from external sources like government extension services and the mass media.

Table 7. Vitality indices of traditional rootcrop knowledge on lesser yam among the selected IPs in Northern Philippines

AGE	IP	RG		RC		CA	
		Male	Female	Male	Female	Male	Female
15-35	<i>Ibaloi</i>	0.88	0.83	1.08	0.76	0.01	-0.02
	<i>Bago</i>	1.14	0.81	1.00	0.86		-0.01
	<i>Iyattuka</i>	0.20	0.56	0.67	0.82	-0.03	-0.02
	<i>Tinguian</i>	1.00	0.96	1.19	1.08	0.02	0.01
36-56	<i>Ibaloi</i>	1.34	0.64	1.14	0.83	0.01	-0.01
	<i>Bago</i>	0.88	0.88	0.95	0.95		
	<i>Iyattuka</i>	2.00	1.11	1.35	1.05	0.02	0.00
	<i>Tinguian</i>	1.00	0.96	1.19	1.08	0.02	0.01
57-77	<i>Ibaloi</i>	1.00	1.00	1.00	1.00		
	<i>Bago</i>	1.00	1.00	1.00	1.00		
	<i>Iyattuka</i>	1.00	1.00	1.00	1.00		
	<i>Tinguian</i>	1.00	1.00	1.00	1.00		

CONCLUSION AND RECOMMENDATION

Conclusions

This study documented traditional varieties of lesser yam (*Dioscorea esculenta*) currently planted or already lost among indigenous people in Northern Philippines. Exchange of information during the key informants workshop made easier the naming of lesser yam varieties locally called *Lukto*, *Loktoh*, *Luktoh*, *Tugui*, *Tugtugi*, *Ontoy*, *Buwang*, *Balugan*, *Lufto*, *Dukay* or *Pukupuk*.

Except for the *Kankana-ey* IPs in Benguet and Mountain Province, the IPs named and cultivated 25 lesser yams. Twelve of these cultivated varieties were classified as plenty, 11 as few and two as rare or endangered. The wild lesser yam known only among the *Aetas*, *Kalingas*, *Buhid-Mangyans*, and *Tinguians* are called *Limeng*, *Atap-ontoy*, *Borot* and *Anayed* or *Boga*, respectively.

The IPs identified lesser yam varieties which are short maturing and/or tolerant to environmental stress like typhoons and drought, and varieties which tastes sweet or used for specific purpose.

The transfer of knowledge is not entirely influenced by age as the middle-aged group is even more knowledgeable than the elderly group which shows the importance of horizontal transmission of knowledge.

Recommendation

This baseline information on lesser yam must be disseminated as wide as possible to improve R&D initiatives.

STUDY 6
TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER
ON SWEETPOTATO (*IPOMOEA BATATAS*) AMONG INDIGENOUS PEOPLE
AND MAJORITY ETHNOLINGUISTIC GROUP IN NORTHERN PHILIPPINES

D.T. Meldoz, B.T. Gayao, and G.S. Backian

ABSTRACT

Sweetpotato (*Ipomoea batatas*) is a traditional crop that has a big role in the food system and the overall culture of minority ethnoscapes in Northern Philippines. Sweetpotato varieties have been planted for several generations of families and in varying landscapes. This study documented the varieties grown and determined the retention or loss of knowledge on said varieties. Documents review, key informant workshops, field visits, and conduct of the aptitude test on traditional knowledge of local sweetpotato varieties were done.

A total of 179 locally-named sweetpotato varieties were documented during this 2012-2013 survey. More of these varieties are in addition to the 210 varieties previously documented from 1989 to 2002. Of the 179 recently documented varieties, 99 are native or traditional varieties and 80 are introduced varieties. Further, 94 sweetpotato varieties were assessed as commonly grown, 63 as endangered, and 22 as lost varieties.

Leaf shape and color, root skin and flesh color, taste and texture, maturity, yield potential, and use were the distinguishing characteristics mentioned by the 13 IPs and two majority ethnolinguistic groups. Leaf shape is described as lobed or non-lobed. Leaf color is green (60 varieties) and green with purple tips (34 varieties). Predominant root skin color is red and white with 44 and 301 varieties, respectively. Predominant flesh color is white (73 varieties) followed by purple (30), yellow (29) and cream (14). There were 49 varieties with sweet flavor, eight having mealy texture, two with soft texture, and two varieties with mealy texture but bland taste. There were 32 short maturing and 72 long maturing varieties. Twenty-four out of the 179 locally-named varieties were considered high yielding but only 18 were identified as market preferred, four preferred for home consumption, five suitably ideal for vegetable-tips, and three as source of herbage for animal feeds. Seven varieties were identified good for processing into dried chips, flour, wine, candies, and native delicacies like *camote cue*, *halaya* and *guinataan*. One sweetpotato variety (*Alla-at*) was claimed suitable for juicing.

Between the younger (15-35 years) and the middle-aged (36-56 years) groups, there is an erosion or loss of indigenous knowledge on sweetpotato varieties specifically among *Masadiit-Tingguians* and female *Ibalois*, *Bagos* and *Iyattukas*. Between the elderly (57-77 years) and middle-aged group, there is retention of indigenous knowledge specifically among the male *Ibalois*, *Bago*, and *Iyattukas*.

INTRODUCTION

Sweetpotato (*Ipomoea batatas*) is known differently to different IPs. It is *ubbi* to *Kalanguyas*; *bella* to *Bugkalots*; *tugui* or *palay* to *Bagos*; *kamote* to *Kapampangans* and *Ilocanos*; *kamoteng gapang* to *Aetas*; *baynaw* to *Buhid-Mangyans*; *wakay* to *Ivatans*, *gaselang* to *Biga-Kalingas*; *katila* to *Masadiit-Tingguians*; *dokto* to *Ibalois*, *lokto* to *Kankana-eyes*; *kantila* to *Isnogs*; *ubih* to *Iyattukas*; and *tugi* or *ubi* to *Applai-Kankana-eyes*. To the *Ivatan*, *Kalanguya*, and *Applai-Kankana-ey* farmers, sweetpotato ranks number one among the root crops grown (Gayao, Meldoz and Backian, 2013-2014).

Among the IPs, sweetpotato is the first alternate crop to rice staple because the crop can be primed and maintained up to three years. In addition, sweetpotato have multiple uses. Every household has this crop in his/her farmlot as supplemental food of the family. The storage roots are used as food, source of cash, and for gifts and barter goods. The young shoots are used as vegetable dish prepared in several recipes. Storage roots and vines are also used as animal feeds. Recently, the storage roots and young shoots are processed into veggie noodles, breads, cookies, and other product lines. It is then a crop that emerged from a low status traditional food crop among *Aetas* and *Mangyans*; a feed crop among *Applai-Kankana-eyes*; an important ceremonial rootcrop to the *Iyattukas*' *uy-uy* tradition; and a cash crop among the *Kalanguya*, *Ilocano* and *Kapampangan* farmers.

Varied information on the diverse uses and specific attributes of sweetpotatoes were documented starting in 1983 where the Northern Philippines Root Crops Research and Training Center-Benguet State University had initially collected 20 sweetpotato germplasm. Then from 1988-1990, the center was able to collect 885 sweetpotato germplasm from different sources in Benguet, Philippine Root Crop Research and Training Center-Visayas State College of Agriculture, Mountain Province, Nueva Vizcaya, Ifugao, Bureau of Plant Industry-EG/AVRDC, and from the International Potato Center (Baucas, et.al.1990).

The present changing livelihood and dietary patterns however, are changing the landscape of sweetpotato production and utilization. Anent to this is the change in varieties, the genetic erosion and depletion of traditional varieties. The availability of staple rice and preference of younger generation for rice and fast foods also decreased the demand for sweetpotato. This study therefore aims to document and inventory sweetpotato varieties commonly grown or known; identified traditional varieties that are endangered or already lost; determined retention or erosion of knowledge on these varieties.

METHODOLOGY

Sites and Key Informant

Selection of study sites (Figure 1) was based on secondary information that identified rootcrops growing areas of selected IPs and majority ethnolinguistic groups in Northern Philippines and validated by local government units (LGUs), collaborating institutions, and researchers.



Fig.1. Map of the Philippines showing the location of the study sites

The 13 indigenous peoples selected for the study consist of *Ibalois*, *Bagos*, *Aetas*, *Ivatans*, *Isnags*, *Buhid-Mangyans*, *Biga-Kalingas*, *Bugkalots*, *Kalanguyas*, *Masadiit-Tingguians*, *Iyattukas*, *Kankana-eyes*, *Applai-Kankana-eyes* with the *Kapampangans* and *Ilocanos* as major ethnolinguistic group (Table 1).

Table 1. Key informants interviewed in Northern Philippines, 2012-2013

	IP GROUP	STUDY SITE	KEY INFORMANT (#)
1	<i>Ibalois</i>	Tuba, Benguet	3
2	<i>Bagos</i>	Sugpon, Ilocos Sur	8
		Sudipen, La Union	3
3	<i>Aetas</i>	Porac, Pampanga	15
		Bamban, Tarlac	16
4	<i>Ivatans</i>	Basco, Batanes	4
5	<i>Isnags</i>	Conner, Apayao	15
6	<i>Buhid-Mangyans</i>	San Jose, Occidental Mindoro	13
7	<i>Biga-Kalingas</i>	Tanudan, Kalinga	14
8	<i>Bugkalots</i>	Belance, Nueva Vizcaya	12
9	<i>Kalanguyas</i>	Ambaguio, Nueva Vizcaya	32
10	<i>Masadiit-Tingguians</i>	Bucloc, Abra	10
11	<i>Iyattukas</i>	Asipulo, Ifugao	4
12	<i>Kankana-eyes</i>	Sagpat, Kibungan, Benguet	10
13	<i>Applai-Kankana-eyes</i>	Bauko, Mountain Province	5
14	<i>Kapampangans</i>	Porac, Pampanga & Capas, Tarlac	12
15	<i>Ilocanos</i>	Paniqui, Tarlac	8
	TOTAL		184

Tools/Techniques Employed

A combination of participatory data gathering approaches was employed. Phase I is gathering of production statistics on roots and tubers and background information IPs from published and unpublished literatures, records of provincial and municipal government offices, National Statistics Office (NSO), Bureau of Agricultural Statistics (BAS), and the National Commission on Indigenous Peoples (NCIP) as a basis for site and IP selection, and collaborating agencies or researchers. Phase II is key informant workshop where the project rationale and objectives were explained and data gathering tools such as detailed interview guide, story-telling, use of pictures, and cue cards were utilized. Phase III is field visits and community walk done after the workshop to verify information, record observations and take photos. Phase IV is the conduct of the aptitude test using a questionnaire on traditional knowledge of local sweetpotato varieties.

Analysis and Write-up

Descriptive statistics using the Excel and SPSS Softwares and the calculation of vitality indices (Zent, 2010) were used to summarize and analyze data gathered. Narrative description, photos or illustrations gave detailed information of the sweetpotato varieties.

List of local or traditional sweetpotato varieties collected during the field work (2012-2013) were enhanced with the comparison and addition of traditional variety names documented in previous researches (1989-2002), specifically among the *Kankana-eyes* in Kapangan, Benguet, the *Ibalois* in Tuba and Sablan, Benguet, the *Applai-Kankana-eyes* in Sagada, Mountain Province, and the *Ilocanos* in Aringay, La Union (Ganga, Anselmo and Baucas, 1989; Bayogan, Salda and Gonzales, 1989; Solimen, Gayao and Prain, 1996; Sim and Meldoz, 2002; and others).

RESULTS AND DISCUSSION

Inventory of Locally-Named Sweetpotato Varieties

In this 2012-2013 research, a total of 179 sweetpotato locally-named varieties were identified by the selected indigenous people and majority ethnolinguistic group in Northern Philippines. More of these varieties were in addition to the previously identified 210 locally-named varieties mentioned in published and unpublished literatures from 1989 to 2002 surveys (Table 2) and the thirty-two sweetpotato varieties approved by the Philippine National Seed Industry Council and Philippine Seed Board which are recommended for local production. This large number of local sweetpotato varieties is just a small portion as compared to the 5,526 cultivated *Ipomoea batatas* accessions from 57 countries maintained at the International Potato Center genebank (Zhang, et al., 2000). Asia is the world's largest sweetpotato producing region with China producing 90%, and where sweetpotato ranks fifth as the most important food crop on a fresh weight basis after rice, wheat, corn and cassava (CIP as cited by Veasey, et al., 2008).

Out of the 179 varieties, the *Kalanguya* farmers in Ambaguio, Nueva Vizcaya had named the highest number (33) of varieties known and grown. The Municipality of Ambaguio is among the top producing municipality in the Province of Nueva Vizcaya with 467.58 hectares planted to sweetpotato. The *Ivatans* in Batanes was second with 21 sweetpotato varieties grown for household consumption followed by the *Bago* farmers in Sudipen and Sugpon with 20 varieties. The *Mangyans* in Mindoro named the least (3) number of varieties grown. The *Mangyans* are shy people that they depend on their own resources rather than seek the help of outsiders, liking sourcing out new varieties of sweetpotato from the local agriculture units.

Table 2. Inventory of sweetpotato varieties named by IPs and majority ethnic group in Northern Philippines

	IP/ ETHNIC GROUP	LOCAL NAME	KNOWN VARIETIES (#)		CLASSIFICATION	
			(1980's- 2002)*	2012- 2013	Native	Introduced
1	<i>Aeta</i>	<i>Kamoteng Gapang</i>	-	8	5	3
2	<i>Applai-Kankana-ey</i>	<i>Tugi or Ubi</i>	33	13	8	5
3	<i>Applai/Ibaloi/Kankana-ey</i>		1	-	-	-
4	<i>Ayangan</i>	<i>Kamote</i>	7	-	-	-
5	<i>Bago</i>	<i>Tugui or Palay</i>	-	20	14	6
6	<i>Ibontoc-Ibayyo</i>	<i>Tugi</i>	21	-	-	-
7	<i>Biga-Kalinga</i>	<i>Gaselang</i>	-	11	3	8
8	<i>Bugkalot</i>	<i>Bella</i>	-	7	5	2
9	<i>Buhid-Mangyan</i>	<i>Baynaw</i>	31	3	2	1
10	<i>Ibaloi</i>	<i>Dokto</i>	42	13	7	6
11	<i>Ibaloi/Kankana-ey/Ibontoc-Ibayyo</i>		2	-	-	-
12	<i>Ibaloi/Kankana-ey</i>		6	-	-	-
13	<i>Ibaloi/Kankana-ey/Ilocano</i>		1	-	-	-
14	<i>Ilocano</i>	<i>Kamote</i>	14	-	-	-
15	<i>Ilocano/Kapampangan</i>	<i>Kamote</i>	-	12	2	10
16	<i>Isneg</i>	<i>Kantila</i>	-	5	3	2
17	<i>Ivatan</i>	<i>Wakay</i>	-	21	2	19
18	<i>Iyattuka</i>	<i>Ubih</i>	-	12	9	3
19	<i>Kalanguya</i>	<i>Ubbi</i>	-	33	29	4
20	<i>Kankana-ey</i>	<i>Lokto</i>	51	14	6	8
21	<i>Kankana-ey/ Ibontoc-Ibayyo</i>		1	-	-	-
22	<i>Masadiit-Tingguian</i>	<i>Katila</i>	-	7	4	3
	Total		210	179	99	80

*Based on published and unpublished studies/researches

The locally-named varieties are further classified as traditional or native and introduced varieties (Figures 2 and 3). The 99 traditional or native varieties are maintained by farmers and their forefathers, while the 80 introduced varieties are brought in from outside

the IP domain. Said varieties are sometimes named after the source of planting material, either the place of origin or the person who introduced the varieties. Thus, there is a high probability that there are duplicates in the locally-named varieties.

No longer mentioned or validated in this 2012-2013 research are the top local varieties recommended for their stable and high yielding potential in highland farming: namely, *Dampitok*, *Monglo*, *Kanga*, and *Pacac* (NPRCRTC Highland Sweetpotato Philippines Project, 1991), one variety recommended by growers- *Bokagan* or *Kilang*. Not also mentioned are the 114 varieties (Table 3) documented previously from the *Ibaloi* and *Kankana-ey*s in Benguet, *Applai-Kankana-ey*s and other tribes in Mountain Province, *Ayangans* in Ifugao, and *Ilocanos* in La Union (Gayao, Sano and Wallace, 1987; Bayogan, Sagudan and Baban, 1990; Mula, 1990; Highland Sweet Potato: Final Report, 1991; Balaki and Solimen, 1991; Ganga and Posa, 1996; Gayao and Sim, 1997; Solimen and Gayao, 1998; Gonzales, et. al, 1999; and Sim and Meldoz, 2002). There is high probability that these varieties were renamed just like the locally-named 'Tagalog' or 'Tokian' variety which was renamed as *Bengueta* when officially approved for national release by the National Seed Industry Council in 2003; or are already lost just like the 31 varieties of the Mangyans documented by Conklin (1954) as cited by Padilla (1994).

Table 3. Locally-named sweetpotato varieties mentioned in studies conducted from 1990-2002

IP/ ETHNIC GROUP	REFERENCE	VARIETY	#
<i>Ibaloi, kankana-ey and Ibayyo</i>	Bayogan, Sagudan and Baban, 1990	<i>40, 50, Akguangan, Alno, Baro/Balo, Batallan, Binallig, Binnawe, Bodat, Bukag/Bukkagan/Tukkag/Bokagan (Kilang), Botagan, Cordon, Dampitok/Lampitokan/Lapintukan, Gumangab/Gumanab/Ginumanab, Landing, Lapinsayan, Lepanto, Makaligong, Mestisa, Nursery, Patoki, Singayan, Tafikang, Tinakian, Tokangan, Zambales</i>	26
<i>Applai-Kankana-ey</i>	Bayogan, Sagudan and Baban, 1990; Solimen and Gayao, 1998	<i>Binakangan, Guinina-ang, Inambiong, Inanupan/Kamulitilit/ U-uway/Kalawitan, Minadli/Siniti, Kamumoy, Kinagayan, Latbang, Linaungan, Putnayan/Madam-et, Tinamulong, Tinumbaga, Yabyabba/Lapsay/ Dinata/ Sinabangan</i>	13
<i>Ayangnan</i>	Balaki and Solimen, 1991	<i>Anhyo, Benguet, Hal-longo, Honghongtot, Hobo-ob, Tinoc</i>	6
<i>Ibayyo, Ibontok</i>	Bayogan, Sagudan & Baban, 1990; Ganga & Posa, 1996; Gayao and Sim, 1997	<i>Abbaw/Abfao, Agubangbang, Akkong, Ingitangit, Pusnayan, Tukkong, Hinaplid, Linabaga, Linoncia, Minarcid, Tukong</i>	11
<i>Ibaloi</i>	Bayogan, Sagudan & Baban, 1990; Solimen and Gayao, 1998 Highland Sweet Potato: Final Report, 1991	<i>Bakwag, Bayabas, Boundary, Cagayan, Cordaro, Dalsa-ac, Damayan, Hostess, Kalsan, Kutibeb, Monglo, Oknay, Pagsay, Pangkayan, Puti-an, Solsogon, Tamulong, Teng-eg, Inmeklog</i>	19
<i>Ilocano</i>	Solimen and Gayao, 1998; Sim and Meldoz, 2002	<i>Biscuit, Bokagan, Gimmatas, Immiklog, Mestisa, Negro/Negro Orig, Peke Negro, Purao</i>	8
<i>Kankana-ey</i>	Bayogan, Sagudan and Baban, 1990; Mula, 1990; Ganga and Posa, 1996; Solimen and Gayao, 1998; Gonzales, et. al, 1999	<i>Atok, Balbalanga, Balingway, Bayokbok, Bungis, Camp 4, Comiles, Dakol, Danggi-an, Dangla, Gaesan/ Gang-esang, Gatipungan, Gayabangan, Gopongan, Iligey, Ingles, Kangaw/ Kangao, Kibungan, Lingayen, Makaligong/ Kaligong, Mangmangili, Mindanao, Pinto-oc, Ponti, Sabol, Sanaay, Sola, Sto. Tomas/Tomas, Tadpook/ Balloling, Tilitilan, Tres Flores</i>	31
		TOTAL	114



Fig. 2. Some of the traditional sweetpotato varieties of the IPs

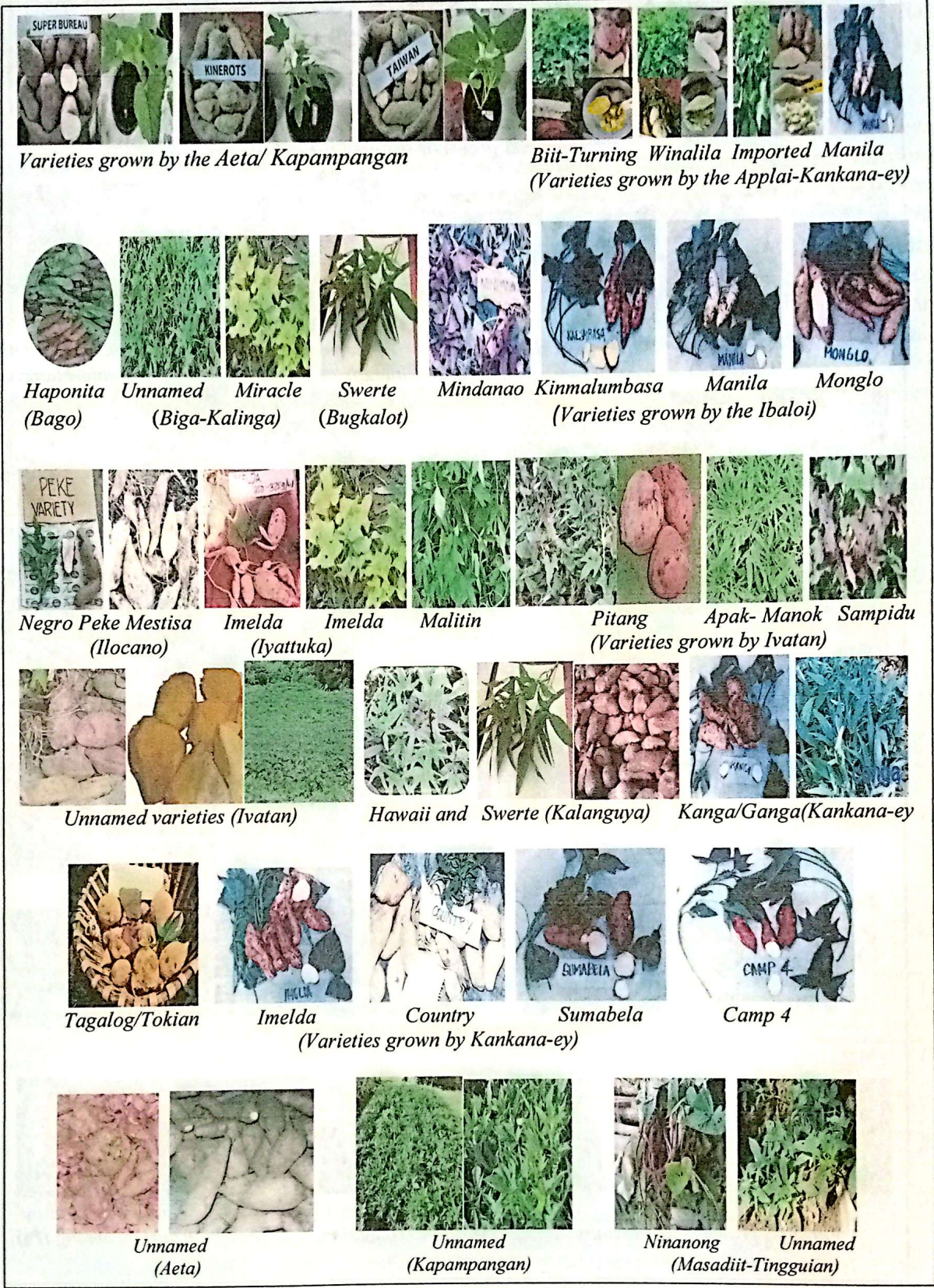


Fig. 3. Some of the introduced sweetpotato varieties as claimed by the IPs

Extent of Cultivation

Based on the key informant's assessment, the extent of cultivation and availability were grouped into three categories, namely: 94 sweetpotato varieties assessed as abundant, common or widely grown by most farmers in the locality; 63 varieties are endangered, few or rarely planted by farmers; and 22 varieties are lost or no longer exist in the locality (Table 4).

Table 4. Extent of cultivation and availability of the 179 sweetpotato varieties named in Northern Philippines

IP/ ETHNIC GROUP	VARIETY CATEGORY		
	Common/ Widely- Grown* (#)	Endangered/ Rare ** (#)	Lost*** (#)
<i>Aeta</i>	8	0	0
<i>Applai-Kankana-ey</i>	8	4	1
<i>Bago</i>	7	10	2
<i>Biga-Kalinga</i>	10	0	1
<i>Bugkalot</i>	2	1	4
<i>Buhid-Mangyan</i>	3	0	0
<i>Ibaloi</i>	2	9	2
<i>Ilocano/Kapampangan</i>	5	3	5
<i>Isneg</i>	5	0	0
<i>Ivatan</i>	19	1	1
<i>Iyattuka</i>	11	0	1
<i>Kalanguya</i>	5	28	0
<i>Kankana-ey</i>	5	6	3
<i>Masadiit-Tingguian</i>	4	1	2
Total = 179	94	63	22

*Abundant and widely grown by most farmers in the locality

**Few and rarely planted by farmers

*** Lost which means it no longer exist in the locality

The *Ivatans* of Batanes had the highest number of widely grown varieties (19) followed by the *Iyattukas* (11), *Biga-Kalingas* (10), *Aetas* and *Applai-Kankana-eyes* (8), *Bagos* (7), *Ilocanos*, *Kalanguyas*, *Kankana-eyes* and *Isnegs* (5), *Masadiit-Tingguians* (4) and the *Buhid-Mangyans* (3) had the least number grown.

The *Kalanguyas* in Nueva Vizcaya had most (28) varieties assessed as rare, probably due to the shift of planting other cash crops in their swidden farm and gardens; followed by the *Bagos* (10), *Ibalois* (9), *Kankana-eyes* (6), *Applai-Kankana-eyes* (4), *Kapampangan* and *Ilocanos* (3), and the *Bugkalots*, *Ivatans* and *Masadiit-Tingguians* (1 each).

Of the 22 lost varieties, the *Kapampangan* farmers had the highest number of lost varieties (5) followed by the *Bugkalot* (4), *Kankana-ey* (3), two varieties each from the *Bago*, *Ibaloi* and *Masadiit-Tingguian* farmers and one each variety from the *Applai-Kankanaey*, *Biga-Kalinga*, *Ivatan*, and the *Iyattuka*. The *Isneg* farmers claimed that their varieties are in no danger of getting lost since these varieties have a tendency to re-grow in fallowed farms. The fewer number of varieties getting lost only shows the adaptability of sweetpotato to grow in adverse climatic conditions even in typhoon prone areas of the

Ivatans. Informants mentioned that varieties becoming rare or lost is because they are replaced due to low yield, low market demand, physiological disorders (such as growth cracks, black discoloration in skin), lack of planting materials, poor eating quality (wet and bland taste), and long maturity. Main biological causes of biodiversity are: the loss of habitats, in this study the reduction of swidden farms; the introduction of exotic species; over-harvesting; 'knock-on' effects like degenerated or diseased planting materials; homogenization in agriculture and forestry, for example only 1-2 varieties are planted widely in Central Luzon; and pollution and global environmental change (Gadgil, Berkes and Folke, 1993).

Description and Attributes

Sweetpotato varieties were distinguished and differentiated based on leaf shape and color, root skin and flesh color, taste and texture of cooked tuber, maturity, storage root yield, and market preference. The characteristics as described by the informants even with similarly-named varieties sometimes vary because of differences in soil and elevation. However, not all description and attributes of the locally-named varieties were mentioned.

Leaf shape. Leaf shape is described either as lobed or non-lobed. The lobed leaves are further described as 3-lobed, 5-lobed and long-lobed (Table 5, Figure 4). The non-lobed are described as round or broad-wide leaf and heart-shape or cordate. Leaf description is similar to morphological description of Huaman (1991).

Table 5. Leaf shape of the locally-named sweetpotato varieties grown by the IPs/ ethnic groups in Northern Philippines

LEAF SHAPE	#	VARIETY
Lobed		
Lobed	14	<i>Biit2, Gallading, Halpido, Imelda, Imported, Kalbo-oy/Kalbu-oy/Kilatan, Kinerots/Kinarot, Marinias, Miracle yellow, Parparya, Paula, Pitang, Wagwag, Winalila</i>
3 lobed	8	<i>Alla-at, Biit Turning, Gilayan, Mamon, Menilaan, Molikka, Sampidu, Ube</i>
5 lobed	7	<i>Apak-manok, Hawaii, Itbuy, Punchi, Gayyadek, Malitin, Swerte</i>
Long lobed	1	<i>Lukbungan</i>
Non-lobed		
Broad/ wide leaf	8	<i>Alusi-is, Biit1, Kentegan, Lubang, Murado New, Sokoowan, Texas, Vizcaya</i>
Heart shaped/ cordate	14	<i>Balballa, Binato White, Binato Violet, Gihhey, Haponita, Ibagyu, Labosan, Mansali, Ninanong, Superbureau, Taiwan (2 type), Urelis or Mamon, Velluga/ Vilyoga</i>
Rounded	7	<i>Acufal, Bintong, Buhbuhan, Chesa, De Colores, Malabing, nayDA</i>

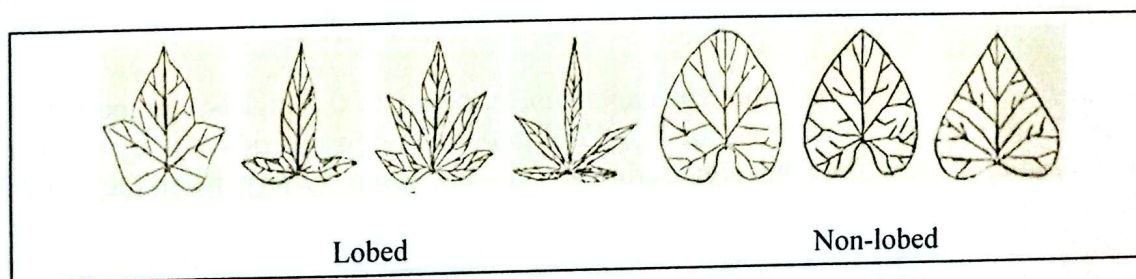


Fig. 4. Leaf-shapes of sweetpotato (Huaman, 1991)

Leaf color. Predominant leaf color observed is green with 60 varieties, green with purple (34 varieties), light green (2), light green with purple (5), purple/light purple (21) and yellow or yellow- green (2) as shown in Table 6, and Figures 5 and 6.

Table 6. Leaf color of the locally-named sweetpotato varieties grown by the IPs/ ethnic groups in Northern Philippines

LEAF COLOR	#	VARIETY
Green	60	<i>Alusi-is, Apak-manok, Appagong, Balitungeg, Biit(3), Biit Turning, Bitnakan, Buhbuan, Dakwag, Galladin, Gayuden, Gihhey, Gilayan, Hallikap, Heng-ewan, Illoboy, Imported, Indanggoh, Itbuy, Kalbo-oy(4), Kamandag, Kapangan, Kentegan, Kinerots/ Kinarot, Kuli-it, Kuyeyep, Labosan, Magaan, Malagampang, Malitin, Manila, Mansali, Marinias, Motmot, Parparya, Payaga, Pihhoy, Pinalyok, Pukapok, Punchi, Puntii Bii, Puntii Laki, Reynas, Samurangan, Standing, Swerte, Taiwan, Texas, Valena, Winalila, 4 Biga-Kalinga unnamed varieties, Iyattuka unnamed variety</i>
Green with purple	34	<i>Alla-at, Balballa, Bangkodel, Binato White, Gayadek, Gihhey, Haponita, Hawaii, Ibagyu, Ilocano or Pakak, Kabuco/Cavoco/Cabuso, Kagitkit, Kerajan, Kiangan, Komindal, Kopiyes, Kulingey, Lukbungan, Lupeet, Menilaan, Molikka, Motling, Murado New, Murado old, nayDA, Nila/Desnila, Pitang, Sampidu, Superbureau, Tocano/ Tokano(2 type), unnamed variety- Biga-Kalinga, Uyapo, Vizcaya</i>
Light green	2	<i>Kalbo-oy(Kankana-ey) and Makita</i>
Light green purple	5	<i>Bayag, Miracle (Kankana-ey), Samping, Sumabela, Tagalog or Tokian</i>
Light purple/ purple	21	<i>Bintong, Binato Violet, Chesa, Dolorong, Halpido, Iyobi, Lubang, Luwas, Manila, Miracle (Masadiit-Tingguian), Miracle Violet, Ninanong, Paula, Purong Ube, Sampero, Sekler, Tuklong, Ube, Ubi- De Colores, unnamed variety- Isneg, unnamed variety- Ivatan</i>
Yellow/yellow green	2	<i>Imelda and Miracle yellow</i>

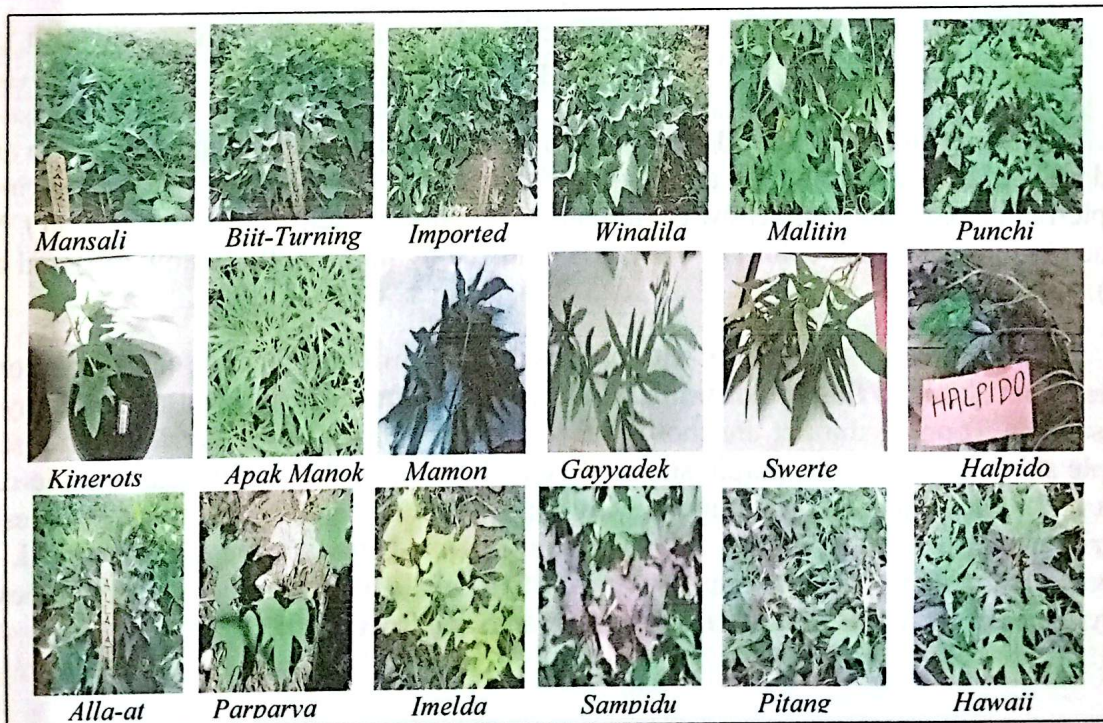


Fig. 5. Traditional sweetpotato varieties with lobed-leaf shape and with green to yellow-green and to purple-leaf colors

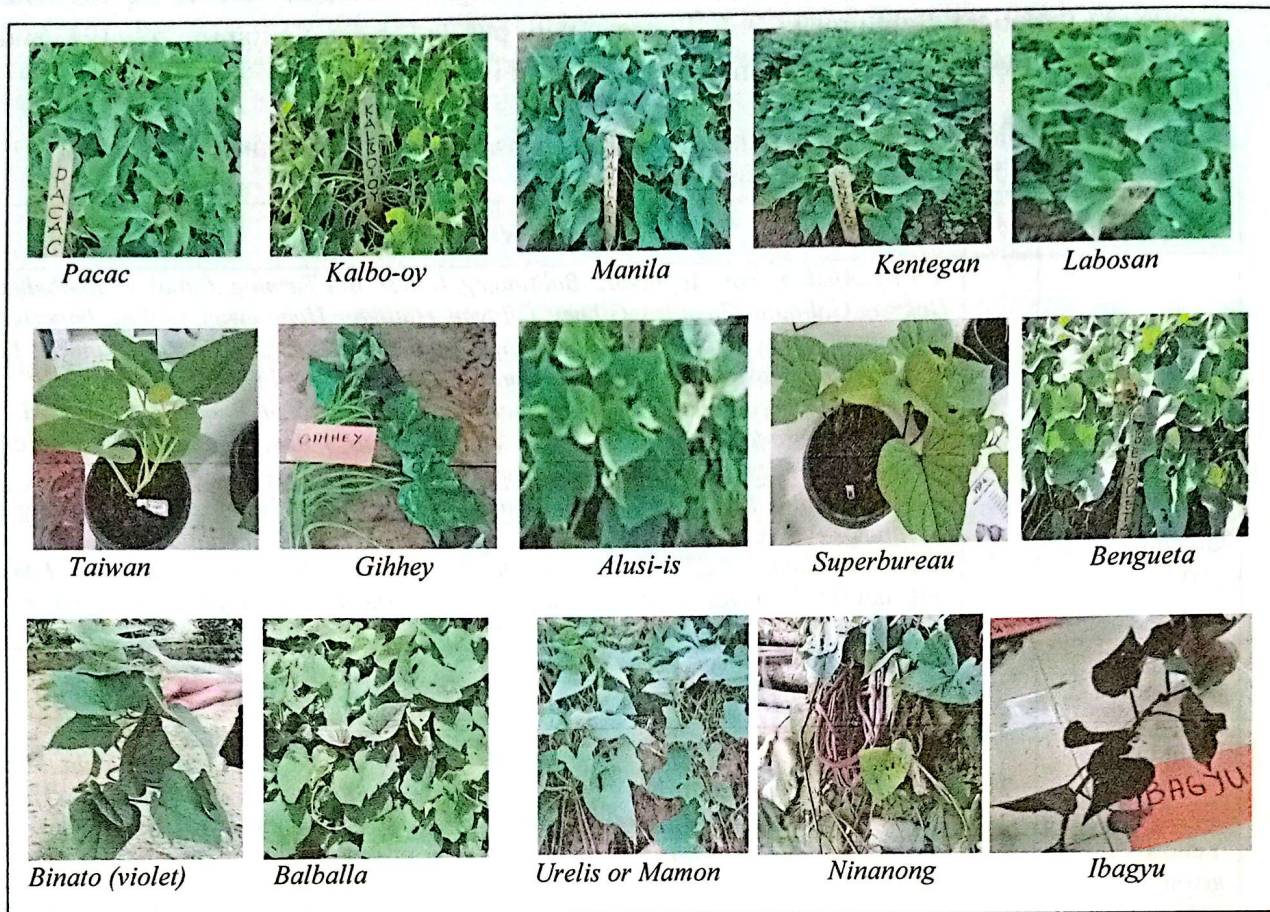


Fig. 6. Traditional sweetpotato varieties with non-lobed leaf shape and with green to purple leaf colors

Storage root skin and flesh color. As shown in Table 7, red and white skin are the predominant skin color with 44 and 31 varieties, respectively followed by purple skin (18), purple-red (12), cream (9), yellow (13), orange and pink (8 each) and brown skin (1). White is the predominant flesh color (73 varieties) followed by purple (30), yellow (29) and cream (14).

There are also 45 varieties with preferred color attributes like red, purple, yellow and orange root skin and flesh color primarily because it is attractive to local markets buyers or consumers. Topping the list are those with orange skin and flesh (4 varieties), those with purple skin and flesh (15), purple skin and yellow flesh (2), those with pink/ purple-red/red skin and yellow flesh (17) and those with yellow skin and yellow (6) or purple flesh (1). Nutrition-wise, yellow to orange flesh color have higher beta-carotene content (FNRI, 1998; Low et al., 2006 as cited by Nwankwo et al., 2015) while purple-fleshed sweetpotatoes have high values of total antioxidant capacity (Manrique and Roca, 2007).

Table 7. Skin and flesh color of locally-named sweetpotato varieties among IPs/ ethnic groups in Northern Philippines

SKIN COLOR	FLESH COLOR							Total
	White (WY)	Cream (LC,CP)	Yellow (DY,YO,YC, YW, YOW)	Orange (OY)	Purple (LP,PW, PC,PY)	Red	Un-named	
Brown	1							1
Cream	1	6	1		1			9
Orange	2		2	4a				8
Purple		1	2c		15b			18
Pink	1		5d		1		1	8
Purple Red	3	3	6e					12
Red	27	1	6f	1	2	1	6	44
White	25	1			5			31
Yellow	5		6g	1	1h			13
Unnamed	8	2	1	2	5			18
Total	73	14	29	8	30	1	7	162
PREFERRED COMBINATION		VARIETY						
a-Orange skin and flesh		4	<i>Binasar, Binato Orange, Kinerots/ Kinarot, Taiwan</i>					
b-Purple skin and flesh		15	<i>Binato Violet, De colores, Haponita, Ilocano or Pakak, Iyobi, Miracle (Masadiit-Tingguian), Murado New, Murado old, Parparya, Purong ube, Ube, Ubi- De colores, Sampero, unnamed variety- Ivatan, unnamed variety- Isneg</i>					
c-Purple skin and yellow flesh		2	<i>Chesa, Gayyadek</i>					
d-Pink skin and yellow flesh		5	<i>Biit-Turning, Kabuco/Cavoco/Cabuso, Kinmalumbasa or Kawitan, Miracle (Kankana-ey), Tokano</i>					
e-Purple-red skin and yellow flesh		6	<i>Itbuy, Malabing, Molikka, Mamon, Sumabela, Tagalog or Tokian</i>					
f-Red skin and yellow flesh		6	<i>Aringay, Biit, Kiangan, Payaga, Pitang, Swerte</i>					
g-Yellow skin and flesh		6	<i>Amsitan, Ibagyu, Kopyies, Menilaan, Luwas, Samping</i>					
h-Yellow skin and purple flesh		1	<i>Manila</i>					
Total		45						

Taste and texture characteristics of cooked sweetpotato roots. A total of 49 varieties have taste characteristics described as sweet or with good taste while 10 varieties have bland taste. There are 24 varieties having mealy or dry texture, three are not mealy, three have soft texture, two hard texture and three with fibrous texture (Table 8). There are eight varieties with sweet taste and mealy texture, namely: *Ibagyu, Kerajan, Kopyies, Sampero, Samping, Tocano, Tres Colores, Urelis or Mamon*; and two with sweet taste and soft texture (*Samurangan* and *Texas*), and two with mealy but bland taste (*Binasar* and *Miracle*).

Table 8. Cooking characteristics of sweetpotato roots as described by IPs/ ethnic groups in Northern Philippines

TEXTURE	TASTE			
	<i>Bland/ Not Sweet</i>	<i>Sweet</i>	<i>Unknown</i>	<i>Total</i>
Mealy/dry	2c	8a	14	24
Not mealy/wet	2		1	3
Soft		2b	1	3
Hard			2	2
Fibrous			3	3
Unknown	6	39		45
Total	10	49	21	80
PREFERRED COMBINATION		VARIETY		
a- Mealy/dry and sweet		<i>Ibagyu, Kerajan, Kopiyes, Sampero, Samping, Tocano, Tres Colores, Urelis or Mamon (Total= 8 varieties)</i>		
b- Soft and sweet		<i>Samurangan, Texas (2)</i>		
c- Mealy/dry and bland/not sweet		<i>Binasar, Miracle (2)</i>		

Maturity period. Some of the informants also classified sweetpotato as short maturing or long maturing depending on elevation and temperature. Short maturity in low, mid- elevation and hot climatic condition is 2.5-3 months while in cooler high elevation mountainous areas short maturity is 4-5 months. The IPs/ethnic groups identified 32 short maturing varieties, 59 with medium-term maturity ranging from 3-6 months depending on elevation and 13 long maturing varieties of 6 to 12 months (Table 9).

Table 9. Maturity period of sweetpotato as experienced by IPs/ ethnic groups in Northern Philippines

MATURITY (Month)	#	VARIETY
A. Short-term maturity = 32 varieties	2.5 to 3	15 <i>Aringay, Bintong, Cordagol, De Colores, Dolorong, Kinerot/ Kinarot, Losbanos, Murado New, Pitang, Pangasinan or Yegyeg, Sekler, Standing, Superbureau, Taiwan, Valena</i>
	3 to 4	17 <i>Alusi-is, Bentong, Biit, Bitnakan, Heng-ewan, Kalbooy, Kuli-it, Mangaldan Miracle(2), Miracle violet, Motmot Motnen, Pukapok, Taiwan, Unknown variety (2-Isneg)</i>
B. Medium-term maturity = 59 varieties	3 to 7	3 <i>Haponita, Sampero, Swerte</i>
	4 to 6	18 <i>Balitungeg, Bentong, Benito, Bitnakan, Dalaydayan, Gayuden, Heng-ewan, Kalbo-oy(2), Kuyeyep, Motmot, Miracle, Mangaldan, Nila/Desnila, Pihhoy, Samurangan, Taiwan, Tagalog or Tokian</i>
	5 to 6	38 <i>Alla-at, Appagong, Bangkodel, Biit 1, Biit 2, Dakwag, Gihhey, Gilayan, Hallikap, Hawaii, Ilocano or Pakak, Illoboy, Iyobi, Kalbo-oy(2), Kamandag, Kiangan, Komindal, Kulingey, Magaan, Malagampang, Mamatis, Manila, Mansali, Menilaan, Motling, Ninanong, Payaga, Parparya, Pappapaya, Pinalyok, Puntii Bii, Puntii Laki, Uyapo, Ungkalan, Tokano, Tuklong, Vellyuga/ Vilyoga</i>
C. Long-term maturity = 13 varieties	6 to 9	12 <i>Bayag, Halpido, Indanggoh, Kapangan, Kagitkit, Mamon, Lubang, Makita, Marinias, Paula, Samping Tocano</i>
	6 to 12	1 <i>Bayani</i>
Total	104	

High yield and market preferred varieties. Twenty-four out of the 179 locally-named varieties were identified by the IPs/ethnic groups as high yielding (Table 10). Eighteen were identified having high market acceptance. High yield and also market accepted varieties were *Kinerots/Kinarot, Pitang, Swerte, Taiwan, Tagalog or Tokian, Sta. Fe, and Valena* (Figure 7). Most of these varieties have red and purple skin, and yellow, orange and purple flesh.

Table 10. High yielding and market preferred varieties of sweetpotato identified by IPs/ethnic groups in Northern Philippines

YIELD AND MARKETABILITY	#	VARIETY
High good yielding varieties	24	<i>Amsitan, Appagong, Binato Violet, Bokol/Bokot, Hawaii, Kalbooy, Kerajan, Kinerots/Kinarot, Labkang, Lupeet, Ninanong, Pitang, Pitayan, Sta. Fe, Swerte, Taiwan, Tagalog or Tokian, Tres Colores, Ungkalan, Unknown(yellow flesh-Biga Kalinga), Urelis or Mamon, Valena, VISCA-3, Wagwag</i>
Market preferred varieties	18	<i>Bentong, Cordagol, Gilayan, Halpido, Ilocano or Pakak, Kiangon, Kinerots/Kinarot, MuradoNew, Pitang, Sampero, Sta. Fe, Superbureau, Swerte, Taiwan, Tagalog or Tokian, Ube, Ubi- De colores, Valena</i>

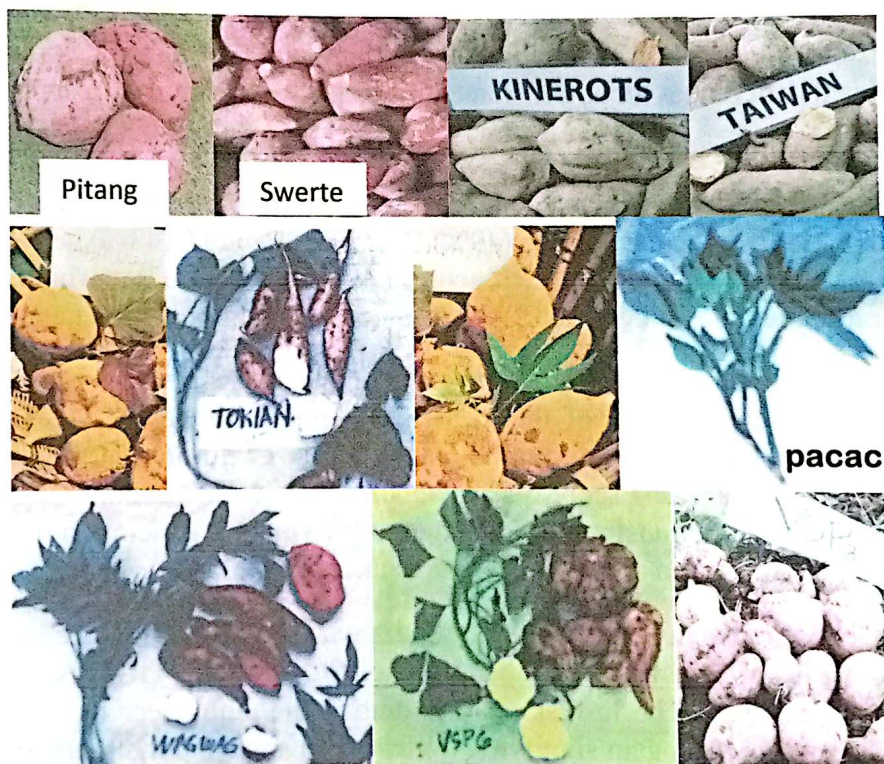


Fig. 7. Some of the high-yielding and market-preferred varieties

Special use of sweetpotato varieties. Indigenous peoples generally consumed sweetpotato simply as boiled. However, based on their experience there are some varieties which are suitable for processing into dried chips, flour, wine, candies, and other native

snack delicacies like *halaya* (mashed sweetpotato with milk, sugar and butter) *camote cue* (dipped fried and coated with sugar) and *guinataan*. Also, the *Alla-at* variety can be used for sweetpotato juice (Table 11). There are also varieties specifically planted for sale which are those that are market preferred, four varieties for home consumption only, five varieties suitable for vegetable-tips harvesting, and three for animal feeds because of its high herbage yield.

Table 11. Special uses of sweetpotato varieties identified by IPs/ ethnic groups

USE PREFERENCE	#	VARIETY
1. For sale	18	Same as market preferred varieties
2- Home consumption	4	<i>Ilocano or Pakak, Kalbo-oy, Superbureau, Kinmalumbasa or Kawitan</i>
3- Vegetable (tips)	5	<i>Makita, Malitin, Mamon, Karumbasa or Kawitan, Kalbo-oy</i>
4- Feed (leaves/herbage)	3	<i>Amsitan, Samurangan, Vizcaya</i>
5-Processing (<i>camote cue</i> , chips, flour,wine,candies, <i>halaya,guinataan</i>)	7	<i>Bentong, Haponita, Kalbo-oy, Kawitan, Mamon, Swerte, Ube</i>
6-Others – juice	1	<i>Alla-at</i>

Traditional Rootcrop Knowledge on Sweetpotato Varieties

The results on the traditional knowledge aptitude test on sweetpotato varieties indicate significant differences among IPs, age groups and occupation of respondents (Table 12).

The *Iyattukas* of Ifugao showed a higher traditional rootcrop knowledge (TRK) mean score of 59% than the *Tingguians* of Abra (49%), *Ibalois* of Benguet (43%), and the *Bagos* of Ilocos Sur and La Union (37%). These TRK scores however are quite low which could imply an erosion of traditional knowledge and maybe even loss of traditional varieties.

The elderly group of 57-77 years old had the highest TRK test score of 60% and as expected are more knowledgeable of the local names and attributes of the sweetpotatoes grown in the locality, followed by the middle-aged group of 36-56 years old garnering a score of 56% and the lowest test score of 24% among the younger generation (15-35 years old). This result implies that transfer of knowledge to the younger generation on sweetpotato varieties, production, utilization and consumption is lacking.

When it comes to occupation, the pensioners who also belong to the elderly group, the farmers and the stay-home wife or husband garnered the highest TRK test score of 69%, 55% and 50%, respectively. The lowest score is among the employees or wage earners at 32% and the students at 26%, again signifying a lifestyle change and their lack of experience or interest in planting and consuming sweetpotato.

Differences in test scores between sex and regardless of educational attainment and source of indigenous knowledge are not statistically significant which means that these factors are not impediments to learning indigenous knowledge.

Table 12. Traditional root crop knowledge scores on sweetpotato according to indigenous people, age groups, sex, occupation, educational attainment and source of knowledge

VARIABLE	DESCRIPTION	TRK Mean Scores (%)	Sig
Indigenous people	<i>Ibaloi</i>	43	0.005
	<i>Bago</i>	37	
	<i>Iyattuka</i>	59	
	<i>Masadiit-Tingguian</i>	49	
Age group (years)	15-35	24	0.000
	36-56	56	
	57-77	60	
Sex	Male	45	0.205
	Female	49	
Occupation	Stay-home wife/husband	50	0.000
	Farmer	55	
	Employee/wage earner	32	
	Student	26	
	Businessman/woman	41	
	Others-pensioners, etc.	69	
Educational Attainment	No formal schooling	54	0.581
	Reached elementary	44	
	Reached high school	50	
	Reached vocational	57	
	Reached college	43	
Source of IK knowledge	1-Kins,relatives, friends	47	0.299
	2-School, church, extension services	0	
	3- Media (print, radio,TV)	58	
	4-1,2 and 3	49	
	5-1 and 2	38	
	6-1 and 3	58	

Retention or Loss of TRK

Between the male middle-aged and elderly group of *Ibaloi*, *Bago* and *Iyattuka* IPs, there is not only retention but also an increase of indigenous knowledge on sweetpotato as indicated by the intergenerational rate of retention (RG) and cumulative retention rates (RC) of greater than one. RG and RC of one are assumed for the elderly group so that there is a loss of TRK among the middle-aged *Tingguians* and the female *Ibalois*, *Bagos* and *Iyattukas* at less than one vitality indices. Between the middle-aged and younger group, there is loss of knowledge as indicated by the less than one vitality indices in both RG and RC and supports the lower TRK test scores of the young group. Yearly, there is also a decline or loss of indigenous knowledge on sweetpotato varieties and attributes as indicated by the 1-5% annual rate of change (Table 13).

Table 13. Vitality indices of traditional rootcrop knowledge on sweetpotato among selected IPs in Northern Philippines

AGE	IP	RG		RC		CA	
		Male	Female	Male	Female	Male	Female
15-35 years	<i>Ibaloi</i>	0.65	0.48	0.88	0.69	-0.01	-0.03
	<i>Bago</i>	0.35	0.44	0.67	0.67	-0.03	-0.03
	<i>Iyattuka</i>	0.34	0.46	0.67	0.68	-0.03	-0.03
	<i>Tingguian</i>	0.28	0.63	0.54	0.75	-0.05	-0.03
36-56 years	<i>Ibaloi</i>	1.13	0.88	1.06	0.95	0.00	0.00
	<i>Bago</i>	1.13	0.91	1.05	0.96	0.00	0.00
	<i>Iyattuka</i>	1.19	0.90	1.08	0.96	0.00	0.00
	<i>Tingguian</i>	0.87	0.82	0.94	0.92	0.00	0.00
57-77 years	<i>Ibaloi</i>	1.00	1.00	1.00	1.00	0.00	0.00
	<i>Bago</i>	1.00	1.00	1.00	1.00	0.00	0.00
	<i>Iyattuka</i>	1.00	1.00	1.00	1.00	0.00	0.00
	<i>Tingguian</i>	1.00	1.00	1.00	1.00	0.00	0.00

CONCLUSIONS AND RECOMMENDATIONS

A total of 389 sweetpotato varieties were documented among 13 indigenous people and two majority ethnic groups in Northern Philippines, 210 from literature reviews and 179 varieties from this 2012-2013 survey. The large number of sweetpotato varieties indicates the importance of the crop among the IPs, and the genetic diversity resulting from many years of human intervention. From the 179 varieties, 99 were classified as traditional varieties and 80 as introduced varieties; 94 varieties were assessed as commonly grown, 63 as endangered and 22 lost varieties.

There are significant differences in TRK mean scores, the highest among the *Iyattukas* and elderly group of 57-77 years, and the lowest among the *Bagos* and younger-aged group of 15-35 years. Vitality indices of less than one intergenerational and cumulative retention rates between the middle-aged and the younger-aged group indicates a loss of knowledge declining at a rate of 1-5 % per year. This means fewer young people are interested in planting and eating sweetpotato which ultimately will redound to loss of sweetpotato specie diversity.

Hence, the varieties with superior qualities like short-maturity, high yield, reddish, orange and purple skin, orange, yellow and purple flesh, and market preferred based on the IPs/ ethnic group description and attributes of locally-named sweetpotato varieties are recommended for collection, conservation, clean-up and dispersal. These varieties were: *Alusi-is*, *Aringay*, *Biit*, *Binato Violet*, *Bentong*, *Haponita*, *Hawaii*, *Ibagyu*, *Ilocano* or *Pakak*, *Itbuy*, *Iyobi*, *Kalbooy (Bugkalot)*, *Kerajan*, *Kiangan*, *Kinerots/Kinarot*, *Kuli-it*, *Labkang*, *Miracle Violet*, *Miracle (Masadiit-Tingguian)*, *Molikka*, *Murado Old*, *Murado New*, *Ninanong*, *Pangasinan* or *Yegyeg*, *Parparya*, *Pitang*, *Pukapok*, *Purong Ube*, *Sampero*, *Samurangan*, *Sta.Fe*, *Standing*, *Sumabela*, *Superbureau*, *Swerte*, *Tagalog* or *Tokian*, *Taiwan*, *Tres Colores (Ibaloi)*, *Ube*, *Ubi- De Colores*, *Urelis* or *Mamon*, *Valena*, and *Wagwag*.

Appendix Table 1. Summary description and attributes of sweetpotato grown by the indigenous people/ major ethnic group in Northern Philippines

#	Local Cultivar Name	IP	Origin	Extent of Prod'n	Maturity (mos)	Leaf Characteristics		Root Characteristics				Taste Characteristics		Root Yield Potential	Use Preference	Other Characteristics
						Leaf Shape	Leaf Color	Root Shape	Root Skin Color	Flesh Color	Root Size	Taste	Texture			
1	<i>Acafal</i>		Ibaloi	3		Round		Rounded	O	W						
2	<i>Alla-at</i>		App'lai-Kankana-ey	I	5	3 lobed	GP		LP	C				5-juice	-	
3	<i>Alusi-is</i>		App'lai-Kankana-ey	I	3.5	Broad	G	Round-oblong	PR	W					Susceptible to weevil	
4	<i>Amianan</i>		Bago	I												
5	<i>Amsitan</i>		Bago	I				Round - singkamas like shape	YW	YW				4-pig	Agaw-cwid, i.e. every node of long vines bear enlarged roots	
6	<i>Apak-manok</i>		Ivatan	2		5 lobed	G			Y	small			3		
7	<i>Appagong</i>		Kalangaya	I	5 to 6		G		W	W				4	Not suitable for human consumption	
8	<i>Aringay</i>		Bago	2	3			Elongated	R	Y						
9	<i>Bagdol</i>		Bago	2				Round	R	-						
10	<i>Balballa</i>		Bago	2		Cordate	GLP			P			Mealy			
11	<i>Balitungeg</i>		Kalangaya	I	4 to 6		G		R	W					Planted only in lowland areas	
12	<i>Bangkodel</i>		Kalangaya	I	5 to 6		GP		R	W						
13	<i>Bayag</i>		Isneg	I	8		LGP			W						
14	<i>Bayani</i>		Kankana-ey	3	12											
15	<i>Benito</i>		Ivatan	3	4-5				R	W					Big vine stem	
16	<i>Bentong</i>		Kapampangan	2	4			Elongated	W	C				1, 5-chips		
17	<i>Bintong</i>		Ilocano	I	3	Round	P	Round to oblong		PW						
18	<i>Biit</i>		Kalangaya	I	3 to 4		G		R	Y					Easily sprouts, susceptible to insects	
19	<i>Biit 1</i>		Isneg	I	6	Wide leaves	G			C	small				Deep rooted	
20	<i>Biit 2</i>		Isneg	I	5 to 6	Lobed	G			C	big					
21	<i>Biit Turning</i>		App'lai-Kankana-ey	2		3 lobed	G	Elongated	LPN K	OC					Bushy, deep rooted	
22	<i>Binasar</i>		Tingguian	I	3				O	O			Mealy			
23	<i>Binato White</i>		Biga-Kalinga	I		Broad heart shaped	GP			W						
24	<i>Binato Orange</i>		Biga-Kalinga	I	3				O	O						

122	Payaga	Kalanguya	1	2	5 to 6	-	G	-	R	Y		Sweet	-	-
123	Pihoy	Kalanguya	1	2	4 to 5	-	G	-	RW	W		-	-	-
124	Pinalyok	Kalanguya	1	2	6	-	G	-	W	W		-	-	-
125	Pitang	Ivatan	2	1	3	Lobed	GP	-	R	Y		Sweet	1	-
126	Pitayan	Kankana-ey	1	3								Sweet	1	Best variety
127	Porsiana	Bago	1	3								Sweet		-
128	Pukapok	Aeta	1	1	3 to 4	-	G	-	Y	W		-	-	-
129	Punchi	Iyattuka	1	1	5 lobed	-	G	-	W	W		Mealy	-	-
130	Punti Bii	Kalanguya	1	2	5 to 6	-	G	-	W	W		-	-	-
131	Punti Laki	Kalanguya	1	2	5 to 6	-	G	-	W	W		-	-	-
132	Purong ube	Kapampangan	2	2	-	-	P	Rounded	P	P		-	-	-
133	Reynas	Mangyan	1	1	-	-	G	-	W	Y		Soft	-	-
134	Sampero	Ibaloi	2	2	3 to 5	-	P	Long elliptic	PPNK	P	mediu m	Sweet	1	-
135	Sampidu	Iyattuka	2	1	-	3 lobed	GP	-	W	W		-	-	-
136	Sampang	Ibaloi	2	2	6 to 9	-	LGP	-	Y	Y		Sweet	Mealy	-
137	Samurangan	Ivatan	2	1	4 to 5	-	G	Rounded	R	LC	small	Good	4	-
138	Sekler	Aeta	1	1	3	-	P	-	W	W		-	-	-
139	Sokoowan	Bago	1	2	-	Broad			-	-		-	-	-
140	Sta. Fe	Kankana-ey	2	1	-	-	-	-	R	W		-	Low DMC	1
141	Standing	Ivatan	1	2	3	-	G	-	R	W	small	Sweet	-	-
142	Sumabela	Bago	1	2	-	-	LGP	-	PR	Y		-	-	-
143	Superbureau	Ilocano/ Kapampangan	2	1	2.5-3	Cordate	GP	-	R	W	big	-	-	1, 2
144	Superbureau	Aeta	2	1	2.5-3	-	GP	-	R	W	big	-	-	1, 2
145	Swerte	Bugkalo/ Kalanguya	2	1	3 to 5	5 lobed	G	-	R	Y		Sweet	-	1, 5
146	Tagalog or Tokian	Kankana-ey	2	1	4 to 6	-	LGP	Elongated	PR	OW		Not sweet	1	1
147	Taiwan	Aeta	2	1	75 days	Cordate	G	-	W	Y		-	-	delicious tips
148	Taiwan	Ilocano/ Kapampangan	2	1	3 to 4	Cordate	G	Rounded	WO	OY		Sweet	1	-
149	Tambuarang	Ibaloi	1	2	-	-	-	-	R	-		Mealy	-	-
150	Texas	Ivatan	2	1	-	Broad	G	-	-	W		Sweet	Soft	Small roots
151	Tocano	Kankana-ey	1	2	6 to 8	-	GP	Elongated	W	YW		Sweet	Mealy	-
152	Tokano	Kalanguya	1	2	5 to 6	-	GP	-	PNK	Y		-	-	-
153	Tres Colores	Ibaloi	2	1	3	-	-	-	-	Y		Sweet	Mealy	1
154	Tuklong	Kalanguya	1	2	4 to 5	-	P	-	R	W		-	-	Not preferred by market
155	Ube	Kapampangan			-	3 lobed	P	-	P	PW		-	-	1, 5-chips
156	Ubi-De colores	Ilocano	2	2	-	-	P	Long elliptic	P	P		Sweet	-	Long shelf-life, good vegetative stage
157	Uga	Ivatan	2	1	-	-			-	W		Sweet	-	-
158	Ungkalan	Bugkalo	1	3	5	-			R	W		Mealy	1	Drought tolerant, climbing herbage
159	Unknown	Biga-Kalinga	2	1	-	-	G	Elongated	-	W		-	-	-

		Kankana-ey	*		4 to 5 5 to 6	shape semi- elliptic	GP	Long elliptic	PR	C		Bland		1			
257	Ingetanget	Bontoc	*				GP		LR	C				1			
258	Inglis	Kankana-ey	*				LG		LR	Y				Hard			
259	Imeklog	Ibaloi	*														
260	Kalabasa/ Kinababasa	Ibaloi	2*	3						Y							
261	Kalbo-oy	Ibaloi	1*	1			G		W	W			Mealy	1	3		Robust growth, low yiled now, shoots are non-hairy
262	Kalbo-oy or Kilatan	Kankana-ey	1*	1	4 to 6		LG		W	W/C		Tasty		1			Preferred, rough skin if planted in sandy soil
263	Kalbo-oy/ Kilatan	Applai- Kankana-ey	2*		6 6 to 12	Heart shape	G		W	C			Soft smooth	1			Preferred variety, 6 to 7 pcs/hill
264	Kalsan/ Kaasan	Bontoc	1*			Tooth	G	Long irregular Round- oval	W/Y	W				1			
265		Ibaloi	*	3					C	C							
266	Ka-angao	Kankana-ey	*	3			R		R	W		Sweet	Dry	1			Fibrous is over maured
267		Kankana-ey	2*		5 to 6		P	Round	PR	Y				1	1		Preferred in loam soil but liked by rodents
268	Kapangan or Pagsay	Ibaloi	2*	1		Rounded	PG	Irregular elongated	C	W				1			Very resistant
269	Kapangan	Kankana-ey	*						YO	W	Med- big						
270	Kawitan	Ibaloi/ Kankana-ey	2*		3	Rounded	P		R	W				1	3		
271	Kentegan	Applai- Kankana-ey	2*	2		Heart shape	GP		PNK	W			Mealy, Hard	1	5 to 6pcs/hill		
272	Kerajan/ Kirayan	Ibaloi/ Kankana-ey	*					Round oval	PNK	C							
273	Kiangan	Ibaloi	2*	2	3	5 lobes	GP	Fusiform	P	PW		Sweet	Moist	1			Average wt/tuber is 300-400g
274	Kingagayan	Applai- Kankana-ey	2*	2													
275	Kimmarabas a	Ilocano	1*			Big heart- shaped	G		C	Y		Tasty	Mealy				Spreading Average root yield
276	Kiwingan	Kankana-ey	*						PNK								
277	Komindal	Ibaloi	*														
278	Kommendar or Mindanao	Ibaloi	1*	2			LG		C	Y							Resistant to water logging, medium yielding
279	Kutibeb	Ibaloi	*														
280	Labusan	Applai- Kankana-ey	*														
281	Landing	Kankana-ey	*														
282	Lapisnayan	Kankana-ey	*														

STUDY 7
POTATO (*SOLANUM TUBEROSUM*) VARIETIES AND KNOWLEDGE TRANSFER
AMONG INDIGENOUS PEOPLE IN THE HIGHLANDS
OF NORTHERN PHILIPPINES

B.T. Gayao, C.G. Kiswa, and A. B. Bautista

ABSTRACT

The indigenous vegetable farmers particularly the *Ibalois*, *Kankana-eyes*, *Applais*, and *Kalanguyas* consider potato as a cash crop intensively cultivated in the highlands of Northern Philippines. But because of continuous planting, plant pest and diseases started to build-up ultimately leading to fast degeneration and loss of varieties. Potato industry demand is high, thus the continuous introduction of new varieties. This situation also makes it imperative to update information on potato varieties grown and to identify varieties which are no longer planted. Secondary data gathering and a follow-up survey of potato varieties known and grown was done.

Thirty-three or 73% of the 45 variety names listed including the so-called native varieties are not known by most farmers; four varieties were once grown but lost by most farmers; while 9 varieties are still grown consisting of locally-bred and originally imported varieties. These are Igorota or Po3 (87-89% of farmers), Granola short/dwarf (87%), Granola long or Granola Mexican (87 and 46-74%, respectively), Raniag (69%), Po4 or Solibao (35-50%), Fina (43%), Greta (30%), Montanosa (28%) and Ganza (26%). Almost 50% of farmers have wide areas planted to Igorota and Granola; and small areas to Raniag by 61% of the farmer respondents. For the other varieties, 1-7 farmers are planting them. The native variety introduced in the 17th and 18th centuries is not known or no longer exist.

In the case of transmitting knowledge on potato varieties, the 57-77 years aged-groups had higher knowledge retention scores than the 15-35 years aged-group but not the 36-56 years aged-groups who did not only retain but also increased their knowledge of potato varieties. This means horizontal transmission like access to market and government extension services had contributed more to transmission of knowledge on potato varieties.

INTRODUCTION

The potato sometimes referred to as white or Irish potato (*Solanum tuberosum*) to distinguish from sweetpotato (*Ipomoea batatas*), ranks third to cassava and sweetpotato among the world's food roots and tubers valued at 16.5 US billion dollars (Scott, et a. 2000).

In the Philippines, potato is considered a vegetable cash crop grown by indigenous people particularly the *Ibalois* and *Kankana-eyes* in the cooler part of the Cordillera mountain ranges. The Cordillera Administrative Region produced 101,828.48 MT or 86% of the country's production of potatoes recorded at 118,479.32 MT as of 2015 (Philippine Statistics

Authority). The aforesaid is lower from previous production estimates of about 295,000 metric tons produced from 10,964 crop hectares annually by about 13,000 farmers in Benguet and Mountain Province (Botangen et al., 1998) and the latest from Benguet Province at 210,613.79MT from 11,006.74 hectares (OPAG, 2014).

The cultivation of potato in Luzon, Philippines documented by Camel (1704) as cited by Potts (1983) implies the introduction of potato before the year 1700 possibly from parts of Peru or Mexico because of the term 'papas' similar to the *Ibaloi* and *Kankana-ey* local name for potato 'pafas' or 'patatas'. Don Blas de Baños, the second Spanish governor of Benguet was attributed with distributing a few potatoes to some *Igorots* who grew them so well in Benguet after 1846 (Semper, 1862 as cited by Potts, 2003). Hence, the two kinds of *native potato* described; the first with tall luxurious foliage, few elongated irregular tubers, white skin, deep eyes and sweet flavored yellow waxy flesh, and the second with tall luxurious foliage, long maturity, and small round white skinned and also with sweet flavored yellow waxy flesh. These native varieties are no longer grown as they are replaced by successive importations of cultivars locally known as *Japanese White* and *Japanese Pink* dating from the early 1950's by Chinese migrant farmers who introduced potato next to cabbage as the main cash crops in old and new clearings extending even to irrigated rice paddies. In the 1960's *Conchita* and *Greta* cultivars were imported from Mexico, and later up to the late 1970's, small quantities of *Red Pontiac* from USA, *Cosima* and other cultivars from the Dutch and Germans were imported (Potts, 2003).

Resulting from several variety adaptation trials, a yield survey was gathered from 419 fields in 1980 resulting to seven cultivars and mixtures of varieties planted by farmers, namely: *Alpha*, *Conchita*, *Cosima*, *Fina*, *Greta*, *Isola* and *Red Pontiac* (Potts, 1983). Continuous adaptation trials of imported potato varieties from the Netherlands and Germany, and potato clones from the International Potato Center based in Peru resulted to the recommendation of the varieties *Conchita*, *Cosima*, *Granola*, *Montañosa*, *Dalisay*, *BSU Po3*, *BSU Po4*, *Baraka*, *Kennebec*, *Agria* and *Berolina* (HARRDEC, 1996).

Montañosa, *Dalisay*, *BSU Po3* and *BSU Po4* are clonal selections from the NPRCRTC and CIP, which the NSIC approved for local release. The other recommendations are selections from the RP-German Seed Potato Program of the Bureau of Plant Industry.

Granola was the variety grown by 95% of farmers in Atok and Buguias, followed by *BSU Po3* also known as *LBR* then renamed *Igorota* (33%), *Sante* or *Smite* (11%), *Dalisay* (10%) and *Solibao* (5%) and very few of *Agria*, *Univita*, *Dalisay*, *Atlantic*, and *Famosa* in 1996. With a follow-up survey in 2004 in Benguet and Mountain Province (Gayao et al., 2006), *Igorota* (78%) and *Granola* (72%) were the predominantly grown varieties, followed by *Solibao* (25%) and *Raniag* (19%). Other varieties mentioned were *Montañosa*, *Hermes*, *Sante*, *Agria*, and *Kennebec*. *Igorota*, *Solibao*, and *Raniag* resulted from local selection of CIP clones and approved by NSIC in 1997 and 2000, respectively.

Starting 2009, the NPRCRTC seed production also dispersed planting materials of new varieties *Ganza*, *Gloria*, *Bengueta*, *Tawid* and *Watwat* (Kiswa, et al., 2011). *Ganza*, *Gloria*, and *Bengueta* were NSIC approved varieties in 2004 and 2007, respectively resulting

from the NPRCRTC breeding work. The Philippines is one of the countries that severely restrict the importation of potato tubers because of phytosanitary concerns (Ezeta, 2008) but there are still seed tuber importation by private companies just like Allied Botanicals which imported Granola and Connect varieties in the year 2013 and the local government of Benguet Province, which imported and distributed to farmers processing varieties- *Sherokee*, *Calwhite* and *Konestoga* (Kiswa, personal communication).

The fast turn-over of varieties as a consequence of industry demand for processed potatoes by fast food chains and snack food companies, the fast degeneration of varieties because of diseases, the lack of quality seeds and the role of potato as a principal source of cash income in vegetable farming is putting pressure on the indigenous peoples' food self-sufficiency and the loss of previously planted potato varieties. Thus, this research was conducted to document knowledge on traditional potato varieties known and/ or grown by highland farmers belonging to the indigenous people in Northern Philippines, and the retention or loss of said knowledge thereof.

The Vitality Index of Traditional Environmental Knowledge (VITEK) is one of new tools that provide a measure for assessing loss or change of traditional knowledge on selected sub-groups of the national population. It can help reveal the links between biological and cultural diversity (Zent, 2010). It offers a new source of specific and detailed information about the status of cultural knowledge and practices. The VITEK indicator was used in this study to determine an answer to the question of what potato varieties are still planted, consumed or traded, or already lost but known among the vegetable farmers (indigenous peoples) in Benguet and Mountain Province in Northern Philippines.

METHODOLOGY

Procedure

This study is part of the project '*Role of roots and tubers in household food security and income of indigenous peoples in Northern Philippines.*' Data gathering procedure involved several phases, i.e. secondary data gathering, key informant interviews, preparation of traditional potato knowledge (TPK) test questionnaire and conduct of the TPK aptitude test.

Test Questionnaire

The information gathered from the secondary data and key informant interviews was used in preparing the TPK test questionnaire on potato varieties, a modified version of the pre-determined Traditional Environmental Knowledge (TEK) aptitude test by Zent (2010). The TPK aptitude test questionnaire also included informant's assessment on the extent of production in terms of area or quantity of potato varieties (Box 1) and whether they lost or had never heard said potato varieties.

Box 1. Categorization in assessing extent of production as perceived by the key informants

- a. Plenty- Large area with many or few growers, or small area with many growers
- b. Few- small area and few growers or users (in need of conservation)

Modified based on understanding extent and distribution of diversity (Sthapit, et al., 2001; IPGRI, 2002)

Respondents

The 54 farmers who participated in the TPK aptitude test belong mostly to the *Kankana-ey* IPs in Benguet and Mountain Province, and belonging to three age groups (Table 1). These farmers belong to an association that had undergone the participatory training to become potato seed growers, and were selected by the regional Department of Agriculture as first-timers in said potato seed production training.

Table 1. Farm location and age group of respondents

MUNICIPALITY	FARMER (#)	AGE	FARMER (#)
Bauko	43	15-35 years	12
Mankayan	4	36-56 years	32
Buguias	3	57-77 years	10
Kibungan	2	Total	54
Others	2		
Total	54		

Data Analysis

Information gathered was encoded using EXCEL to facilitate calculation of vitality indices (Zent, 2010) and statistical analysis. The SPSS software was used for statistical analysis (ANOVA at 5% level of significance). The vitality indices computed are: the intergenerational rate of retention (RG), the cumulative rate of retention (RC), and the annual rate of change (CA). The RG and RC of the oldest or the reference age are assumed to be one.

DISCUSSION OF RESULTS

Unknown and Lost Varieties

Thirty-three out of the 45 or 73% of potato varieties listed in the TPK questionnaire are not known by most farmers. Nine varieties are not known by 100% of the farmer-respondents, nine varieties not known by 93-98%, six varieties not known by 80-89%, seven varieties not known by 54-78%, and two varieties are not known by 48-52% of the farmers (Table 2).

One-hundred percent unknown varieties include the so-called native varieties that existed even before the 19th century, the Japanese white and Japanese pink varieties imported in the 1950's, the 2006 seed board approved variety '*Bengueta*'; the recommended varieties for organic production '*Tawid*' and '*Watwat*'; and the newly imported varieties '*Columbus*, '*Connect*, '*Sherokee*, '*Cal-white* and '*Konestoga*' which were distributed for commercial production in 2015. The native varieties, Japanese white and Japanese pink, were already lost as reported in the 1980-81 field survey conducted by Potts (1983). The imported variety *Columbus* is already presumed lost since there are no new importations. According to potato farmers, most varieties except *Granola* (Figure 1) are already low-yielding after 3-5 crop cycles and hence discarded and will become lost if there will be no source of clean seeds (Gayao et al., 2006). The unknown varieties *Connect*, *Sherokee*, *Cal-white* and *Konestoga* probably did not yet diffused to the farmer-respondents since there are no plant materials available for dispersal. In the informal potato seed system it is only in the 4th to 6th cropping that a farmer will sell seeds to other farmers (Gayao et al., 2006). However, the varieties *Bengueta*, *Tawid* and *Watwat* are not entirely lost since these are being maintained for basic seed production purposes and sold to interested farmers who came to learn about the said varieties and are curious to plant new potato varieties.

The other varieties not known include those introduced in the 1960's (*Conchita*, Figure 2), 1970's (*Cosima*), 1980's (*Alpha* and *Isola*) and the locally selected and seed board approved varieties *Dalisay* and *Montanosa* (1989), *Solibao* (1997), *Ganza* (2004) and *Gloria* (2007); and the imported seed board approved varieties *Baraka*, *Kennebec*, *Agria* and *Berolina* (1990's). These are all presumed lost except for varieties *Solibao*, *Ganza* and *Gloria* which are also being maintained for seed production purposes at the Northern Philippines Root Crops Center- Benguet State University.



Fig. 1. Granola- widely grown variety in Benguet and Mountain Province

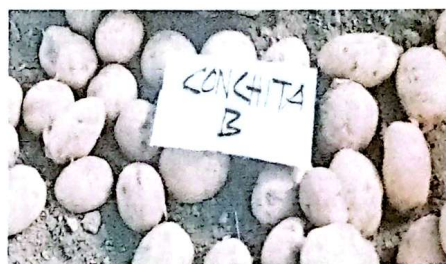


Fig. 2. Conchita and Atlantic- among the lost varieties

Table 2. Potato varieties introduced but unknown to farmers
in Benguet and Mountain Province, Northern Philippines

YEAR INTRODUCED*	VARIETY	FARMER, #		FARMER, %	
		Lost	Unknown	Lost	Unknown
1700-1900	<i>Native varieties</i>	0	54	0	100
1950's	<i>Japanese white</i>	0	54	0	100
	<i>Japanese pink</i>	0	54	0	100
	<i>Columbus</i>	0	54	0	100
2007	<i>Bengueta</i>	0	54	0	100
2015	<i>Connect</i>	0	54	0	100
	<i>Sherokee</i>	0	54	0	100
	<i>Cal-white</i>	0	54	0	100
	<i>Konestoga</i>	0	54	0	100
1960's	<i>Conchita</i>	23	28	43	52
1970's	<i>Cosima</i>	22	26	41	48
1980's	<i>Alpha</i>	1	52	2	96
	<i>Isola</i>	12	41	22	76
1989	<i>Dalisay</i>	6	46	11	85
	<i>Montanosa</i>	8	31	15	57
1990's	<i>Kennebec</i>	3	50	6	93
	<i>Agria</i>	3	48	6	89
	<i>Berolina</i>	9	45	17	83
	<i>Univita</i>	8	43	15	80
	<i>Sante/ smite</i>	9	42	17	78
	<i>Baraka</i>	8	36	15	67
1997	<i>Solibao</i>	6	29	11	54
2000's	<i>Signal</i>	1	53	2	98
	<i>Caesar</i>	1	53	2	98
	<i>Franzi</i>	1	53	2	98
	<i>Farmer</i>	1	52	2	96
	<i>Remarka</i>	1	52	2	96
	<i>Recolta</i>	1	52	2	96
	<i>Dejima</i>	3	50	6	93
	<i>Idaho</i>	6	48	11	89
	<i>Gineke</i>	12	41	22	76
2004	<i>Ganza</i>	4	36	7	67
2007	<i>Gloria</i>	1	47	2	87

*Based on literature reviews and KI

Varieties Grown and Lost

The varieties *Greta*, *Mexican*, *Red Pontiac* and *Fina* were at some time grown by the farmers (Table 3) but most were lost. The so-called Mexican potato once grown by the *Ibaloi* and *Kankana-ey* indigenous people before the 1970's (Gayao et. al, 2013) might refer to *Conchita* or *Greta* which were imported from Mexico in the 1960's (Potts, 1983). The importance of a clean seed source of seed stock is emphasized as one of the major reasons of losing varieties (Gayao et al., 2006) in addition to deliberate discarding of varieties because of low yield and disease susceptibility like in the case of *Red Pontiac*, *Cosima* and *Idaho* varieties according to a *Kankana-ey* farmer-respondent in Kibungan, Benguet.

Table 3. Lost potato varieties once grown by farmers in Benguet and Mountain Province, Northern Philippines

YEAR INTRODUCED*	VARIETY	FARMER, #		FARMER, % n=54	
		Unknown	Lost	Unknown	Lost
1970's	<i>Red Pontiac</i>	8	40	15	74
1960's	<i>Greta</i>	6	32	11	59
1980's	<i>Mexican</i>	4	25	7	46
1980's	<i>Fina</i>	14	17	26	31

*Based on reviewed literature

Varieties Grown and Extent of Production

As shown in Table 4, the top varieties grown by farmer-respondents were *Igorota* or *Po3* (87-89% of farmers), *Granola short/dwarf* (87%), *Granola long* or *Granola Mexican* (87 and 46-74%, respectively), *Raniag* (69%), *Po4* or *Solibao* (35-50%), *Fina* (43%), *Greta* (30%), *Montanosa* (28%) and *Ganza* (26%). *Igorota* (Figure 3), *Granola*, *Solibao* and *Raniag* (Figure 4) were also predominantly grown by farmers in 2004 (Gayao et al, 2006) while *Fina* and *Greta* were varieties grown by farmers in 1980 (Potts, 1983).

On the extent of production, almost 50% of the farmer-respondents grow plenty of wide areas to *Igorota* and *Granola* while less than 50% had small farm area planted. There were more (61%) farmers who grow small areas of *Raniag* than farmers (26%) who planted large areas of *Raniag*. For the varieties *Solibao*, *Fina*, *Greta*, *Montanoza* and *Cosima*, only 3-7 farmers grew in small areas, and only 1-2 farmers plant few of the varieties *Baraka*, *Conchita*, *Ganza*, *Gloria*, *Red Pontiac*, *Agria*, *Farmer*, *Dejima*, *Isola* and *Kennebec*.



Fig. 3. Igorota is the Seed Board-registered name given for LBR and BSU Po3

Table 4. Potato varieties currently grown by farmers and extent of production in Benguet and Mountain Province, Northern Philippines

YEAR INTRODUCED*	VARIETY	FARMER, #			FARMER, % n=54		
		Extent of production			Extent of production		
		Plenty	Few	Total	Plenty	Few	Total
1996	<i>Po3</i>	25	23	48	46	43	89
1996	<i>Igorota</i>	23	24	47	43	44	87
1990's	<i>Granola short/dwarf</i>	24	23	47	44	43	87
1990's	<i>Granola long</i>	18	22	40	33	41	74
1990's	<i>Granola Mexican</i>	8	17	25	15	31	46
2000	<i>Raniag</i>	14	33	37	26	61	69
1996	<i>Po4</i>	6	21	27	11	39	50
1996	<i>Solibao</i>	6	13	19	11	24	35
1980's	<i>Fina</i>	7	16	23	13	30	43
1960's	<i>Greta</i>	5	11	16	9	20	30
1989	<i>Montanosa</i>	3	12	15	6	22	28
2004	<i>Ganza</i>	1	13	14	2	24	26
1996	<i>Baraka</i>	2	8	10	4	15	19
1980's	<i>Cosima</i>	3	3	6	6	6	11
2007	<i>Gloria</i>	1	5	6	2	9	11
1970's	<i>Red Pontiac</i>	1	5	5	2	9	9
1960's	<i>Conchita</i>	2	2	4	4	4	7
1996	<i>Agria</i>	1	2	3	2	4	6
2000's	<i>Farmer</i>	1	0	1	2	0	2
2000's	<i>Dejima</i>	1	0	1	2	0	2
1980's	<i>Isola</i>	1	0	1	2	0	2
1996	<i>Kennebec</i>	1	0	1	2	0	2

*Based on reviewed literature and KI



Fig. 4. Some potato varieties recommended, conserved and multiplied for initial seed production purposes at the Northern Philippines Root Crops Research and Training Center- Benguet State University

Traditional Knowledge on Potato Varieties

Traditional knowledge test results on potato varieties is not statistically different among age-groups (Table 5), negating the assumption that the older farmers knew more of potato varieties grown in Benguet and Mountain Province. Knowledge acquisition is not affected by age; the same results were obtained on cassava varieties (Meldo, et al., 2016). As mentioned by Bruyere et al. (2016), knowledge transmission does not often occur between older and younger generations (vertical instruction), it can also occur through more horizontal interaction between peer, and oblique transmission from non-familial mentors like their access to government extension services and market. The results in this study validated such claims, where the 36-56 years old group had higher rates of intergenerational rate of retention (1.05) and cumulative rate of retention (1.02) than the 57-77 years old group. The hypothesis of gradual knowledge acquisition during life (Vandebroek and Balick, 2012) is used in the vitality indices of traditional environment knowledge (VITEK) assumption so that the oldest-aged group is given a score of one (Zent, 2010). This assumption is valid between the 15-35 years old and the 36-56 years old groups with retention scores of less than one (0.80 and 0.93) as shown in Table 6. Therefore, in the case of transmitting knowledge on potato, farmer's access to sources of seeds and information from government extension services or mass media will contribute more rather than age.

Table 5. Traditional root crop knowledge scores on potato varieties according to age groups among the predominantly Kankana-ey IPs in Benguet and Mountain Province, Northern Philippines

AGE (Years)	TRK mean score	
	Number	(%)
15-35	11	32
36-56	14	40
57-77	13	38
<i>F-value</i>	1.64	1.62
<i>Sig</i>	0.204	0.207

Table 6. Vitality indices on retention or loss of knowledge on potato varieties among the vegetable farmers in Northern Philippines

Age (years)	TPK Score (%)	VITALITY INDEX		
		RG	RC	CA
15-35	32	0.8	0.93	-0.004
36-56	40	1.05	1.02	0.001
57-77	38	1	1	0

RG and RC of the oldest or the reference age are assumed to be one

CONCLUSIONS

Potato has been among the roots and tubers planted for subsistence in swidden farms by indigenous people in Benguet. Potato was introduced by the Spaniards possibly in the 17th and 18th century, thus the so-called native or traditional varieties. When it was re-introduced as a cash crop then, the importation of varieties began for the *Japanese white* and *Japanese pink* in the 1950's, the *Conchita* and *Greta* from Mexico in the 1960's, the *Red Pontiac*, *Cosima* and unnamed Dutch and German varieties in the 1970's. The importation of varieties and seed tubers has never stopped despite government strict regulation and the availability of locally-bred varieties.

Forty-five variety names including the so-called native varieties were listed for validation of farmers in Benguet and Mountain Province. Thirty-three or 73% of potato varieties listed in the questionnaire were not known to most farmers and four were at one time grown but now were lost.

The nine varieties that are still grown are locally-bred or originally imported varieties. These are *Igorota* or *Po3* (87-89% of farmers), *Granola short/dwarf* (87%), *Granola long* or *Granola Mexican* (87 and 46-74%, respectively), *Raniag* (69%), *Po4* or *Solibao* (35-50%), *Fina* (43%), *Greta* (30%), *Montanosa* (28%) and *Ganza* (26%).

Almost 50% of farmers have wide areas planted to *Igorota* and *Granola* and the rest are planted in small areas. Small areas are planted to the *Raniag* variety by 61% of farmers.

The so-called native or traditional varieties no longer exist including the imported varieties that were discarded because of low-yield, susceptibility to diseases, low marketability, and no local source or no importation of new seeds.

In the case of transmitting knowledge on potato varieties, the 57-77 years old group had higher knowledge retention scores than the 15-35 years old group. In this instance, the hypothesis of gradual knowledge acquisition during life is rejected. In other words, farmer's access to sources of seeds and information from government extension services or mass media had contributed more to acquisition of knowledge on potato varieties especially for this highly preferred cash crop.

STUDY 8
TRADITIONAL VARIETIES AND KNOWLEDGE TRANSFER ON CASSAVA
(*MANIHOT ESCULENTA*) AMONG INDIGENOUS PEOPLE AND MAJORITY
ETHNOLINGUISTIC GROUP IN NORTHERN PHILIPPINES

D. T. Meldoz, B. T. Gayao, and G. S. Backian

ABSTRACT

Cassava (*Manihot esculenta*) is one of the roots and tubers that served as an important alternate staple food in the olden times among the indigenous peoples in Northern Philippines. The study was carried out in Northern Philippines to document, identify and determine knowledge transmission on traditional cassava varieties known to and grown by different IPs and the majority ethnolinguistic group in Northern Philippines. The documentation was done in four phases- secondary data gathering, key informant interview-workshops, field visits and aptitude tests.

Fifty-one cassava varieties were documented during the survey in 2012-2013, classified into 22 native varieties and 29 introduced varieties. These were further categorized as 30 cassava varieties commonly grown, 19 endangered and two lost varieties.

The selected IPs/ ethnic groups in Northern Philippines distinguished characteristics of cassava varieties along crop maturity, root flesh color, taste and texture of cooked roots, and uses. Eleven varieties were short maturing (3-4 months), four with short to long maturity, and 15 with long (6-12 months) maturity. Twenty-four varieties exhibited white-flesh color, 17 with yellow flesh and one variety with cream flesh. Four varieties are sweet (*Abuhay, Dayakot, Diket, Shihet*) and only one variety was slightly bitter. Moreover, seven varieties have sticky texture, two mealy, and five with soft texture. Twenty-seven of these locally-named varieties were only for home use.

Between the middle-aged and elderly groups, there is retention of traditional rootcrop knowledge on cassava locally-named varieties. Between the middle-aged and younger groups of *Bagos, Tingguians* and female *Ibalois and Iyattukas*, there is knowledge retention but a loss of knowledge among the male *Ibalois* and *Iyattukas*.

INTRODUCTION

Cassava is a tropical root crop that provides the staple food and livelihood of an estimated 800 million people worldwide, (FAO, 2013; Kyamanywa, *et al*, 2011; Anyiro, and Onyemachi, 2014; and CTCRI News, 2007). It is also an important raw material in the production of starch, alcohol and animal feeds (Cagasan, *et al*, 2002).

In the Philippines, cassava is one of the root and tuber crops grown by indigenous people. It is one of their important sources of cash income and the third most important source of food, next to rice and sweetpotato. It has an important contribution to the livelihood

and food security, especially of people in marginal areas. However, modernization has resulted in many changes in tribal lifestyles. New food habits changed the mixed and highly nutritious traditional dietary habits and staple foods. Deforestation, the change from mixed crops to cash crops, and the availability of exotic vegetables and tubers in the markets, had reduced the consumption of local foods (Shankar, 2003).

Hence, this study therefore was undertaken to document the cassava varieties commonly known to and grown by the selected IPs/ ethnic groups in Northern Philippines, and to determine knowledge transfer.

Cassava (*Manihot esculenta*) is a perennial woody shrub with an edible root that grows in tropical and subtropical countries believed to have been cultivated mainly for its starchy roots for 9000 years, making it one of agriculture's oldest crops (Mtunguja, et al., 2014). Cassava is also known among the minority or indigenous people in Northern Philippines as *kamoteng kahoy*, *kahoy*, *katimuro*, *kamoteng dutung*, *moros*, *moro* and *molo*, *balinghoy*, *kayo-kayo*, *padpadli* or *padpadi*, *samal*, *hanglay*, *balangoy*, *kaka-iw* and *kalasan* (Gayao, et al., 2013 and 2014).

FAO (2013) reported that since 2000, the world's annual cassava production has increased by an estimated 100 million tons, driven in Asia by demand for dried cassava and starch for use in livestock feed and industrial applications. In the Philippines, cassava production went up to 776.20 thousand metric tons from 758.88 thousand metric tons in 2015, or by 2.3 percent. According to the Philippine Statistics Authority (2016), the Autonomous Region of Muslim Mindanao produced 424.94 thousand metric tons or 54.7% of the cassava produced the country, followed by Northern Mindanao (14.3%) and Cagayan Valley (8.3%).

METHODOLOGY

Sites and Key Informants

Selection of IPs/ majority ethnic groups in Northern Philippines based on secondary information of rootcrops growing areas was validated by local government units (LGUs), collaborating institutions and researchers. There were 184 key informants consisting of 13 indigenous peoples (IPs): *Ibalois*, *Bagos*, *Aetas*, *Ivatans*, *Isnags*, *Buhid-Mangyans*, *Biga-Kalingas*, *Bugkalots*, *Kalanguyas*, *Masadiit-Tingguians*, *Iyattukas*, *Kankana-eyes*, *Applai-Kankana-eyes*, and the two major ethnolinguistic groups, the *Kapampangans* and *Ilocanos* (Figure 1).

Data Gathering Techniques

In all the four phases of the research, the data gathering was participatory. Phase 1 was gathering of secondary data from published and unpublished literatures and records of provincial and municipal government units, National Statistics Office (NSO), Bureau of Agricultural Statistics (BAS), and the National Commission on Indigenous Peoples (NCIP) as a basis for identifying sites, ethnolinguistic groups, collaborating agencies and researchers.

Phase II consisted of the Key Informant Workshop where story -telling, pictures, cue cards, and interview guide questions were used to facilitate and maintain a dynamic interaction. Phase III was made up of field visits and community walk done after the workshop to visualize gathered information, take pictures, and record observations. Phase IV was the administration Aptitude Test Questionnaire on traditional knowledge of local cassava varieties.

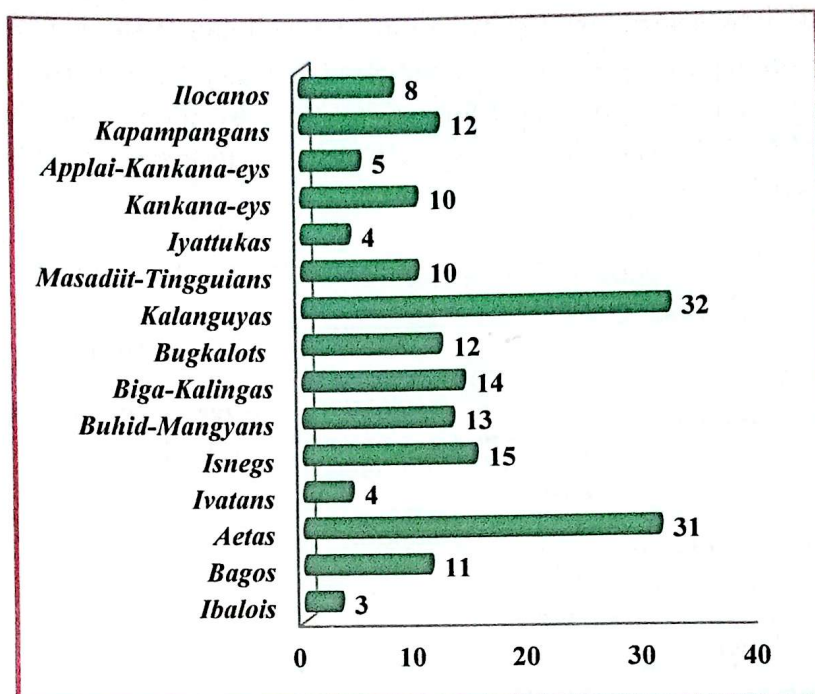


Fig. 1. The number of key informants interviewed in Northern Philippines, 2012-2013

Data Analysis and Write-up

Information gathered was encoded using the EXCEL to facilitate calculation of vitality indices (Zent 2010) and statistical analysis. The SPSS software was used for statistical analysis (ANOVA at 5% level of significance). The vitality indices computed are: the intergenerational rate of retention (RG), the cumulative rate of retention (RC), and the annual rate of change (CA). The RG and RC of the oldest or the reference age is assumed to be one.

DISCUSSION OF RESULTS

Inventory of Cassava Varieties

The IPs/ ethnic groups named 51 cassava varieties but after describing each, the final number was reduced because of similarities (Table 1).

The *Ibaloi* farmers in Tuba, Benguet had named eight varieties followed by the *Aetas* and *Kapampangans* in Pampang and Tarlac at six and five cassava varieties, respectively.

The rest of the IPs named 2-3 varieties. The key informants further classified the locally-named varieties as traditional or native and introduced. The traditional or native varieties are endemically grown and maintained by IP farmers while the introduced varieties are brought in from outside the IP's domain. In this research, 22 were classified as native varieties and 29 as introduced varieties. Part of the 29 introduced varieties may include the 20 cassava varieties (like the Golden Yellow) already registered in the Philippines (Mariscal et al., 2001) including two new selections 'KU 50' from Thailand and 'SM818-1' recommended by the Technical Working Group to the National Seed Industry Council for release; and the four new cassava varieties recommended for nationwide cultivation in the Philippines as follows: PSB Cv-17 (CG87-03-01), PSB Cv-18 (CG87-02-13), PSB Cv-19 (SM808-1) and PSB Cv-20 (CG91-13-01).

Table 1. Inventory of cassava varieties named by IPs or ethnolinguistic groups in Northern Philippines, 2012-2013

IP/ ETHNIC GROUP	NAME	SOURCE		TOTAL	
		<i>Native</i>	<i>Introduced</i>		
1	<i>Aeta</i>	<i>Kamoteng dutung, moros</i>	2	4	6
2	<i>Applai-Kankana-ey</i>	<i>Padpadli, padpadi, kalasan</i>	3	0	3
3	<i>Bago</i>	<i>Kahoy</i>	1	2	3
4	<i>Biga-Kalinga</i>	<i>Padpadli</i>	2	1	3
5	<i>Bugkalot</i>	<i>Samal</i>	1	2	3
6	<i>Buhid –Mangyan</i>	<i>Balinghoy, kayo-kayo</i>	2	0	2
7	<i>Ibaloi</i>	<i>Katimuro</i>	1	7	8
8	<i>Ilocano</i>	<i>Kamoteng kahoy, kahoy</i>	0	2	2
9	<i>Isneg</i>	<i>Moro</i>	3	0	3
10	<i>Ivatan</i>	<i>Kamoteng kahoy</i>	1	1	2
11	<i>Iyattuka</i>	<i>Kahoy</i>	2	1	3
12	<i>Kalanguya</i>	<i>Hanglay</i>	0	2	2
13	<i>Kankana-ey</i>	<i>Balangoy, Kaka-iw, Kahoy</i>	1	2	3
14	<i>Kapampangan</i>	<i>Kamoteng kahoy, kahoy</i>	2	3	5
15	<i>Masadiit-Tingguian</i>	<i>Kahoy or molo</i>	1	2	3
	Total		22	29	51
Traditional varieties		<i>Abuhay, Biit (yellow & white flesh), Dayakot, Diket, Giyaba, Golden Yellow, Kisday New, Kisday Original, Maranggit, Matabya/Matabia, Moro, Ngila, Pinusuan, Pudaw, Native or Kasigudan/ Kadaanan, Original Bayag, Unknown (white flesh)</i>			
Introduced varieties		<i>Bangkok, Batangas, KU50, Lakan, Miracle (White and yellow flesh) Moresya, Negro, Samar, Semi-Miracle, Shihet (white & yellow flesh), Tumingka, Unknown (white and yellow flesh)</i>			

The Northern Philippines Root Crops Research and Training Center presently maintains 15 Philippine Seed Board (PSB) approved varieties and 28 genotypes (2009-2016). Except for Miracle and Golden Yellow, none of the PSB or NSIC cassava varieties was mentioned by the IPs/ ethnic groups. Variety is a botanical nomenclature division consisting of more or less recognizable entities within a species that are not genetically isolated from each other while genotype is a genetic constitution of an individual or group of plants (<http://croppgenebank.sgrp.cgiar.org/>). These collections are mainly conserved in field genebanks of the Center (Table 2).

Table 2. Cassava varieties and genotypes maintained at the Northern Philippines Root Crops Research and Training Center- Benguet State University

Classification	#	Variety/Genotypes
NSIC/PSB Varieties	15	NSIC 22, NSIC 30, NSIC 39, NSIC 41, NSIC 42, NSIC 43, NSIC 44, PSBLakan2, PSBLakan3, PSBLakan1, VI, V2,V3, V4 (Miracle), Golden Yellow
Genotypes	28	1.1,1.2,1.3,1.4,1.5,1.6,2.1,2.2,2.3, 2.4,2.7,2.9,2.11,3.1,3.2,3.3,3.4, 3.5,3.6,3.7,3.9,3.11, 4.1,4.2,4.3, 4.4,4.5,4.6
Total	43	

Extent of Cultivation

The cassava varieties named by the IPs/ ethnic groups were further grouped into three categories based on farmer's assessment of the extent of cultivation and availability, i.e. commonly grown (abundant and widely grown by most farmers in the locality); endangered/rare (few and rarely planted by farmers); and lost which means it no longer exist in the locality.

There were 30 cassava varieties assessed as commonly grown, 19 as endangered, and two as lost by the *Ibalois* in Benguet, specifically, the *Original Kisday* and *Negro* (Table 3). Currently planted varieties were mostly named Miracle which was either white or yellow-fleshed. The *Aetas* had six widely grown varieties, the highest among the IPs followed by the *Biga-Kalingas*, *Bugkalots*, *Isnegs*, *Iyattukas*, and *Masadiit-Tingguians*; the *Buhid-Mangyans*, *Ivatans*, *Kalanguyas* and *Kapampangans* at two varieties each; and the *Bagos* with only one variety. The *Ibalois* in Benguet had six varieties assessed as endangered followed by the *Applai-Kankana-eyes*, *Kankana-eyes* and *Kapampangans* at three each; and *Bagos* and *Ilocanos* at two each. The endangered varieties include the introduced PSB or NSIC varieties *Lakan*, *Golden Yellow*, and *Ku50*.

Table 3. Extent of varieties cultivated by IPs/ ethnolinguistic groups in Northern Philippines

EXTENT OF CULTIVATION	IP/ GROUP	NUMBER	VARIETY
Common Varieties =30	<i>Aeta</i>	6	<i>Bangkok, Lakan, Matabya, Moro, Moresya, Tumingka</i>
	<i>Bago</i>	1	<i>Miracle</i>
	<i>Biga-Kalinga</i>	3	<i>Miracle, Native, Unnamed (white flesh)</i>
	<i>Bugkalot</i>	3	<i>Giyaba, Unknown (yellow & white flesh)</i>
	<i>Buhid-Mangyan</i>	2	<i>Abuhay, Maranggit</i>
	<i>Isneg</i>	3	<i>Diket, Ngila, Pudaw,</i>
	<i>Ivatan</i>	2	<i>Unnamed (white and yellow flesh)</i>
	<i>Iyattuka</i>	3	<i>Dayakot, Original/Native, Unnamed (Yellow flesh)</i>
	<i>Kalanguya</i>	2	<i>Unnamed (white and yellow flesh)</i>
	<i>Kapampangan</i>	2	<i>Matabia, Pinusuan</i>
Endangered/ Rare Varieties = 19	<i>Ibaloi</i>	6	<i>Kisday New, Original Bayag, Semi-Miracle, Samar, Shihet (white & yellow flesh,)</i>
	<i>Ilocano</i>	2	<i>Golden Yellow, Miracle</i>
	<i>Kankana-ey</i>	3	<i>Miracle (white & yellow flesh), Native</i>
	<i>Bago</i>	2	<i>Batangas, Native</i>
	<i>Kapampangan</i>	3	<i>Golden Yellow, KU50, Lakan(4- types)</i>
	<i>Applai-Kankana-ey</i>	3	<i>Biit (yellow & white flesh), Native</i>
Lost Varieties = 2	<i>Ibaloi</i>	2	<i>Kisday Original, Negro</i>
Total		51	

Description and Attributes

Cassava varieties were distinguished and differentiated based on maturity, root flesh color, taste and texture of cooked roots, root yield potential, and uses. Detailed descriptions of each of the varieties are shown in Appendix Table 1.

Maturity. The local cassava varieties mature within 3 to 12 months. The ethnolinguistic groups identified 11 short maturing varieties (Table 4). Four had short to long maturity depending on where it was planted, shorter in hot low elevation areas and longer if planted in mid-elevation areas. Fifteen were identified as long maturing varieties. Pictures of some of traditional varieties are shown in Figure 2.

Table 4. Maturity of locally-named cassava varieties grown by IPs/ ethnolinguistic groups in Northern Philippines

MATURITY (Month)		#	VARIETY
Short maturity	3 to 4	11	<i>Bangkok, Shihet, Maranggit, Miracle, Moresya, Ngila, Tumingka, Samar</i> , and 3 unnamed varieties
Short-long maturity	5 to 7	4	<i>Biit yellow, Miracle, Semi-Miracle, Shihet</i>
Long maturity	6 to 12	15	<i>Bayag, Biit white, Diket, Giyaba, Golden Yellow, Kisday New, Kisday Original, Matabya, Moros, Native/Kasigudan/ Kadaanan, Original Bayag, Padpadli</i> , and 2 unnamed varieties
Total		47	

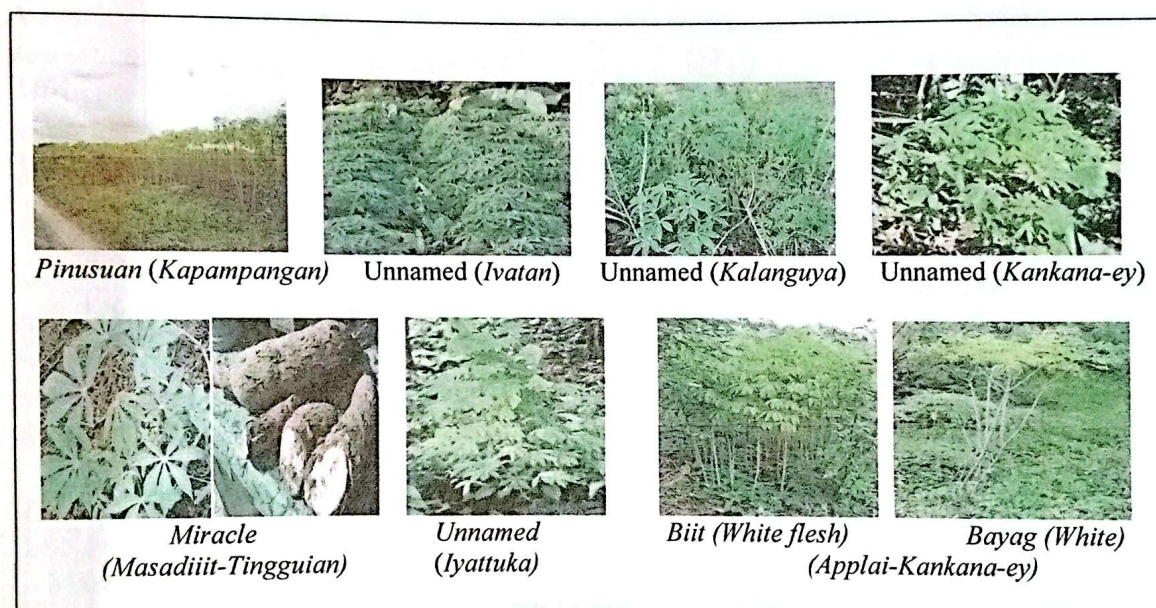


Fig. 2. The cassava varieties known to and grown in Northern Philippines

Root flesh color. There were 17 varieties exhibiting yellow flesh, 24 with white flesh, and one with cream flesh (Table 5). Flesh color of some varieties is shown in Figure 3.

Among the NPRCRTC collections (Figure 4), six have yellow flesh (NSIC 22, NSIC 30, NSIC 43, NSIC 44, PSB *Lakan 2*, *Golden Yellow*), four with cream flesh (NSIC 39, NSIC 41, PSB *Lakan 1* and *V3*); and five with white flesh color (NSIC 42, PSB *Lakan 3*, *VI-Kalpao*, *V2*, and *V4-Miracle*).

Table 5. Root flesh color of cassava varieties of IPs/ ethnic groups in Northern Philippines

COLOR	#	VARIETY
Yellow	17	<i>Biit, Diket, Golden Yellow, Lakan2, Miracle (4 types), Ngila, Maranggit, Samar, Shihet, Tumingka, 4 Unnamed</i>
White	24	<i>Abuhay, Bangkok, Batangas, Bayag, Biit, Dayakot, Giyaba, Kisday Original, KU50, Matabia/Matabya, Moresya, Miracle, Native, Negro, Original Bayag, Original/Native/ Kasigudan/ Kadaanan, Padpadli, Pudaw, Pinusuan, Semi-Miracle, Shihet, 3 Unnamed</i>
Cream	1	<i>Lakan 1</i>
No. of varieties	42	



Fig. 3. The cassava varieties with white and yellow flesh color



Fig. 4. Flesh color of cooked cassava (NPRCRTC collection)

Taste characteristics. Four varieties had sweet flavor (*Abuhay, Dayakot, Diket and yellow-fleshed Shihet*) and one with slightly bitter taste (*Kisday original*).

Along texture, seven were hard especially when these get cold after cooking (*Biit-yellow and white flesh, Diket, Maranggit, Miracle, Samar and unnamed-Iyattuka*), seven were sticky (*Dayakot, Golden Yellow, Miracle, Shihet, Tumingka, and 2 unnamed from the Ivatan and Bugkalot IPs*); two were described as mealy texture (*Moresya and Padpadli*); and five (*Batangas, Bayag, Miracle white, Shihet white*) were soft (Table 6).

Table 6. Cooking characteristics of cassava describe by IPs/ ethnic groups in Northern Philippines

TEXTURE	TASTE (#)		TOTAL
	<i>Sweet</i>	<i>Unknown</i>	
Mealy		2	2
Sticky	2a	5	7
Hard	1b	6	7
Soft	1c	4	5
Total	4	17	21
PREFERRED COMBINATION		VARIETY	
a-Sticky/soft and sweet		<i>Dayakot, Shihet (yellow)</i>	
b-Hard and sweet		<i>Diket</i>	
c-Soft and sweet		<i>Abuhay</i>	

Specific use. There are 27 varieties used for home consumption only (Table 7). Varieties mostly used by the IPs/ ethnic groups in preparing their native delicacies such as *suman*, *pitchi-pitchi*, *tapey* (fermented cassava), *nilubyan*, and *buko* (dried chips) are the *Miracle*, *Abuhay*, *Shihet*, *Kisday Original* and two unnamed varieties of *Ivatans*. The varieties preferred either for market, for feeds, for home use and for processing are *Moros*, *Lakan* (4 types, Figure 5), and one unnamed variety of the *Ivatans*.

Among the IPs, cassava is regarded more as a food insurance crop since it is consumed only when rice or all the other cultivated root crops are exhausted. This is the reason why 100% of the *Buhid-Mangyans* and also some of the *Ibalois* and other IP households grow at least a few plants in their farms or backyards. The *Kankana-eyes*, however, no longer plant cassava in higher elevations. Among the *Ivatans* in Batanes and the *Kapampangans* in Pampanga, cassava is cultivated more as cash crop.

Table 7. Uses of cassava varieties among the IPs/ ethnic groups in Northern Philippines

USE PREFERENCE	#	VARIETY
1-Market		
2-Home use	27	<i>Diket, Shihet, Tumingka, Miracle (4 types), 3 Unnamed (Iyattuka, Bugkalot-2), Biit, Ngila, Maranggit, Samar, Moresya, Padpadli, Dayakot, Semi-Miracle, Bayag, Bangkok, Pudaw, Original Bayag, Giyaba, Batangas, Negro, Original/Native/Native or Kasigudan Kadaanan, Kisday New</i>
3-Feeds	1	<i>Matabia/Matabya</i>
4-Processing	7	<i>Miracle, Abuhay, Miracle, Shihet, Kisday Original, 2 Unnamed (Kalanguya)</i>
5- Combination of:		
<i>1 and 2</i>	2	<i>Moros, Native or Kasigudan/Kadaanan</i>
<i>1, 2 and 3</i>	1	<i>Lakan (4 types)</i>
<i>1, 2 and 4</i>	1	<i>Unnamed (Ivatan)</i>
<i>3 and 4</i>	2	<i>Golden Yellow, Lakan, KU50</i>
Total	41	

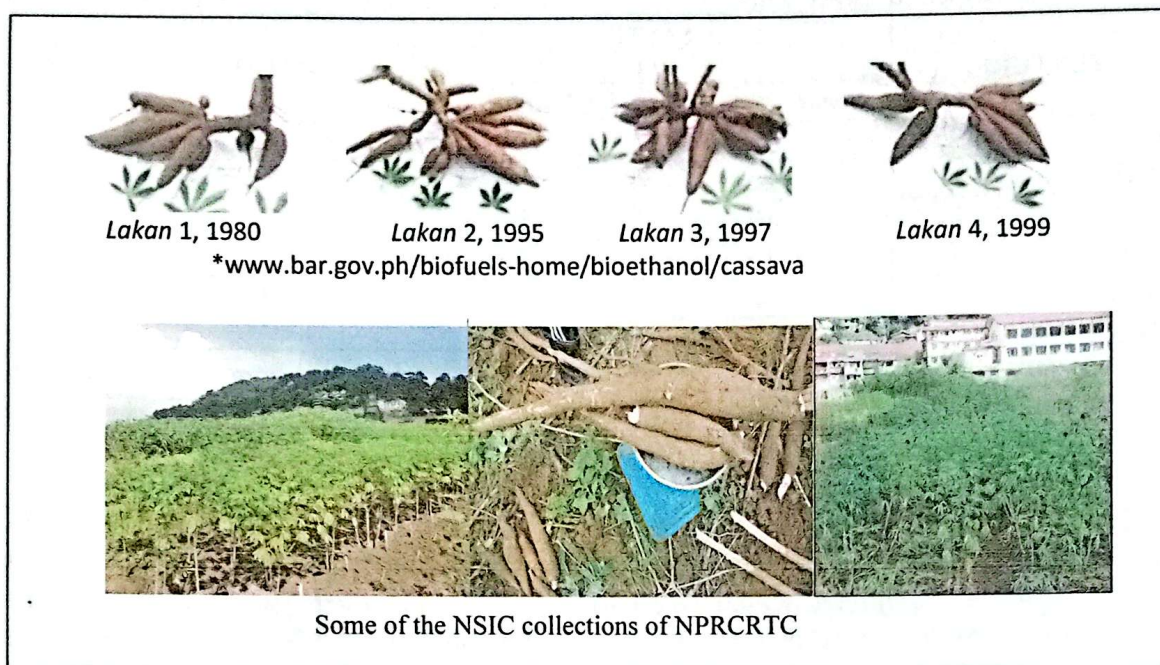


Fig. 5. Some of the NSIC/PSB varieties of cassava

Traditional Rootcrop Knowledge Scores

Analysis on traditional rootcrop knowledge (TRK) aptitude scores on cassava varieties shows significant differences among indigenous peoples and occupation group (Table 8). Differences in age group, sex, educational attainment and source of indigenous knowledge grouping revealed is not statistically significant.

The *Bagos* of Ilocos Sur scored higher TRK with a mean score of 98%, followed by the *Tingguians* of Abra (89%) and *Iyattukas* of Ifugao (83%). The lowest TRK mean score is among the *Ibalois* (44%). The low TRK mean score of the *Ibalois* is the result of their shift to growing other crops or other livelihood means which can imply an erosion of traditional knowledge or even loss of traditional cassava varieties.

With respect to occupation, stay-home wife/husband showed a higher TRK mean score of 90%, followed by employee/wage earner (81%), farmers and students (79%), pensioners, etc. (68%), and the lowest from those who are in the business with a TRK mean score of 41%.

Table 8. Traditional root crop knowledge (TRK) mean scores on cassava varieties

VARIABLE	DESCRIPTION	TRK Mean Scores (%)	Sig.
IP Group	<i>Ibaloi</i>	44	0.000**
	<i>Bago</i>	98	
	<i>Iyattuka</i>	83	
	<i>Tingguian</i>	89	
Age group (years)	15-35	75	0.081
	36-56	84	
	57-77	78	
Sex	Male	78	0.073
	Female	80	
Occupation	Stay-home wife/husband	90	0.008**
	Farmer	79	
	Employee/wage earner	81	
	Student	79	
	Businessman/woman	41	
	Others-pensioners, etc.	68	
Educational Attainment	No formal schooling	75	0.299
	Reached elementary	71	
	Reached high school	81	
	Reached vocational	60	
	Reached college	83	
Source of indigenous knowledge	1-Kins, relatives, friends	74	0.133
	2-School, church, extension services	100	
	3- Media (print, radio, TV)	100	
	4-1,2 and 3	90	
	5-1 and 2	67	
	6-1 and 3	87	

**Highly significant at 1% level of significance

Vitality Indices of TRK

Vitality indices as shown by the intergenerational rate of retention (RG) and cumulative rate of retention (RC) in Table 9 shows not only a retention of traditional knowledge in the middle-aged (36-56 years old) group of male *Bagos* and female *Tingguians* and but even an increase in knowledge among the female *Ibalois*, *Bagos* and *Iyattukas*, and male *Tingguians*, and a loss of TRK only among the male *Ibalois* and *Iyattukas* if compared with the elderly (57-77 years old) group.

Between the younger-aged (15-35 years old) and the middle-aged group, there is retention of knowledge in the younger-aged group of male and female *Bagos* and *Tingguians*, and female *Iyattukas*, but a loss of knowledge in the male and female *Ibalois* and male *Iyattukas*. The loss of knowledge ranges from 2-3% annually.

Table 9. Vitality indices of traditional rootcrop knowledge on cassava varieties among selected IPs in Northern Philippines

AGE (year)	IP	RG		RC		CA	
		Male	Female	Male	Female	Male	Female
15-35	<i>Ibaloi</i>	0.67	0.54	0.82	0.77	-0.02	-0.02
	<i>Bago</i>	1.00	1.00	1.00	1.07	0.00	0.01
	<i>Iyattuka</i>	0.63	1.00	0.74	1.04	-0.03	0.00
	<i>Tingguian</i>	1.00	1.20	1.19	1.08	0.02	0.01
36-56	<i>Ibaloi</i>	0.94	1.02	0.98	1.01	0.00	0.00
	<i>Bago</i>	1.00	1.16	1.00	1.07	0.00	0.00
	<i>Iyattuka</i>	0.80	1.10	0.91	1.04	0.00	0.00
	<i>Tingguian</i>	1.49	1.00	1.19	1.00	0.01	0.00
57-77	<i>Ibaloi</i>	1.00	1.00	1.00	1.00	0.00	0.00
	<i>Bago</i>	1.00	1.00	1.00	1.00	0.00	0.00
	<i>Iyattuka</i>	1.00	1.00	1.00	1.00	0.00	0.00
	<i>Tingguian</i>	1.00	1.00	1.00	1.00	0.00	0.00

The increase, retention or loss of traditional knowledge between two age groups depends on other factors, e.g. among *Ibalois*, the loss could be attributed to their access to other livelihoods brought about by the opening of the highway traversing the locality hence the abandonment of swidden farming. Zent and Maffi (2015) also noted no significant differences between older and younger people's knowledge, that whether knowledge decline had occurred or is occurring were made based on correlations with other dynamic variables. Also, over time elders and other community members relinquished their rights and responsibility to educate younger generations.

While the results in this study showed that there is both retention and loss of knowledge between age groups, there is still a need to transfer and conserve traditional knowledge for an appropriate adaptation of traditional practices to meet the changing livelihood needs of younger generation (Parrotta, et al., 2016), and the increased self-esteem resulting from the younger generation's acknowledgement and value of the importance of their indigenous knowledge (IFAD, 2016).

CONCLUSIONS AND RECOMMENDATIONS

Cassava is one of the roots and tubers that served as alternate staple food in the olden times. However, modernization has changed the mixed and highly nutritious traditional dietary habits, staple foods and lifestyles of indigenous peoples in Northern Philippines. Thus, the fear of losing knowledge and the cassava varieties traditionally planted. The study documented traditional varieties of cassava commonly grown, endangered or already lost among the *Aetas*, *Applai-Kankana-ays*, *Bagos*, *Biga-Kalingas*, *Bugkalots*, *Buhid-Mangyans*, *Ibalois*, *Isnegs*, *Ivatans*, *Iyattukas*, *Kalanguyas*, *Kankana-ays*, *Kapampangans/Ilocanos*, and *Masadiit-Tingguians* and determined retention or loss of knowledge on cassava varieties. Secondary data, key informant interviews, field visits and aptitude tests were conducted.

The ethno-linguistic groups had grown 22 cassava varieties which were also grown by their ancestors which they refer to as native and 29 introduced varieties which came from outside their ancestral domain. These 51 varieties were further categorized into 30 commonly grown, 19 as endangered and two as lost varieties. Some of the varieties have specific growth traits like short or long maturity; utilization features for market, feeds, home consumption, and for processing; taste attributes like sweetness, mealiness and stickiness; texture like soft and smooth. Some of the traditional varieties recommended for conservation and dispersal are: *Abuhay*, *Bangkok*, *Batangas*, *Bayag*, *Dayakot*, *Diket/Shihet*, *Golden Yellow*, *Maranggit*, *Miracle*, *Moresya*, *Ngila*, *Padpadli*, *Tumingka*, *Samar*, *Shihet*, and *Tumingka*.

Differences along traditional rootcrop knowledge mean scores between the selected IPs and occupation groups are significant but not along sex, age, educational attainment, and IK source. There is not only retention but even an increase in traditional knowledge between the elderly (57-77 years old) and middle-aged (36-56 years old) groups; and between the middle-aged and younger (15-35 years old) groups but also a loss of knowledge in the male and female *Ibalois* and male *Iyattukas*, which ranges from 2-3% annually. This seemingly contradicting result on the retention and loss of traditional knowledge on cassava varieties depends on the changes that occurred or are occurring in the livelihood and lifestyles of the IPs.

Appendix Table 1. Characteristics of locally named cassava varieties according to IPs/ ethnic groups in Northern Philippines

#	VARIETY	IP/ ETHNIC GROUP	ORI GIN (a)	EXTE NT OF PROD' N (b)	MAT URIT Y (Mon th)	ROOT		TASTE		ROOT YIELD POTENT IAL (t/ha)	USE (e)	OTHER TRAIT
						Root size	Flesh Color	Taste	Texture			
1	<i>Abuhay</i>	<i>Buhid-Mangyan</i>	1	1			White	Sweet	Soft		4	For <i>suman</i>
2	<i>Bangkok</i>	<i>Aeta</i>	2	1	3 to 4		White				2	Red skin
3	<i>Batangas</i>	<i>Bago</i>	2	2		Big	White		Soft		2	Best in sandy loam soil,
4	<i>Bayag</i>	<i>Applai-Kankana-ey</i>	1	2	12 to 24		White		Soft		2	Thick skin, do not become woody, small roots if 1 year old
5	<i>Biit</i>	<i>Applai-Kankana-ey</i>	1	2	6		Yellow		Hard when cold		2	
6	<i>Biit</i>	<i>Applai-Kankana-ey</i>	1	2	6 to 12		White				2	Thin skin and hard to uproot
7	<i>Dayakot</i>	<i>Iyattuka</i>	1	1			White	Sweet	Sticky, Soft		2	
8	<i>Diket</i>	<i>Isneg</i>	1	1	4 to 12		Yellow	Sweet	Hard		2	Aromatic
9	<i>Giyaba</i>	<i>Bugkalot</i>	1	1	12	Big	White				2	
10	<i>Golden Yellow</i>	<i>Kapampangan /Ilocano</i>	1	2	8 to 10		Yellow		Sticky	43	3, 4	Drought tolerance For starch
11	<i>Kisday New</i>	<i>Ibaloi</i>	1	2	8 to 10						2	7-8 finger leaves
12	<i>Kisday Original</i>	<i>Ibaloi</i>	1	3	10 to 12	Big-leg size	White	little bit bitter			4	7-10 finger leaves, for <i>buco</i> or <i>binobodan</i>
13	<i>KU50</i>	<i>Kapampangan</i>	2	2						high yielding	3, 4	High cyanide content, for starch
14	<i>Lakan (4 types)</i>	<i>Kapampangan</i>	2	2	3 to 4		White, cream-yellow			24-34	1,2,3	24-34
15	<i>Lakan</i>	<i>Aeta</i>	2	1	3 to 4		White/cream to yellow				3, 4	for starch
16	<i>Maranggit</i>	<i>Buhid-Mangyan</i>	1	1	4		Yellow		Hard when cooled		2	
17	<i>Matabia</i>	<i>Kapampangan</i>	1	1			White				3	Becomes woody when not harvested Elongated(1m)
18	<i>Matabya</i>	<i>Aeta</i>	1	1	12	Big,					3	Woody when old, elongated
19	<i>Miracle</i>	<i>Bago</i>	2	1		Small	Yellow		Sticky		2	Many and heavy roots
20	<i>Miracle</i>	<i>Biga-Kalinga</i>	2	1	6 to 7		Yellow				2	Controlled root size
21	<i>Miracle</i>	<i>Kankana-ey</i>	2	2	4		Yellow		Hard		4	One time harvest. for <i>tapey</i>
22	<i>Miracle</i>	<i>Masadiit-Tingguians</i>	2	1	5 to 6		Yellow		Hard		2	
23	<i>Miracle</i>	<i>Masadiit-Tingguians</i>	2	1	5 to 6		White		Soft		2	Preferred variety
24	<i>Miracle</i>	<i>Kankana-ey</i>	2	2	6		White				4	- <i>tapey</i> / fermented cassava, elongated

25	Miracle	Ilocano	2	2			White				1,2	
26	Moresya	Aeta	2	1	3 to 4		White		Mealy		2	
27	Moros	Aeta	1	1	12						1, 2	Do not become woody
28	Native	Bago	1	2			White				2	Thin/ small stems, no market, sturdy plant that survives even not re-planted
29	Native	Biga-Kalinga	1	1		Large	White				2	Elongated (1m)
30	Native	Kankana-ey	1	2	9						2	Plenty of stalks, roots become woody and gumares (slimy) if over matured
31	Native,	Masadiit-Tingguians	1	1	7 to 10	Big, very long	White				1, 2	Easy to produce roots
32	Negro	Ibaloi	2	3			White				2	With striped dark maroon stripes in the stem near the shoot tip, petiole is dark purple
33	Ngila	Isneg	1	1	4		Yellow				2	Elongated leaves
34	Original Bayag	Ibaloi	1	2	12		White				2	Can be planted anytime
35	Original/ Native	Iyattuka	1	1			White				2	
36	Padpaali	Biga-Kalinga	1	1	12	Big	White		Mealy		2	
37	Pinusuan	Kapampangan	1	1		Big	White				1,2	Most saleable, not very long roots
38	Pudaw	Isneg	1	1	8		White				2	Elongated
39	Samar	Ibaloi	2	2	4		Yellow		Hard		2	Roots become woody if harvested in 6 months, hard to cook, preferred by rats
40	Semi-Miracle	Ibaloi	2	2	6 to 7		White				2	Short leaves
41	Shihet	Ibaloi	2	2	4		Yellow	Sweet	Sticky, soft		2	
42	Shihet	Ibaloi	2	2	6	Big	White		Soft		4	For tapey or fermented cassava
43	Tumingka	Aeta	2	1	3 to 4		Yellow		Sticky		2	
44	Unnamed	Ivatan	2	1	3		Yellow		Sticky	15-18 kg/hill	1,2, 4	For suman.pitchi-pitchi
45	Unnamed	Ivatan	1	1	12	Big	White			15-20kg/hill	1,2	
46	Unnamed	Iyattuka	2	1			Yellow		Hard when cold		2	Very attractive
47	Unnamed	Bugkalot	2	1	4		Yellow				2	
48	Unnamed	Bugkalot	2	1	3 to 4		White		Sticky		2	
49	Unnamed	Kalanguya	2	1			Yellow			3-5kg/hill	4	Green stalk, leaves, tapey or fermented cassava
50	Unnamed	Kalanguya	2	1	6 to 12		White			5-10 kg/hill	4	Green stalk/leaves -tapey or fermented cassava
51	1.1		*					Not bitter	Hard			
52	1.2		*									

53	1.3		*					Slightly hard			
54	1.4		*								
55	1.5		*								
56	1.6		*								
57	2.1		*					Hard			
58	2.2		*				Either bitter/ not bitter	Hard			
59	2.3		*								
60	2.4		*								
61	2.7		*								
62	2.9		*				Not bitter	Mod. hard			
63	2.11		*				Not bitter	Mod. hard			
64	3.1		*				Mode rately bitter	Slightly hard			
65	3.2		*								
66	3.3		*				Not bitter	Slightly hard			
67	3.4		*								
68	3.5		*					Slightly hard	8.30		
69	3.6		*						5.63		
70	3.7		*				Not bitter	Soft	14.52		
71	3.9		*						4.67		
72	3.11		*					Slightly soft	8.93		
73	4.1		*				Not bitter	Slightly hard	6.30		
74	4.2		*					Hard	11.08		
75	4.3		*				Not bitter	Slightly hard	10.38		
76	4.4		*						6.72		
77	4.5		*					Slightly hard	16.63		
78	4.6		*					Slightly hard	7.30		
79	Golden Yellow		*			Yellow					
80	NSIC 22		*			Yellow	Sweet	Slightly hard	11.67		
81	NSIC 30		*		10 to 12	Yellow	Slightly sweet		12.5		

82	NSIC 39		*		10 to 12		Cream	Slightly sweet		5.87		
83	NSIC 41		*		10 to 12		Cream	Slightly sweet	Slightly hard	1.90		
84	NSIC 42		*		10 to 12		White	Slightly sweet		4.90		
85	NSIC 43		*		10 to 12		Yellow	Slightly sweet	Slightly hard	9.43		
86	NSIC 44		*		10 to 12		Yellow	bland	Slightly hard	5.00		
87	PSB - Lakan 1		*		10 to 12		Cream	bland	Slightly hard	4.73		
88	PSB - Lakan 2		*		10 to 12		Yellow	Slightly sweet	Slightly hard	7.77		
89	PSB- Lakan 3		*		10 to 12		White	Slightly sweet	Slightly hard	7.20 t/ha		
90	VI -Kalpao		*				White	Slightly sweet	Slightly hard	13t/ha		
91	V2		*				White	Sweet	Slightly hard	5.87t/ha		
92	V3		*				Cream	Slightly sweet	Slightly hard	9.17t/ha		
93	V4-Miracle		*				White	Slightly sweet	Slightly soft	5.87t/ha		

Notes/Legend:

a- Origin

- 1- traditional
- 2- introduced
- *- NPRCRTC Collections

b- Extent of Production

- 1- common
- 2- rare
- 3- lost

c- Use Preference

- 1- market
- 2- home use
- 3- feeds
- 4- processing
- 5- combination of: 1 and 2; 1,2 and 3; 1,2 and 4; 3 and 4

REFERENCES

- Agenda for indigenous peoples' food security: Assert indigenous peoples' right to land and resources. (2009). Retrieved from <http://www.eedtfip.org/node/3>
- Anonymous. (2010). *Nueva Vizcaya provincial development and physical framework plan 2007-2013*. Nueva Vizcaya Provincial Planning Office.
- Anwar, Mumtaz A. (2014). Role of information management in the preservation of indigenous knowledge. Retrieved from [http://pu.edu.pk/images/junal/pjlis/pdf\(2\)*](http://pu.edu.pk/images/junal/pjlis/pdf(2)*)
- Anyiro, Chidozie Onyedikachi and Onyemachi Amarachi Delight (2014). Adoption of cassava value added innovation and its implication on rural livelihood: A case of rural women in Abia State, Nigeria. *The Ninth African Economic Conference on the theme 'Knowledge and Innovation for Africa's Transformation*. United Nation Conference Center, Addis Ababa, Ethiopia. 1 - 3 November 2014. <https://www.researchgate.net/publication/296183628>.
- Balaki, E. and J. Solimen (1991). The role of sweetpotato in the diet, culture and ecology of an ethno-community. In UPWARD. 1991. *Sweet Potato Cultures of Asia and South Pacific. Proceedings of the 2nd Annual UPWARD International Conference*. Los Banos, Philippines. pp.113-119.
- Bareja, Ben G. (2010). Root crops, tuber crops and corm crops distinguished. List of examples. Retrieved from <http://www.cropsreview.com/root-crops.html>. Accessed April 18, 2016.
- Baucas, M.B., Z.J. Baucas, B.A. Anselmo, E.O. Badol, and L.L. Tandang (1990). Collection, maintenance, characterization and documentation of sweetpotato germplasm. *Working Paper Series*. NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 45-51.
- Bayogan, E.V. and H.L. Quindara (1989). Assessment of quality losses in taro at harvest. *Working Paper series*. Vol. 2, NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 108-111.
- Bayogan, E.V., C.C. Sagudan and J.D. Baban (1990). Assessment of production, postproduction, utilization and processing techniques and problems in highland sweetpotato. *Terminal Report. IDRC-NPRCRTC-BSU Project*. NPRCRTC, La Trinidad, Benguet. 143 pp.
- Bayogan, E.R.V., E.T. and V. B. Salda (1989). Assessment on the postproduction and utilization techniques in highland sweetpotato. In: *Research Results Presented in a Series of Working Papers*. Vol. 2. 1989. Northern Philippines Root Crops Research and Training Center, Benguet State University, La Trinidad, Benguet, Philippines. pp.73-86.

- Bayogan, E.R. V., V. B. Salda and I.C. Gonzales (1989). Postharvest characteristics of 15 local sweet potato varieties. In: *Research Results Presented in a Series of Working Papers*. Vol. 1. 1989. Northern Philippines Root Crops Research and Training Center, Benguet State University, La Trinidad, Benguet, Philippines. pp.77-83.
- Bayogan and Quindara (1989). Assessment of postproduction practices and problems in highland taro and yam. In: *Results Presented in a Series of Working Papers*: Vol. II. NPRCRTC, BSU, La Trinidad, Benguet. pp.124-139.
- Cagasan, E.K, A.B. Loreto, S. L. Sanchez and L. E. Sister (2002). Cassava production and chip processing in Pamahawan, An Upland Village in Bontoc, Southern Leyte. In: *Secondary Farmers of Secondary Crops? Women and Rootcrop Livelihood in the Philippines*. FAO-RAP Project, CIP-UPWARD, Los Baños, Laguna, Philippines. 250 pp.
- Collin, M.A. (2008). Driving innovation: Intellectual property strategies for a dynamic world, Cambridge University Press, Cambridge, UK. As cited in: *The Future Control of Food*. Edited by Geoff Tansey and Tasmin Rajotte. The Quaker International Affairs Programme, 2008. Earthscan. UK and SA
- Dayo, Helen, F., Jocelyn D. Labios and Amparo M. Wagan (1998). Rootcrop agriculture in Batanes: Diversity and transformation of an island food system. In: G. Prain and C.P. Bagalanan. *Conservation and Change. Farmer Management of Agricultural Biodiversity in the Context of Development*. User's Perspective with Agricultural Research and Development, Los Banos, Laguna. pp. 14-44.
- Den Hartog, A.P., W.A. Van staveren and I.D. Brouwer (2006). *Food habits and consumption in developing countries: Manual for field studies*. Wageningen Academic Publishers, The Netherlands. 224p.
- Department of Agriculture and Fisheries (2014). About taro. Retrieved from <https://www.daf.qld.gov.au/plants/fruit-and-vegetables/.../about-taro>.
- Elfick, J. (2015). Taro project. School Science Lessons. Retrieved from <http://www.uq.edu.au>.
- Eyong, Charles Takoyoh (2014). Indigenous knowledge and sustainable development in Africa: Case study on Central Africa. Retrieved from www.krepublishers.com
- Food and Agriculture Organization (2006). Quality Declared Seed (QDS). Rome, Italy: FAO. Retrieved from <http://www.fao.org>.
- Food and Agriculture Organization (2013). Save and grow: Cassava, a guide to sustainable production intensification. Food and Agriculture Organization of the United Nations. Rome, 2013. <http://www.fao.org/3/a-i3278e.pdf>. Accessed on May 10, 2017.

- IFAD (2016). The traditional knowledge advantage: Indigenous peoples' knowledge in climate change adaptation and mitigation strategies. International Fund for Agricultural Development (IFAD). <https://www.ifad.org/documents/10180/2a1e3eb4-51a3-4746-8558-2fc1e6d3e645>
- Food and Nutrition Research Institute (1998). *The Philippine food composition tables*. 2nd printing. DOST. ISBN 971-8769-00-5 Metro Manila, Philippines.
- Ganga, Z.N., B.A. Anselmo and M. B. Baucas. 1989. Preliminary yield trial on sweet potato. In: *Research Results Presented in a Series of Working Papers*. Vol. 1. 1989. Northern Philippines Root Crops Research and Training Center, Benguet State University, La Trinidad, Benguet, Philippines. pp.72-76.
- Gayao, B.T., D.T. Meldoz and G.S. Backian (2016). Loss of traditional root crop knowledge (TRK) among some indigenous peoples in Northern Philippines. *Benguet State University Research Journal*. #75. Benguet State University, La Trinidad 2601, Benguet, Philippines. pp 6-15.
- Gayao, B. T.,D. T. Meldoz, G. S. Backian and E. Bagioan. (2014). Indigenous knowledge, technology and role of roots and tubers among the highland Tingguians in Abra, Philippines. *Traditional Roots and Tubers Knowledge Series*. #12. May 2014. NPRCRTC-Benguet State University, La Trinidad, Benguet, Philippines. 30p.
- Gayao, B. T.,D. T. Meldoz and G. S. Backian (2014). Indigenous knowledge, technology and role of roots and tubers among the Iyattuka ethno-linguistic groups in Ifugao, Philippines. *Traditional Roots and Tubers Knowledge Series*. #13. June 2014. NPRCRTC-Benguet State University, La Trinidad, Benguet, Philippines. 23p.
- Gayao, B. T.,D. T. Meldoz and G. S. Backian (2013). Indigenous knowledge, technology and role of roots and tubers among the Ibalois in Benguet, Philippines. *Traditional Roots and Tubers Knowledge Series*. #1. December 2013. NPRCRTC-Benguet State University, La Trinidad, Benguet, Philippines. 48p.
- Gayao, B. T.,D. T. Meldoz and G. S. Backian (2013). Indigenous knowledge, technology and role of roots and tubers among the Bago ethno-linguistic groups in Northern Philippines. *Traditional Roots and Tubers Knowledge Series*. #2. December 2013. NPRCRTC-Benguet State University, La Trinidad, Benguet, Philippines. 39p.
- Gayao, B. T.,D. T. Meldoz and G. S. Backian (2013-2014). *Traditional Roots and Tubers Knowledge Series 1-14*. NPRCRTC- Benguet State University and the Neys-van Hoogstraten Foundation. <http://rootcrops-bsu@hostclink.net>.

- Gayao, B.T. and J.M. Sim (1997). *Sweetpotato production: Transference of planting materials and varieties grown in Bayyo, Bontoc, Mountain Province, Philippines. Users Perspective with Agricultural Research and Development (UPWARD)*, Los Banos, Laguna. Benguet State and University-Northern Philippines Root Crops Research and Training Center, La Trinidad, Benguet. 25p.
- Gayao, B.T., E.O. Sano and M. Wallace (1987). *Root and tuber crop production in the Philippines with focus on sweet potato and white potato*. NPRCRTC, Benguet State University, La Trinidad, Benguet. 95p.
- Hedrick, Terry E., Leonard Bickman and Debra J. Rog (1993). *Applied research design: A practical guide*. Applied Social Research Methods Series. Vol. 32. SAGE Publications, Inc., Newbury Park, California; London, UK and New Delhi, India. 141p.
- Indigenous Environmental Network Statement on the Right to Food and Food Security. (2001). Retrieved from http://www.treatycouncil.org/new_page_52114.htm
- IPGRI (2002). *Neglected and Underutilized plant species: Strategic action plan of the International Plant Genetic Resources Institute*. IPGRI, Rome, Italy.
- IPGRI. Molecular markers for genebank management. Tech. Bulletin 10: *Molecular Markers for Genebank Management and Seed Handling in Genebanks Training Course*. <http://croptgenebank.sgrp.cgiar.org/index.php/component/glossary/Glossary-1>
- Jusuf, M., St. A. Rahayuningsih, and Minantiyorini (2001). Present status of sweetpotato germplasm conservation in Indonesia. In: *Conservation and Utilization of Sweetpotato Genetic Diversity in Asia*. Proceedings of 2nd Asia Network for Sweetpotato Genetic Resources. 3-5 November, 1999, Bogor, Indonesia.
- Keesing, Felix (1962). *The Ethnohistory of Northern Luzon*. Stanford University Press. Stanford, California. p.188.
- Kenyon, Lawrence et al. (2006). A synthesis/lesson-learning study of the research carried out on roots and tubers crops commissioned through the DFID RNRRS research programs. 75p. Retrieved from https://assets.publishing.service.gov.uk/media/57a08c3140f0b64974001064/Root_Tuber_research_synthe
- Kuhnlein, H.V. (2007). Indigenous peoples' food diversity and food security. Retrieved from <http://www.indigenouspeoplesissues.com/index.php>
- Kyamanywa, S., Kashaija I., Getu E., Amata R., Senkesha N., Kullaya A. (2011). Enhancing food security through improved seed systems of appropriate varieties of cassava, potato and sweetpotato resilient to climate change in Eastern Africa. Nairobi, Kenya, ILRI.

- Lebot, V., S. Hartati, N.T. Hue, N.V. Viet, N.H. Nghia, T. Okpul, J. Pardales, M.S. Prana, T.K. Prana, M. Thongjiem, C. M. Krieke, H. Vaneck, T.C. Yap, and A. Ivancic (2010). Characterizing taro using isozymes and morpho-agronomic descriptors. In: *The Global Diversity of Taro: Ethnobotany and Conservation*. Bioersivity International, Rome, Italy.
- Lim, D. I. (2000). Comparative productivity of ubi, tugui and camote in Batanes 1999. *Unpublished Undergraduate Thesis*. College of Economics and Management. University of the Philippines, Los Banos, College, Laguna. 85p.
- Malanes, Maurice (2006). *Indigenous peoples and the convention on biological diversity*. Tebtebba Foundation. Baguio City, Philippines. 132p.
- Manrique, I. and W. Roca (2007). Potential of sweetpotato (*Ipomoea batatas*) biodiversity as a functional food in the tropics. CIP, Lima-Peru Workshop. *Functional Foods and Medicinal Products Developments from Amazonian Crops* EULAFF - EMBRAPA WORKSHOP. Rio de Janeiro, Brazil, Dec. 3-5, 2007. Powerpoint presentation. Retrieved from <http://www.bioeurolatina.com/bioeuro/archivos/William%20Roca-Brazil.pdf>
- Mariscal, A. M., J. L. Bacusmo, V.Z. Acedo, and E. Abogadie (2001). Recent progress on the conservation and use of sweetpotato in the Philippines. In: *Conservation and Utilization of Sweetpotato Genetic Diversity in Asia*. Proceedings of 2nd Asia Network for Sweetpotato Genetic Resources. 3-5 November, 1999, Bogor, Indonesia.
- Mariscal, Algerico M., Reynaldo V. Bergantin and Anita D. Troyo (2000). Cassava breeding and varietal dissemination in the Philippines- Major achievements during the past 20 years. ciat-library.ciat.cgiar.org/articulos_ciat/asia/proceedings.../193.pdf.
- Markwei, Carol, S.O. Bennett-Lartey and Eric Quarcoo. 2010. Assessment of cultivar diversity and agronomic characteristics of cocoyam (*Xanthosoma sagittifolium*) in Ghana through ethnobotanical documentation. In: *The Global Diversity of Taro: Ethnobotany and Conservation*. Bioersivity International, Rome, Italy.
- Mtunguja, M.K., Laswai, H.S., Muzanila, Y.C. Ndunguru, J. (2014). Farmer's knowledge On selection and conservation of cassava. *Journal of Biology, Agriculture and Healthcare*. www.iiste.org. ISSN 2224-3208 (Paper) ISSN 2225-093X (Online). Vol.4, No.10, 2014.
- Meldo, D.T., B.T. Gayao and C.B. Pulinney (2006). Minor rootcrops: An industry situationer. *BSU Research Journal*. Benguet State University, La Trinidad, Benguet. pp.104-114..

- Meldoz, Dalen T., Betty T. Gayao and Constancio B. Pulinney (2007). Minor root crops: Industry profile in the Philippines. In: *NPRCRTC Working Paper Series*. No.7. Benguet State University. 24p.
- Mula, R.P. (1992). Farmer's indigenous knowledge of sweetpotato production and utilization in the Philippine Cordillera Region. *UPWARD Working Paper*. Series No. 1, 1992. Los Banos, Philippines. 40p.
- Niehof, Anke (2010). Food, diversity, vulnerability and social change. Mansholt Publication Series. Vol. 9. Wageningen Academic Publishers. The Netherlands. 139p.
- Niehof, Anke. 1999. *Household, family and nutrition research: Writing a proposal*. Wageningen: Household and Consumer Studies, Wageningen University. 74p.
- Nwankwo, I.I. M, E.O. Ekah and C.J. Eluagu (2015). Morphological characterization and yield evaluation of sweetpotato landraces for genetic recombination. *Pyrex Journal of Agricultural Research*. Vol 1 (4) pp. 020-025. Retrieved October, 2015 from <http://www.pyrexjournals.org/pjar>
- Ogbebor. Osarome (2011). The value of indigenous knowledge system based on literature review. Retrieved from <http://osarome.blogspot.com>
- Pacuz, L.M., D.K. Simongo and E.T. Botangen (2013). Varietal evaluation for growth and Yield of cassava under La Trinidad condition: *In 2013 Agency In-House Review Proceedings, July 23,-26,2013*. Northern Philippines Root Crops Research and Training Center. Benguet State University.
- Parrotta, John, Youn Yeo-Chang & Leni D. Camacho (2016). Traditional knowledge for sustainable forest management and provision of ecosystem services. *International Journal of Biodiversity Science, Ecosystem Services & Management*. 12:1-2, 1-4, DOI: 10.1080/21513732.2016.1169580. <http://www.tandfonline.com/>. Accessed on May 13, 2017
- Philippine Council for Agriculture, Aquatic and Natural Resources Research and Development (1998). Ubi Industry Situationer. Los Banos, Laguna. Retrieved from <http://www.pcarrd.dost.ph/division/acd>.
- Philippine Rural Development Project Provincial Commodity Investment Plan (PCIP). Province of Tarlac. (2015).. Retrieved December 2016 from <http://drive.daprdp.net/>
- Philippine Statistics Authority (2014). Agricultural Accounts and Statistical Indicators Division. email: info@bas.gov.ph. Retrieved from <https://psa.gov.ph/sites/default/files/2014%>

- Philippine Statistics Authority (PSA). 2016. Major Vegetables and Rootcrops Quarterly Bulletin, October-December 2016. <https://psa.gov.ph/vegetable-root-crops-main/cassava>. Accessed May 15, 2017.
- Promoting Indigenous Knowledge: A Way Towards Indigenous Peoples' Food Security. (2010). Retrieved from <http://www.edtfip.org/node/144>
- Rao, Ramanatha V., Matthews Peter J., Eyzaguirre Pablo B. and Hunter D. (editors) (2010). *The global diversity of Taro: Ethnobotany and conservation*. Bioversity International. Rome, Italy.
- Rao, R. and D. Campilan (2002). Exploring the complementarities of in-situ and ex-situ conservation strategies for Asian sweetpotato genetic resources. *Proceedings of the 3rd International Workshop of the Asian Network for Sweetpotato Genetic Resources (ANSWER) held in Denpasar, Bali, Indonesia on 2-4 October, 2001*. International Plant Genetic Resources Institute Regional Office for Asia, the Pacific and Oceania (IPGRI-APO), Serdang, Malaysia.
- Reemer, F.P. (1990). *Consumption patterns of sweetpotato in Southeast Asia*. User's Perspective with Agricultural Research and Development and Wageningen University. 96 p.
- Root Crop Industry in the Philippines: An Assessment (2010). Northern Philippines Root Crops Research and Training Center. Benguet State University. Second printing December 2010
- Salda, Violeta B. 1989. Postproduction, consumption and utilization of indigenous cocoyams in the northern Philippines. *Working Paper series*. Vol. 2, NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 108-115.
- Salda, Violeta B. 1993. *Postharvest handling and utilization studies on indigenous crops in Northern Philippines*. International Foundation for Science, Stockholm, Sweden.
- Sano, E., M. Fang-asan, B. Gayao and E. Alupias (1991). Sweetpotato as a buffer in crises situations: the case of Amlimay, Buguias during the 1990 earthquake crises in Benguet. In UPWARD. 1991. *Sweet Potato Cultures of Asia and South Pacific. Proceedings of the 2nd Annual UPWARD International Conference*. Los Banos, Philippines. pp.120-125.
- Schneider, J. and A. Yaku (1996). Conservation for development: The relevance of indigenous rootcrop knowledge in Irian Jaya. In: *Into Action Research: Partnership in Asian Rootcrop Research and Development*. UPWARD, Los Banos, Laguna, Philippines. pp.4-10.

- Scott, G.J., R. Best, M. Rosegrant and M. Bokianga (2000). *Roots and tubers in the global food system: A vision statement to the Year 2020*. A co-publication of the International Potato Center (CIP), Centro Internacional de Agricultura Tropicana (CIAT), International Food Policy Research Institute (IFPRI), International Institute of Tropical Agriculture (ITA) and International Plant Genetic Resources Institute (IPGRI). International Potato Center, Lima Peru. 111p.
- Secretariat of the Convention on Biological Diversity (2010). Climate change, traditional knowledge, innovation and practices. *Hand-outs distributed during the 1st National Conference on Biodiversity, Gender and Indigenous Knowledge*. October 6-8. Agricultural Training Institute, Benguet State University, La Trinidad, Benguet.
- Shankar, Gowtham (2003). Building on tribal resources. Endogenous development in the North Eastern Ghats. *Ancient Roots, New shoots. Endogenous Development in Practice*. Bertus Haverkort, Katrien van 't Hooft and Wim Hiemstra (eds). Leusden: ETC/Compas. London: Zed Books. 2003.
- Sim, J.M. and B.T. Gayao (1989). Economic importance of *galiang* in northern Philippines: Production and utilization practices. *Working Paper series*. Vol. 2, NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 116-122.
- Sim, J.M. and B.T. Gayao (1989). Market demand of taro in Baguio City and San Fernando, La Union. *Working Paper Series*. Vol. 2, NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 112-123.
- Sim, J.M. and B.T. Gayao (1992). Traditional farming practices in taro production in the province of Benguet and La Union. *Working Paper Series*. Vol. 2, NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 24-43.
- Sim, J.M. and B.T. Gayao (1992). Socio-economic importance of taro in Benguet and nearby areas. *Working Paper Series*. Vol. 2, NPRCRTC, Benguet State University, La Trinidad, Benguet. pp. 45-54.
- Simongo, D. K., I. C. Gonzales and E. T. Botangen (2015). Performance of selected cassava progenies under La Trinidad condition. *In 2013 Agency In-House Review Proceedings*, August 17-19,2015. Northern Philippines Root Crops Research and Training Center. Benguet State University.
- Slimak (2010). Use of tropical root crops in effective intervention strategies for treating difficult and complex cases and chronic diseases. October 2010. CA 2359057. Patent.ipexl.com/inventor

- Solimen, J. and B. Gayao (1998). Community-based knowledge systems in sweetpotato genetic resources management among four ethno-linguistic groups in Northern Philippines. In Prain, G. and C. Bagalanon. 1998. *Conservation and Change: Farmer Management of Agricultural Biodiversity in the Context of Development*. UPWARD, Los Banos, Laguna. pp. 120-186.
- Sthapit, Bhuwon, Ramanatha Rao and Devra Jarvis (2001). Processes of implementation of in- situ conservation of agro-biodiversity on-farm in the perspective of sweet potatoes. *Paper prepared for the Asian Network for Sweetpotato Genetic Resources (ANSWER) Workshop on Exploring the Potential of In-situ (On-farm) Conservation of Sweetpotato Genetic Resources in Asia*. October 2-4, 2001, Dnpasar, Bali, Indonesia.
- Tang, Ruifei and Michael C Gavin (2016). A classification of threats to traditional Ecological knowledge and conservation responses. *Conservation and Society*. Volume 14, Issue 1. p57-70. <http://www.conservationandsociety.org/text.asp?2016/14/1/57/182799>.
- Tangonan, P. 2008. *Analysis of the livelihood systems of upland households in the province of Tarlac, Philippines*. Tarlac College of Agriculture, Tarlac, Philippines.
- Tansy, Geoff and Tasmin Rajotte (eds.) (2008). *The future control of food: A guide to international negotiations and rules on intellectual property, biodiversity and food security*. Earthscan, UK and USA.
- The Role of Ethnoscape and Indigenous People of India and their Culture in the Conservation of Biodiversity. (2016, June). Retrieved from <http://www.fao.org/docrep/ARTICLE/WFC/XII/0186-A1.HTM>
- Trinidad , Trinidad P., PH.D., Aida C. Mallillin, Anacleta S. Loyola, Rosario S. Sagum, PH.D., Rosario R. Encabo, Zoilo B. Villanueva, Marco P. de Leon, Ryan Q. Ibardaloza (2013). *Health and wealth through root crops towards biodiversity*. Food and Nutrition Research Institute. Department of Science and Technology. Retrieved October 2013 from [http:// www.citem.gov.ph](http://www.citem.gov.ph)
- Trinidad, Trinidad P. PH.D., Rosario S. Sagum, PH.D., Aida C. Mallillin and Rosario R. Encabo. *Nutritional and health benefits of root crops and legumes*. Study IV. Cholesterol-lowering effects of local root crops and legumes in humans with moderately-raised serum cholesterol levels. Retrieved October 2013 from www.fnri.dost.gov.ph
- United Nations Development Programme (2010). Fast Facts Lagom. Indigenous Peoples in the Philippines. UNDP Philippines. Retrieved from <http://www.ph.undp.org/content/dam>.

- Verdonk, Inge (1991). The Role of sweetpotato in the Philippine diet. In UPWARD. 1991. *Sweet Potato Cultures of Asia and South Pacific*. Proceedings of the 2nd Annual UPWARD International Conference. Los Banos, Philippines. pp.429-439.
- Veasey, Elizabeth Ann, Aline Borges, Mariana Silva Rosa, Juerema R. Queiroz-Silva, Eduardo de Andrade Bressan and Nivaldo Peroni (2008). Genetic diversity in Brazilian sweetpotato (*Ipomoea batatas* (L.) Lam., Solanales, Convolvulaceae) landraces assessed with microsatellite markers. *Genetics and Molecular Biology*. Vol. 31, #3. Sao Paulo. <http://dx.doi.org/10.1590/S1415-47572008000400020>
- Zent, Stanford. 2010. *VITEK quick-step method guide*. Hand-out. Instituto Venezolano de Investigaciones Cientificas. Apartado, Venezuela. Srzent@gmail.com. Retrieved from <http://www.terralingua.org/projects/vitek>
- Zent, Stanford. 2010. Resilience and vitality of traditional ecological knowledge. *Paper presented during the 1st National Conference on Biodiversity, Gender and Indigenous Knowledge*. October 6-8. Agricultural Training Institute, Benguet State University, La Trinidad, Benguet.
- Zent, Stanford. 2010. A VITEK Case Study. In: *Vitality Index of Traditional Environmental Knowledge: Introductory Guide*. Terralingua. Retrieved from <http://www.bipindicators.net/vitek/www.terralingua.org/vitek>
- Zent, Stanford and Luisa Maffi (2015). Final report on indicator No. 2: Methodology for developing a vitality index of traditional environmental knowledge (VITEK). *For the Project "Global Indicators of the Status and Trends of Linguistic Diversity and Traditional Knowledge"*. http://terralingua.org/wpcontent/uploads/2015/07/VITEK_Report.pdf.
- Zhang, Dapeng, Jim Cervantes, Zosimo Huaman, Edward Carey and Marc Ghislain (2000). Assessing genetic diversity of sweetpotato (*Ipomoea batatas* (L.) Lam) cultivars from tropical America using AFLP. *Genetic Resources and Crop Evolution*. 47:6, pp. 659-665. Doi.10.1023/A:1026520507223