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Lesser Yam (*Dioscorea esculenta*) Grown and Knowledge Transfer Among Indigenous People in Northern Philippines

Grace S. Backian, Betty T. Gayao, and Dalen T. Meldoz

Northern Philippines Root Crops Research and Training Center, Benguet State University
**Corresponding author e-mail address: gracebsu_nprcrtc@yahoo.com*

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Abstract

Lesser yam (*D. esculenta*) or *tugui,* is a perennial crop cultivated to supplement human food and cash needs. Reference data on indigenous varieties is limited. Hence, this documentation utilizes secondary data, key informant interviews, and field observation to determine varieties known or cultivated and the retention or loss of traditional knowledge regarding this crop among 13 indigenous peoples (IPs) in the Northern Philippines. The IPs named 25 cultivated and four wild species, 12 of which were classified as plenty, 11 as few, and two as rare or endangered. The *Aeta*, the *Biga-Kalinga*, the *Buhid-Mangyan*, and the *Tingguian* call the lesser yam, respectively as *Limeng, Atap-ontoy, Borot*, and *Anayed* or *Boga*. Most of the lesser yam varieties mature in eight months and were either sweet (six varieties) or bitter (four varieties). The *Bago* group had the highest mean score (90%) in traditional knowledge while the *Ibaloi* group had the lowest mean score (34%). Traditional knowledge on lesser yam is retained and even increased between the middle-aged group (36-56 years) and the older-aged group (57-77 years) of male and female *Iyattukas*, and male *Tingguians*. On the other hand, this knowledge is lost between the younger-aged group (15-35 years) and a middle-aged group of male and female *Ibalois* and *Iyattukas*. The decrease in knowledge on lesser yam was 1-3 percent annually between the younger-aged group and the middle-aged group. Only those born before the 1980s retained traditional knowledge about the diversity and variety of roots and tubers, cropping practices, and utilization. Loss of knowledge especially in the younger generations of the IPs can result in the loss of varieties, which may affect food security and even employment among the IPs.

Introduction

The lesser yam, *Dioscorea esculenta*, is a root and tuber crop (RTC) commonly used for food, providing carbohydrates and minerals especially for the indigenous peoples (IPs) in Northern Philippines, who call it *Lukto, Loktoh or Luktoh, Tugui or Tugtugi, Ontoy, Buwang, Balugan, Lufto, Dukay*, and *Pukupok*. For the *Ivatans* of Batanes, it is an important staple crop while among other IPs, it supplements food and cash needs. Often grown on marginal soil, the output is limited although it has contributed to food security and even employment among IPs,

who are among the small farmers that dominate the 35.1 percent of the country's total agricultural workforce in the countryside (Dar, 2017). Also known as Chinese yam, the lesser yam is among the most ancient species of *Dioscorea*. The vine seldom climbs to more than 3m, with a thin stem varying from smooth to prickly. Its tubers are smaller than most other yams, usually borne in clusters, and may number from 5 to 20 per plant. Lesser yam best thrive in the warm tropical regions and grows best at elevations above 500masl (Specialty Produce, n.d.). These crops thrive well in marginal areas where the more important crops cannot be successfully grown. Traditionally, lesser yam is grown with minimal or no intervention at all and does not usually need fertilizers especially when planted in soil that has just been cleared from bush.

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* (The New Zealand Digital Library, n.d.). In the Northern Philippines specifically in the Ilocos Region, *tugui* cultivation accounts for more than 50% of production in the country (Legaspi & Malab, 2013). Literature on lesser yam in the Philippines is very limited and there is no available database on lesser yam cultivated specifically by the indigenous peoples. Furthermore, the production and consumption of lesser yams are constrained by the changing physical and social environment. The impact of the physical environment like nutrient-depleted soils, increased frequency of drought and/or floods, and increase in daytime temperatures can contribute to poor growth and low yields. Socially, changing dietary patterns and food preferences can contribute to low demand for the root crop, while loss of knowledge especially in the younger generations of the IPs can result in the loss of varieties that are no longer planted. Hence, this study aimed to inventory lesser yam varieties known, grown, or cultivated, and to determine the retention or loss of traditional knowledge related to this crop among indigenous people in the Northern Philippines.

Methodology

This study was part of the project 'Role of Roots and Tubers in Household Food Security and Income of Indigenous Peoples in Northern Philippines' and so adhered to the same phased procedure: Phase 1- data gathering (secondary data) and linking with local partners, Phase 2- key informant workshops, which included focus group discussion, story-telling, use of cue cards and detailed interview guide, supplemented by farm visits and a community walk to observe and take pictures, Phase 3- the tabulation, presentation and validation of data, Phase 4- the conduct of the traditional knowledge test, and Phase 5- writing up the Traditional Roots and tubers Knowledge and Tubers Knowledge Series per IP (rootcrops-bsu@hostclink.net) and the integrated write up per subject. For the loss of knowledge, the aspects of the Vitality Index of Traditional Environmental Knowledge (VITEK) methodology as described by Zent (2010), like the listing/documentation of traditional knowledge, defining the conceptual knowledge (know-what), and the practical skills (know-how) knowledge, preparing the traditional aptitude test questionnaire, then administering the test to a sample of selected subjects were done. The data gathered in Phase 1 were the bases for preparing the list of traditional knowledge and the aptitude test questionnaire in this study.

On the selection of site and indigenous people, out of the 13 IPs, the *Ibaloi* of Taloy Sur in Tuba, Benguet; the *Bago* of Banga and *Malikliko* in Sugpon, Ilocos Sur and Sudipen, La Union; the *Masadiit Tingguian* of Labaan in Bucloc, Abra; and the *Iyattuka* of Amduntog in Asipulo, Ifugao were selected. The selection was based on the accessibility of the location and the availability of resident research coordinators.

Questionnaires consisting of simple questions on production and utilization were prepared for the selected groups. Questions ranged from the diversity of their root and tuber resources, cropping system, cultivation and utilization knowledge, and practices consisting of conceptual and skills knowledge. The respondents were further asked to indicate from whom or where they learned such knowledge.

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 who belong to three age groups (15-35 years old, 36-56 years old, and 57-77 years old), were equally divided into male and female subjects. Tests were

done individually and independently or with the assistance of the local coordinators. Checking and scoring of the completed questionnaires were done on-site by the project team and local partners.

The indigenous knowledge and resources on lesser yam were gathered from 164 root crop farmers. There were 65 males (40%) and 99 females (60%), which are distributed into three age groups, the 15-35-year-old, 36-56-year-old, and the 57-77-year-old. The middle-aged (36-56 years) comprise 51% of participants (Table 1).

To analyze the data, narrative descriptions of summarized data gathered were done in the first phase followed by encoding aptitude test scores of traditional knowledge on lesser yam in EXCEL software to facilitate ANOVA using SPSS software and the calculation of Traditional Rootcrop Knowledge (TRK) vitality indices adopted from Zent (2010). TRK scores and vitality indices are measures to determine the retention or loss of traditional knowledge.

To test differences and relationships in scores

Table 1

Profile of selected Indigeous Peoples

Indigenous People	Specific sites (Sitio/ Barangay/Municipality/ Province)	Number of respondents				
		Male	Female	Age Group		
				15-35	36-56	57-77
Aeta	Villamaria in Porac, Pampanga and Sta. Rosa in Sto. Nino, Bamban, Tarlac	18	12	10	16	4
Bago	Banga, Sugpon, Ilocos Sur, and Malikliko, Sudipen, La Union	8	3	0	11	0
Biga-Kalinga	Tanudan, Kalinga	1	13	5	7	2
Bugkalot	Tamuyan, Belance, Dupax del Norte, Nueva Vizcaya	9	3	0	9	3
Buhid-Mangyan	San Jose City, Occidental Mindoro	11	2	9	3	1
Ibaloi	Taloy Sur, Tuba, Benguet	1	2	0	3	0
Isneg	Talifugo, Conner, Apayao	2	2	0	3	12
Ivatan	Batanes Province	1	13	0	1	4
Iyattuka	Amduntog, Asipulo, Ifugao	0	4	0	1	3
Kalanguya	Tiblac, Ambaguio, Nueva Vizcaya	8	24	8	17	7
Benguet-Kankanaey	Sagpat, Kibungan, Benguet	3	7	0	6	4
Applai- Kankanaey	Bauko Municipal Agriculture Office, Mountain Province	0	5	0	1	4
Tingguian	Bucloc, Abra	3	7	0	5	5
	n, 164	65	99	32	83	49
	%	40	60	20	51	30

among IPs as influenced by age groups, gender, education, occupation, and source of knowledge, the chi-square analysis in the SPSS software was used. The level of significance was set at 5%. For the intergroup comparison, the calculations of VITEK statistics were separately done and analyzed per IP case, that is, the intergenerational rate of retention (RG), the cumulative rate of retention (RC), and the annual rate of change (CA) (Zent, 2010). RG indicates the rate of retention between any successive pair of groups, while RC reflects the proportion of the baseline aptitude level retained by each succeeding age group. CA expresses the average rate and direction of change per year reflected by the target age group. Formulas of calculation are:

RGt = gt/gr where gt is the mean score of the target age group (younger age group) and gr is the mean score of the reference age group

RGt of the oldest age group was set at 1 based on the logic that no information about the aptitude level of the preceding generation is available and therefore it cannot be assumed that any difference or changes have occurred in prior time periods.

RCt = RCr10log(RGt) where reference RC is multiplied by 10 raise to the power of the logarithm of the target RG. RC of the group was also set at 1.

CAt = RCt -1 where ygt is the length in years of the target age group interval *ygt*.

Statistical calculations tests were separately done and analyzed per IP case.

Results

Knowledge on Cultivated and Wild Lesser Yam

Cultivated Lesser Yam

Among the IPs, the *Ibaloi* informants know of seven varieties they had or once planted, the *Bago* know of four varieties, the *Biga-Kalinga, Isneg, Ivatan, Iyattuka, Kalanguya*, and *Tingguian* grow two varieties each, and the *Buhid-Mangyan* and the *Bugkalot* cultivate only one variety. The Benguet-*Kankana-ey* and the *Applai-Kankana-ey* 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) all of which have smaller tuber sizes as compared to the lesser yam varieties of the *Ivatans*, especially the *Ulong* variety which could weigh up to two kilos or more per tuber (Figure 2), or of the *Bago's* native variety, *Bayag tugtugui*.

Wild Lesser Yam Species

The *Aeta*, the *Biga-Kalinga*, the *Buhid-Mangyan* and the *Tingguian* know of a wide lesser yam, respectively called *Limeng*, *Atap-ontoy, Borot* and *Anayed* or *Boga* (Table 2). The wild species are found in the forest and undisturbed lands near the creeks and river banks. The *Limeng* of the *Aetas* was considered endangered as only a few of this wild lesser yam are now found in the wild. The *Buhid-Mangyans* locally call the wild lesser yam as *Borot* which they harvest only during lean months they call *tigkiwiri*.

Extent of Production and Variety Availability

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

Planted only by a few are the *Native Tugtugui,* the *Bayag* and one unnamed of the *Bagos*; one

Figure 1

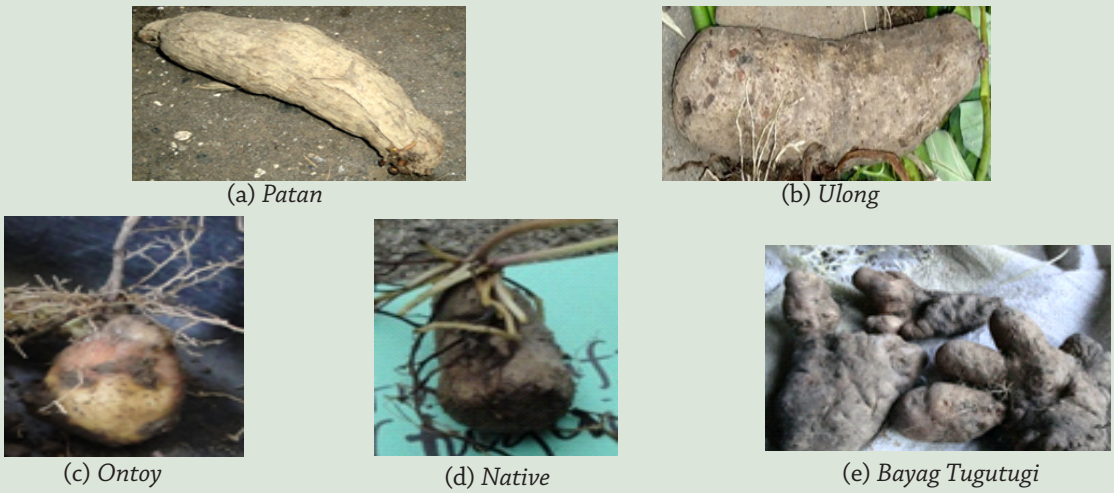
Cultivated Lesser Yam Varieties of the Ibaloi in Tuba, Benguet

Luspak/Dampiray *Ulsod* *Semi-mores*

Bacvag *Mores* *Shiket* *Anajed*

Figure 2

Lesser yam of the Ivatan (a &b), Biga-Kalinga (c), Isneg (d), and Bago (e)



(a) *Patan* (b) *Ulong*

(c) *Ontoy* (d) *Native* (e) *Bayag Tugutugi*

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 are produced if planted in cooler areas called *diteng*. The *Kalanguyas* claimed that their introduced native and commercial lesser yam varieties are endangered.

Description and Variety Attributes

Maturity, eating quality, and yield influence whether farmers continue to plant and conserve the lesser yam. The other attributes commonly

Table 2

Number and Names of Cultivated and Wild Lesser Yam Varieties Identified by the IPs in Northern Philippines

Ethnoscape A. Cultivated	Local Name	Number	Local Name of Varieties
Applai-Kankanaey	*Lokto*	-	-
Bago	*Tugtugi*	4	*Bayag, Biit, Native Tugtugi, Unnamed*
Benguet-Kankanaey	*Tugui*	-	-
Biga-Kalinga	*Ontoy*	2	*Ontoy1, Ontoy2*
Bugkalot	*Tugui*	1	*Unnamed/round type*
Buhid-Mangyan	*Buwang*	1	*Buwang*
Ibaloi	*Balugan*	7	*Luspak or Dampiray, Semi-mores, Ulsod, Anajed, Bacvag, Mores, Shihet-Iloko*
Isneg	*Lufto*	2	*Native, Pangasinan*
Ivatan	*Dukay*	2	*Ulong, Patan*
Iyattuka	*Luktoh*	2	*Luktoh 1, Luktoh 2*
Kalanguya	*Lokto*	2	*Native, Commercial*
Tingguian	*Tugui*	2	*Gawisan, Powegan*
B. Wild Lesser Yam			
Aeta		1	*Limeng*
Biga-Kalinga		1	*Atap ontoy*
Buhid-Mangyans		1	*Borot*
Tingguian		1	*Anayed or Boga*

mentioned by the IPs were spininess of vine stems, and tuber shape (Table 4). Maturity varied from six to 12 months and the presence of spines may either be sparse or dense. Key informants described the tuber shapes as round, oval-oblong, elongated, and irregular. The tubers may either be sweet or bitter and apparently, the bitterness is from the second skin. Other attributes mentioned include direction of tuber growth, i.e., upward and sideward tuber growth, presence of hair, or smoothness of the tuber.

The unnamed lesser yam variety of the *Benguet-Kankana-eys* matures in ten months after planting (MAP). The *Gawisan* and *Powegan* varieties of the *Tingguian* mature in eight months. The *Biit* of the *Bugkalot* and an unknown variety of the *Bago* both mature within six months. Most of the varieties described, however, mature from eight to more than eight months.

Each variety has a unique combination of features by which they are known to the IP. A perceived positive attribute comes together with a less desirable trait. For instance, the *Native Tugtugi* of the *Bagos* is tolerant to environmental stress like a typhoon but has small tubers. The *Bayag* that was introduced to the *Bagos* from Nueva Vizcaya produces 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 produces smaller tubers. The *Bago's* unknown variety similar to Bayag that has upwards and sideward tuber formation termed by the farmer-respondents as *agpogiit*, the tubers are irregularly shaped. The *Bugkalots' tugui* matures at six MAP but has hairy tubers. The *Native* variety of the *Kalanguyas* has small round-shaped tubers similar to potato tubers but the Commercial variety has elongated tubers with thorny skin.

Table 3

Indigenous Lesser Yam Varieties and Extent of Variety Availability

Indigenous People	Indigenous Varieties	Extent of variety availability*		
		Common or Plenty	Few	Rare or Endangered
Bago	*Bayag*		/	
	Biit	/		
	Native Tugtugi		/	
	Unnamed		/	
Bago-Kalinga	*Ontoy 1*	/		
	Ontoy 2	/		
Bugkalot	*Unnamed/ round type*		/	
Buhid-Mangyans	*Buwang*		/	
Ibaloi	*Luspak or Dampiray*	/		
	Semi-mores	/		
	Ulsod	/		
	Anajed		/	
	Bacvag		/	
	Mores		/	
	Shihet-Iloko		/	
Isneg	*Native*	/		
	Pangasinan	/		
Ivatan	*Ulong*	/		
	Patan	/		
Iyattuka	*Luktoh 1*	/		
	Luktoh 2	/		
Kalanguya	*Native*			/
	Commercial			/
Tingguian	*Gawisan*		/	
	Powegan		/	
TOTAL	*25*	12	11	2

**Plenty – when grown by more farmers and can be made available during the harvest period*
Few – when grown by few farmers and may not be available during the harvest period
Rare or endangered – grown before and rarely seen

Some varieties have more positive attributes and are thus preferred by the IP growers. The *Buwang* variety cultivated by the *Buhid-Mangyans* yields 5kg/hill, has a sweet taste and is sometimes considered wild since it is hardly cared for. The *Ivatans' Ulong* and *Patan* varieties are high-yielding, producing 15 kg/hill in nine months. According to the key informants, these varieties are a suitable substitute for macaroni in the preparation of salad. *Ontoy 1* of the *Biga-Kalinga* has spreading tuber growth, with the bitter outer skin, but is high yielding with desirable round to oblong shape tubers. *Ontoy 2* on the other hand, is deep-rooted, has a sweet taste, and produces bigger tubers.

Table 4

Description and Other Attributes of Indigenous Lesser Yam Varieties

Local Name	Ethnoscape	Maturity (months)	Taste	Yield & tuber size	Tuber shape	Other Atrributes
Biit	*Bago*	1		small		less weight
Unknown	*Bugkalot*	1			1	hairy tubers
Gawisan	*Tingguian*	3			1	
Native	*Isneg*	3	3		1	smooth skin, upward tuber growth
Unnamed	*Bago*	3			6	Upwards and sideward tuber formation
Powegan	*Tingguian*	3		big	7	
Ulong	*Ivatan*	3		one big 15kg tuber/hill	7	smooth skin
Patan	*Ivatan*	3		big tubers	7	cracked skin
Pangasinan	*Isneg*	3	1		7	hairy tuber, thorny, downward tuber growth
Ontoy2	*Biga-Kalinga*		1	big	7	
Luspak or Dampiray	*Ibaloi*		1			short solon
Buwang	*Buhid-Mangyan*		1	5kg/hill		wild type
Ulsod	*Ibaloi*		1	many small tubers	7	thick skin but cooks easily, no spines
Bacvag	*Ibaloi*		1	clustered		hairy tubers, but has slightly bitter taste, preferably planted
Bayag	*Bago*	3	3	large	6	spiny
Shihet-Iloko	*Ibaloi*		3			long spines that is difficult to rot, suitably planted in warm areas
Ontoy1	*Biga-Kalinga*		3	big	3	
Semi-mores	*Ibaloi*		3			second skin is bitter
Native-Tugtugi	*Bago*			small tubers		with spines, high tolerance to stress
Anajed	*Ibaloi*			big tubers		easy to multiply, many runners
Mores	*Ibaloi*			3-4 big tubers/ hill		long spines, bitter or if not skinned, best (original) variety
Luktoh 1	*Iyattuka*					with many *pitngil* or tuberlets
Luktoh 2	*Iyattuka*					with many *pitngil*
Native	*Kalanguya*			small tubers	1	
Commercial	*Kalanguya*				7	thorny

Legend:

Maturity
1- Up to 6 months
2-7 months
3-8 months or more

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 traditional rootcrop knowledge (TRK) scores that specifically focused on production and utilization 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 was not affected by the three age groups although it is expected that the older age group knew more and this was reflected as it had the highest score with 70%. There was no significant difference in gender on TRK in lesser yam although there was a higher TRK score among males (68%) than the females (63%) maybe because the males are the ones who are engaged mostly in farming activities.

Differences in TRK mean scores by the source of knowledge are highly significant. Traditional knowledge on lesser yam is mostly learned from kin, relatives, and friends (66%), and when amplified by media, TRK mean scores increased to 86% (Table 6). Kin, relatives, friends, and media are considered immediate environment that plays a significant role in forming and influencing people's attitudes and behavior. Significant differences were found between the different occupations. The students who have greater access to information from kin and media, followed by the farmer, the unemployed household members in the village, and the elderly are more knowledgeable on lesser yam than the employees or businessmen. TRK scores are not influenced by educational attainment though those who have not attended any formal schooling are more knowledgeable on lesser yam and probably because they are the ones engaged in farming or stay home in the village. Nobody learned IK on lesser yam from school, church, and extension services alone.

Retention or Loss of Traditional Rootcrop Knowledge

Conceptual knowledge pertains to knowledge on the diversity and variety of cultivated lesser yam. The practical skills component pertains to cultivation and utilization practices. The computed vitality indices as shown in Table 7 invalidated the assumption that the oldest age group of 57-77 years knew more than the middle age group (36-56 years) and the younger age group (15-35 years). There is not only retention but there was an increase in the intergenerational rate of retention (RG) and cumulative retention rate (RC) in both the middle age group (36-56 years) of male and female *Iyattukas*, and to some extent with the male *Tingguians*, with a vitality index of greater than one.

The annual rate of change showed that there is a 1-3 percentage decrease in knowledge on lesser yam between the middle age group and the younger age group but an increase in knowledge between the middle age group and the older age group at 1-2% annually. There is a loss of knowledge among the younger age group (15-35 years) probably because the younger age group are not much involved in farming activities because they do some other tasks or they may be employed but not related to agriculture where there is no opportunity to transfer knowledge on lesser yam. On the other hand, the retention and even increase in IK between the middle age group and the older age group is because they are the ones doing the farming activities as a source of food and income.

Table 5

Traditional Rootcrop Knowledge Scores on Lesser Yam by IP, Age, and Gender Groups in Northern Philippines

Grouping variable	Variables	TRK mean scores (%)	*p-value*	*Eta*
IP Group	*Ibaloi*	34	*0.000*	*0. 529*
	Bago	90		
	Tingguian	83		
	Iyattuka	54		
Age Group(years)	15-35	57	*0.092*	*0.202*
	36-56	58		
	57-77	70		
Gender	Male	68	*0.241*	*0.134*
	Female	63		

Table 6

Traditional Rootcrop Knowledge Scores on Lesser Yam According to Source, Occupation and Educational Attainment

Grouping Varibale	Variables	TRK Mean Scores (%)	*p-value*	*Eta*
Source of knowledge	1- Kins, realtives, friends 2- School, church, extension services	66	*0.002***	*0.356*
	3- Media (print, radio, TV)	50		
	1, 2 and 3	76		
	1 and 2	45		
	1 and 3	86		
Occupation	Unemployed	69	*0.035**	*0.290*
	Farmer	71		
	Employee	46		
	Student	76		
	Businessman/woman	33		
	Others-pensioners etc.	67		
Educational attainment	No formal education	75	*0.813^{ns}*	*0.100*
	Reached elementary	62		
	Reached high school	50		
	Reached vocational	57		
	Reached college	43		

Table 7

Vitality Indices of Tradtional Rootcrop Knowledge on Lesser Yam Among the Selected IPs in Northern Philippines

Age Group	Indigenous People	Intergenerational Rate *of Retention (RG)*		*Cummulative Rate of Retention (RC)*		*Annual Rate of Change (CA)*	
		Male	Female	Male	Female	Male	Female
15-35	*Ibaloi*	0.88	*0.83*	*1.08*	*0.78*	*0.01*	*- 0. 02*
	Bago	1.14	*0.81*	*1.00*	*0.86*		*- 0.01*
	Iyattuka	0.20	*0.56*	*0.67*	*0.82*	*- 0.03*	*- 0.02*
	Tingguian	1.00	*0.96*	*1.19*	*1.08*	*0.02*	*0.01*
36-56	*Ibaloi*	1.34	*0.64*	*1.14*	*0.83*	*0.01*	*- 0.01*
	Bago	0.88	*0.88*	*0.95*	*0.95*		
	Iyattuka	2.00	*1.11*	*1.35*	*1.05*	*0.02*	*0.00*
	Tingguian	1.00	*0.96*	*1.19*	*1.08*	*0.02*	*0.01*
57-77	*Ibaloi*	1.00	*1.00*	*1.00*	*1.00*		
	Bago	1.00	*1.00*	*1.00*	*1.00*		
	Iyattuka	1.00	*1.00*	*1.00*	*1.00*		
	Tingguian	1.00	*1.00*	*1.00*	*1.00*		

Discussion

Cultivated lesser yam is one of the roots and tuber crops (RTC) planted in the different landscapes of the IPs. Lesser yams either grow wild, along river banks, or in the forests. Lesser yam is one of the mixed crops grown in swidden farms, a common farmscape where the IPs usually grow their root crops. Also, planted for food and cash purposes but more as a sort of insurance crop for occurrences of food insecurity or if the other crops fail. Lesser yam is one of the subsistence crops in typhoon-prone Batanes island province and the consumption of wild yams by El Nino drought-affected upland farmers, and by fishermen and farm laborers while awaiting harvest of the wet season rice crop (Dayo et al., 1998; Gayao et al., 2013). Wild lesser yams were harvested before because of food security and are still harvested today, especially among the older generation of the IPs. Indigenous varieties may have lost their importance due to the development and introduction of new conventional crop varieties. The decline in the cultivation of roots and tuber crops which include lesser yam may have been affected due to the introduction of other crops and the need for cash among the indigenous growers. Food preference, easy availability of alternate varieties, availability of subsidized food items, lack of avenues of local produce, and non-availability of quality planting materials are some attributes in the decline of heirloom vegetable cultivation (Chorol et. al., 2018).

Traditional knowledge is most comprehensively transmitted by elders to youth and children. However, formal education and social media have obscured the oral transmission of traditional knowledge from elders. There are fewer opportunities, especially for children, to spend time with and learn from parents, grandparents, and others who are knowledgeable about environmental conservation practices and beliefs. Culturally significant and environmental education programs can counter these losses as can hands-on activities and practices on traditional grounds, and/or field sites of rare and endemic species.

Among the indigenous people, the roots and tubers are not only used for meeting household food needs but are also traded, used for medicinal purposes, and as gifts and offerings. In the eyes of the people, root and tuber crop farming inculcates the virtues of industriousness and self-reliance. Unfortunately, only those born before the 1980s retain traditional knowledge of the diversity and variety of roots and tubers, cropping practices, and utilization. The younger generation already exhibited a loss in both conceptual knowledge and practical skills regarding roots and tubers. Conceptual knowledge pertains to the lesser yam varieties, where are these planted, and their utilization. Practical skills pertain to cultivation and utilization practice including the local terms for said cultivation and utilization technology.

Knowledge transfer is defined as one direction, and focused type of communication of knowledge that occurs between individuals, groups, or organizations where the knowledge receiver has cognitive understanding, can use the knowledge or applies the knowledge. Athayde et al. (2017), found out that native language proficiency and formal schooling were important variables in the retention and erosion of IK in weaving.

Conclusion and Recommendation

The loss of traditional knowledge on the cultivated and wild species of the indigenous lesser yam varieties is a reality only among the younger generation, particularly those born in the 1980s. There is no loss or little loss of knowledge for those born before the 80s. But 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. 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 results from accumulated individual and communal experiences to solve problems which can be a rich source of hypotheses for scientific validation or a springboard for innovations and inventions. Also, regardless of ethnicity, age, gender, occupation, and educational attainment, traditional knowledge on roots and tubers diversity, production, and utilization techniques could be enhanced by sharing information in schools, extension services,

and media, not only from the elderly, parents, relatives and friends.

The NPRCRTC could be a learning site on indigenous production and utilization practices in Northern Philippines. Other learning sites provided by agencies like the Agricultural Training Institute of the Department of Agriculture (DA-ATI) can aid in the retention of knowledge with hands-on activities. Likewise, awareness about the important role of roots and tubers which include lesser yam in household food security and income should start by teaching children to regularly eat roots and tubers.

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