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LOSS OF TRADITIONAL ROOTCROPS KNOWLEDGE (TRK) AMONG SOME INDIGENOUS PEOPLES IN NORTHERN PHILIPPINES

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ABSTRACT

The documentation of traditional knowledge on root and tuber crops production and utilization was done prior to this study of determining the loss of knowledge on the production and utilization of traditional root and tuber crop commodities among the *Ibaloi, Bago, Tingguian* and *Iyattuka* indigenous peoples in northern Philippines.

Results of this study showed that loss of traditional knowledge on root and tuber among the indigenous peoples is a reality only among the younger generation, particularly those born starting in the 1980's. Loss of knowledge among the younger generation pertains both to conceptual and practical domain. Conceptual knowledge pertains to the diversity and variety of roots and tubers, growing landscapes, cropping practices and uses and local terms on roots and tubers. Practical skills pertain to cultivation and utilization practices.

There is no loss or little loss of knowledge for those born before the eighties. The one percent annual loss of knowledge among the 36-56 years middle age group is in practical skills on the cultivation and utilization practice, including the local terms for said cultivation and utilization practices. An exception is among the *Ibalois* who exhibited not a loss but an annual one percent increase in traditional roots and tubers knowledge.

Loss of knowledge for those born after the eighties is higher, ranging from 37-64% reflecting an annual loss of 2-3% among the 15-35 years age group of the *Bagos* and *Tingguians* and a one percent annual loss for the younger *Ibalois* and *Iyattukas*.

Keywords:*traditional root crops knowledge, Ibaloi, Bago, Tingguian and Iyattuka, indigenous peoples*

INTRODUCTION

Root and tuber crops have been identified as food crop that would to feed the world in coming decades (Scott *et al*., 2000). By 2020, well over two 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 sources of food, nutrition and cash income. However, 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, indigenous peoples or ethno-linguistic groups. Such bias, obscured further by the changes in environment, culture, food systems, political and economic structures and lack of information, consequently led to erosion or loss of knowledge. This in turn may compromise household food security, income and dietary intake. As observed and as mentioned in Niehof (2010), the younger generation no longer recognizes some traditional foods like root crops.

Anthropological writings, published and unpublished literatures (Beyer, 1955; Keesing,

1962 and Conklin, 1967 as cited by Acabado, 2012; Sano *et al.*, 1991; Balaki and Solimen, 1991; Verdonk, 1991; Solimen *et al.*, 1998; Dayo *et al.*, 1998; Tangonan, 2008) documented the importance of root and tuber crops among indigenous peoples in northern Philippines especially sweetpotato, taro, cassava and yam as staple, subsistence or survival crops; there is however lack of information on cultivation and utilization practices that includes the lesser known and/or wild roots and tubers. Thus, prior to the conduct of this research phase, documentation of indigenous knowledge was also done and published in the Traditional Rootcrops Knowledge Series, #1, #2, # 12 and #13 (Gayao *et al*., 2014).

Seldom is loss of knowledge measured, hence, the objective of this research is to determine the erosion or loss of knowledge on the production and utilization of traditional roots and tuber resources among the *Ibaloi*, *Bago*, *Tingguians* and *Iyattuka* indigenous peoples in Northern Philippines.

METHODOLOGY

Features of the VITEK (Vitality Index of Traditional Environmental Knowledge) methodology as presented by Zent (2008; 2010), like the listing/documentation of traditional knowledge, defining the conceptual knowledge (know-what) and the practical skills (know-how) knowledge, preparing the traditional knowledge aptitude test questionnaire, then administering the test to a sample of selected subjects were done.

Documentation of traditional knowledge on root and tuber crops production and utilization practices among the 13 IPs (the *Ibaloi*, *Bago, Aeta, Ivatan, Isneg, Buhid-Mangyans, Biga-Kalingas, Bugkalot, Kalanguya, Tinggiuan, Kankana-ey, Iyattuk*a and *Applai-Kankana-ey*) in Northern Philippines was done in the first phase of this research. The results were the bases for preparing the list of traditional knowledge and the aptitude test questionnaire in this study.

Selection of Sites/ Indigenous People (IP)

Out of the 13 IPs, the *Ibalois* of Taloy Sur in Tuba, Benguet; the *Bagos* of Banga and *Malikliko* in Sugpon, Ilocos Sur and Sudipen, La Union; the *Masadiit Tingguians* of Labaan in Bucloc, Abra; and the *Iyattukas* of Amduntog in Asipulo, Ifugao were selected. Selection was based on accessibility of location and the availability of resident research coordinators.

Test Questions

Four sets of questionnaires consisting of simple questions answerable by multiple choice, yes-no, or true-false were prepared for the selected groups. The number of traditional rootcrops knowledge (TRK) questions and responses varied among the IP groups depending on the documented indigenous knowledge specific to production and utilization of roots and tubers (Table 1). 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. In addition, the respondents were also asked to indicate from whom or where they learned such knowledge. Questions were reviewed by the previous phase key informants or local researchers. The test questions were translated in the local dialect in the case of the *Bagos* and *Tingguians.*

Table 1. Number of traditional roots and tubers knowledge questions administered per IP group

IP Group	Conceptual Knowledge	Skills Knowledge	Total
Ibaloi	96	26	122
Bago	59	10	69
Tingguian	52	10	62
Iyattuka	33	12	45
Total	240	58	298

Test Administration/Test Subjects or Respondents

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, and belonging 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 (Table 2). The respondents were purposively identified with possible replacements from the available and willing resident IPs at the 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 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.

Analysis

To test differences and relationships in scores as influenced by age groups, gender, education, occupation and source of knowledge, the chi-square analysis (Pearson's chi-square and Pearson's R) in the SPSS software was used. The 5% level of significance or probability was used in the analysis.

ForttheVITEKstatistics,*i.e.*theintergenerational rate of retention (RG), the cumulative rate of retention (RC) and the annual rate of change (CA), formulas used were the following:

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

RGt= gt/gr where gt- mean score of the target age group (younger age group)
gr– 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(s) is available and therefore it cannot be assumed 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:

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

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

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

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

RESULTS

Traditional root crop knowledge (TRK) test results among the IP groups and age groups

Traditional knowledge of root crops among the IP groups showed significant differences (p.05) in both the conceptual and skills components and in the total test scores (Table 3). The *Iyattukas* of Ifugao showed highest total test score (56.21%) followed by the *Tingguians* of Abra (49.83%), the *Ibalois* of Benguet (46.79%) and lastly the *Bagos* of Ilocos Sur and La Union (41.12%). This trend is consistent with the conceptual knowledge test scores, but not in practical skills test scores where the *Ibaloi* was second to the *Iyattuka* at 62.37% and 62.91%, respectively.

TRK test scores among age groups also differed significantly (Table 3). As expected, there was a declining trend in root and tuber crops knowledge with the oldest age group (57-77 years old) having the highest TRK scores, followed by the middle age (36-56 years) group then the youngest (15-35 years) age group for both the conceptual and skills component and the total score at 55.24%, 53.15% and 36.83%, respectively.

TRK test score between males and females was not significantly different. Further, the relationship of test scores to age group was significantly closer than the relationship of test scores to IP grouping and gender which showed weak association based on Pearson's R values of less than 1 (Table 3).

Loss of traditional root crop knowledge

In general, there is a loss of TRK between the younger age group and the middle age group as shown by the intergenerational rate of retention

Table 2. Number of traditional knowledge test subjects per IP groups and age groups

IP Group	Male	Female	Total	%
Ibaloi	16	22	38	24.1
Bago	20	22	42	26.6
Tingguian	19	17	36	22.8
Iyattuka	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

Table 3. Traditional root crop knowledge scores among the indigenous peoples, age groups and gender

IP Group	TRK Mean Scores (%)			Age Group	TRK Mean Scores (%)			Gender	TRK Mean Scores (%)		
	Concept	Skills	Both	(years)	Concept	Skills	Both		Concept	Skills	Both
Ibaloi	42.50	62.37	46.79	15-35	34.04	46.21	36.83	Male	45.41	51.65	46.91
Bago	41.52	38.86	41.12	36-56	52.51	54.72	53.15	Female	45.56	56.00	48.66
Iyattuka	53.67	62.91	56.21	57-77	52.83	63.98	55.24				
Tingguian	48.33	56.94	49.83								
Pearson's chi-square value	0.023	0.030	0.022	0.016	0.013	0.013	63.95ns	43.81ns	51.88ns		
Sig	0.010	0.000	0.013	0.012	0.000	0.195	0.443	0.205	0.765		
Pearson's R value	0.180	0.041	0.153	0.406	0.271	0.405	0.058	0.119	0.08		
Sig	0.240	0.606	0.055	0.000	0.001	0.000	0.481	0.138	0.315		

(Table 4) and the cumulative retention rate (Table 5).

For both conceptual knowledge and practical skills among male and female, the younger age group of *Tingguians* knew only 52% and the younger *Ibalois* knew 68% of middle age group TRK based on the intergenerational rate of retention or 47% and 79% respectively based on the cumulative rate of TRK retention. The younger *Bagos* knew 73% retaining 66% of middle age TRK; and the younger *Iyattukas* knew 80% retaining 79% of the middle age TRK.

Between the middle age group and the oldest age group (57-77 years), there was less loss of TRK only among the *Bagos* and *Tingguians*. In fact, TRK increased among the *Ibalois*, while among the *Iyattukas*, the middle and oldest age TRK remained the same except in the skills component and among the female group as indicated by the green-colored rates in Table 4 and Table 5.

Loss of conceptual knowledge pertains to knowledge on the diversity and variety of roots and tubers, roots and tubers landscapes, cropping practices and uses, and local terms of the aforementioned. Practical skills component pertains to cultivation and utilization practices including the local terms for said cultivation and utilization technology.

Table 6 shows the annualized rate of change according to age, IP group and gender and by concept and skills component. The results are color-coded to highlight significant negative or positive

Table 4. Intergenerational rate of TRK retention between successive pair of age groups of selected IPs in Northern Philippines

Age Group	IP Group	Rate of Retention (RG)					
		Concept	Skills	Both	Male	Female	Both
15-35 years	*Ibaloi*	0.68	0.71	0.68	0.62	0.75	0.68
	Bago	0.69	0.83	0.73	0.80	0.64	0.73
	Iyattuka	0.72	0.54	0.80	0.70	0.80	0.80
	Tingguian	0.48	0.69	0.52	0.38	0.64	0.52
36-56 years	*Ibaloi*	1.19	1.00	1.16	1.15	1.17	1.16
	Bago	0.96	0.80	0.91	0.93	0.89	0.91
	Iyattuka	1.00	0.80	1.00	1.10	0.90	1.00
	Tingguian	0.94	0.87	0.93	0.89	0.96	0.93
57-77 years		1	1	1	1	1	1

Table 5. Cumulative rate of TRK retention reflecting baseline knowledge level retained by each succeeding age group of selected IPs in Northern Philippines

Age Group	IP Group	Rate of Retention (RG)					
		Concept	Skills	Both	Male	Female	Both
15-35 years	*Ibaloi*	0.81	0.71	0.79	0.81	0.71	0.79
	Bago	0.66	0.66	0.66	0.74	0.57	0.66
	Iyattuka	0.78	0.70	0.79	0.78	0.87	0.79
	Tingguian	0.45	0.60	0.47	0.34	0.62	0.47
36-56 years	*Ibaloi*	1.19	1.17	1.16	1.19	1.00	1.16
	Bago	0.96	0.80	0.91	0.93	0.89	0.91
	Iyattuka	1.00	0.89	1.00	1.00	0.79	1.00
	Tingguian	0.93	0.87	0.93	0.89	0.95	0.93
57-77 years		1	1	1	1	1	1

Table 6. Annual rate of change in traditional rootcrops knowledge of selected IP's in Northern Philippines

Age Group	IP Group	Rate of Change (CA)			
		Concept	Skills	Male	Female
15-35 years	*Ibaloi*	-0.01	-0.01	-0.01	-0.01
	Bago	-0.02	-0.02	-0.02	-0.02
	Iyattuka	-0.01	-0.01	-0.01	-0.02
	Tingguian	-0.03	-0.02	-0.03	-0.02
36-56 years	*Ibaloi*	0.01	0.00	0.01	0.01
	Bago	0.00	-0.01	0.00	-0.01
	Iyattuka	0.00	-0.01	0.01	-0.01
	Tingguian	0.00	-0.01	-0.01	0.00
57-77 years		0.00	0.00	0.00	0.00

trends for the younger generation as compared to the older generation. Green indicates a significant decrease in knowledge (loss rate of> 1% per year), red indicates a very sharp decrease (loss rate of > 2% per year) and blue indicates a significant increase in knowledge. The younger age groups (15-35 years) of the *Bagos* and *Tingguians* showed a faster decline of 2-3% annually in traditional root crops knowledge than the *Ibaloi* and *Iyattuka* younger age group at a 1% TRK loss per year. Among the middle age group (36-56 years) a significant TRK loss of 1% annually is shown only in practical skills component of the *Bago*, *Iyattuka* and *Tingguian* IP's, specifically the male *Tingguians* and the female *Bagos* and *Iyattukas*. The middle age group of *Ibalois*, however, exhibited not a loss but an annual 1% increase in TRK knowledge.

Other factors affecting changes in traditional root crops knowledge

Though individual differences in TRK means scores are significant based on Pearson's chi-squire values of less than 5%, the influence of occupation, education and access to information to mean scores is very little as shown by the Pearson's R values in Tables 7, 8 and 9.

Nevertheless, old-age pensioners, farmers and stay-home wife/husband had higher TRK scores (53, 52 and 49%) respectively, than the students, businessmen/women and employees (36, 40 and 43%) respectively, as shown in Table 7. Those who did not attend formal education classes and those who had attended vocational courses showed higher TRK scores (55% and 54% in Table 8) as compared to those who reached elementary, high school and college (45-49%). Test subjects who learned TRK from school, church and extension services garnered highest test scores at 62% than those who learned TRK from media (54%), kin, relatives and friends (46%) or from a combination of sources (Table 9).

DISCUSSION

In general, mean test scores of the IP groups knowledge on their root and tuber crops, production and utilization practices, aggregated further into age groups and gender are significantly different (except gender) but not impressive at scores ranging from 37-64% of the expected 100%. This result already signifies either decreased root crop cultivation or a diminished utilization of roots and tubers for household food and cash income source purposes. The *Ibalois, Iyattukas, Bagos* and *Tingguians* have now diminished swidden farm areas (600-1,000 m_2) and rootcrops (2-750 plants/ hills) unlike before the 1980's (Gayao *et al*., 2013; 2014). The intensive usage of spaces near or along the rice terraces (the *lobah* or the wider side of the pathway, *tonong* or the top of pathway, *aping* or the shorter/ inner side of the pathway and *dulyah*, the dry land within the perimeters of the ricefield) 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.

The decrease in cultivation and use of roots and tubers will not immediately result to loss of knowledge or skills. This was shown in the case of the middle age group (36-56 years) who had higher retention rates even surpassing that of the oldest age group (57-77 years) and this can be due to the fact that they were exposed to root crop cultivation and consumption at a young age. The younger age group (15-35 years) who had less or no exposure to learning TRK had lower test scores and retention rates. This again reiterates the need to document and share indigenous practices on roots and tubers and raise awareness on the value of indigenous knowledge in the community, not necessarily only from elders but also from schools, extension services and media.

Rates of retention of the middle age group that surpassed, maintained or decreased as compared to the oldest age group confirms that indigenous knowledge is dynamic and not static. TRK is enhanced by internal and external knowledge and experiences. Increase in TRK, *e.g.* in the area of nutrition and health value of eating organic food like root crops was shown by the middle age *Ibalois*.

Table 7. Traditional root crop knowledge mean scores according to occupation of selected indigenous peoples in Northern Philippines

Occupation	TRK Mean Scores (%)		
	Concept	Skills	Both
Stay-home wife/husband	48.50	54.77	49.92
Farmer	50.86	58.01	52.33
Employee/ wage earner	41.65	50.70	43.95
Student	32.95	49.18	36.45
Businessman/woman	37.14	49.43	40.29
Others- pensioners, *etc*.	52.00	55.00	53.00
Pearson's chi-square value	0.033	0.025	0.029
Sig	0.243	0.001	0.584
Pearson's R value	0.167	0.080	0.152
Sig	0.036	0.316	0.056

Table 8. Traditional root crop knowledge mean scores according to education of selected indigenous peoples in Northern Philippines

Education	TRK Mean Scores (%)		
	Concept	Skills	Both
No formal schooling	56.67	54.60	55.00
Reached elementary	43.74	51.26	45.58
Reached high school	47.64	56.13	49.58
Reached vocational	54.33	53.67	54.22
Reached college	44.98	56.22	47.59
Pearson's chi-square value	0.029	0.015	0.025
Sig	0.034	0.394	0.254
Pearson's R value	0.019	0.047	0.001
Sig	0.809	0.556	0.990

Table 9. Traditional root crop knowledge mean scores according to source of knowledge of selected indigenous peoples in Northern Philippines

Source of Knowledge	TRK Mean Scores (%)		
	Concept	Skills	Both
1- Kins, relatives, friends	44.24	53.29	46.37
2- School, church, extension services	48.00	100.00	62.00
3- Media (print, radio, TV)	49.50	66.75	54.25
4- 1,2 and 3	53.03	56.79	53.82
5- 1 and 2	36.94	52.44	40.17
1 and 3	56.20	58.20	56.43
Pearson's chi-square value	0.032	0.022	0.031
Sig	0.667	0.063	0.287
Pearson's R value	0.125	0.046	0.107
Sig	0.118	0.568	0.180

The younger and middle age *Ibaloi* and *Tingguian* females and younger age *Iyattuka* females scored higher retention rates (75-117%, 64-96%, 80-90%, respectively) than the males at 62-115%, 38-89% and 70-110%, respectively. This was attributed to the fact that it was the women (unemployed mothers, widows and grandmothers) who stay at home in the villages to take care of young children, oversee care taking of farm and forest lands and the person in-charge of day to day household food, while the men folks oversee land preparation and harvesting of rice and cash crops. As such, the women are more knowledgeable on collecting, planting, harvesting, cooking and preserving the different kinds of roots and tubers. Until now, small quantities of roots and tubers are exchanged or sold by stay home women and elders for kitchen necessities and cash needs. This is different in the case of the *Bagos* where men have higher retention rate (80-93%) as compared to the female retention rate of 64-89%. This is because of greater yam cultivation which is now a cash crop included in upland rice farming.

Loss of knowledge was also measured by the annual rate of change wherein the younger age group of the *Bagos* and *Tingguians* regardless of gender had a faster loss of TRK (2-3% annually) for both the conceptual and skills domain, than the younger *Ibalois* and *Iyattukas* and the middle-age group in skills domain (1%). Most of the younger age group failed to identify or recognize the diversity of their root and tuber resources planted or gathered in the wild, the local names of their varieties, techniques of planting and cooking and other uses. On the other hand, the middle age group retained their conceptual TRK, *i.e.*, their knowledge is similar to that of the oldest age group while that of the *Ibaloi* middle age group increased their knowledge. This is because most of them had the opportunity to learn from their 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. The differences in TRK retention or loss among age group and domains validate the general conclusion from a case study by Zent (2008) that an understanding of traditional knowledge retention or loss requires multiple measures disaggregated by semantic domain and socio demographic group.

The schools, church and barangay-based extension services (mostly health and nutrition workers in this study) are the most mentioned sources of TRK knowledge, more than media or kin, relatives or friends alone which means that TRK could be learned regardless of ethnic group, age, gender, education and occupation.

CONCLUSIONS AND RECOMMENDATIONS

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 peoples 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 80s.

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 result 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 a source book of roots and tubers resources in Northern Philippines and a summary of indigenous production and utilization techniques on roots and tubers which could guide farmers and future entrepreneurs.

Regardless of ethnicity, age, gender, occupation and educational attainment, traditional knowledge on roots and tubers diversity, production and utilization techniques could also be enhanced by sharing information in schools, church, extension services and media, not only from elderly, parents, relatives and friends. The Northern Philippines Root Crops Research and Training Center could be a learning venue on indigenous production and utilization practices in Northern Philippines and elsewhere in the world.

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