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Development and Validation of Knowledge Test on Indigenous Alder based *Jhum* Cultivation and Mechanism for Knowledge Dissemination

Priti Priyadarshni[1]*, R.N. Padaria[2], R.R. Burman[2], Rashmi Singh[2] and Sanjoy Bandyopadhyay[2]

ABSTRACT

Jhum cultivation has been blended in the tradition of hill's tribes. Narrowing *Jhum* cycle has a devastating effect on the land and environment. In order to overcome the effect of *Jhum* cultivation, the famers of Khonoma village, Nagaland has indigenously developed very economical and unique model of Alder based *Jhum* cultivation with terrace farming on lower latitudes. To maintain the essence of this model, village developed *Thesu* group to transfer the knowledge from generation to generation. The present study aims at development of knowledge test to measure the level of knowledge about Alder based *Jhum* cultivation among the different age groups in Khonoma village, Kohima district, Nagaland. A set of 16 items were prepared and with content validation administered to randomly selected 45 farmers. Based upon the Item difficulty index and item discriminatory power, a set of 12 items was selected. Cronbach's Alpha of 0.904 established its reliability and the validity was established with discriminant validity. The average knowledge was found to highest among young farmers who were actively involved in agricultural activities.

Keywords: Development, Dissemination, Indigenous, Knowledge, Mechanism, Validation

INTRODUCTION

Shifting cultivation is blended with tradition and culture of the North-eastern people of India (Ranjan *et al.*, 1999 and Radhakrishnan *et al.*, 2006). Increasing population and shrinking of landholding has been creating food and livelihood scarcity in Himalayan region (Pokhriyal and Bist,1988; Partap, 1998a). Consequently, there is conversion of forest area into *Jhum* land. The tribes of Nagaland too follow *Jhum* cultivation. Also the *Jhum* cycle is narrowing to fulfill the food demand. UNDP has reported that earlier *Jhum* cycle was of 40-45 years then reduced to 5-10 years, now it has reduced to 2 years (Pratap, 2011). It has resulted in a large scale soil erosion, land degradation, forest denudation and water stress. Amidst this system of sole *Jhum* cultivation, the *Angami* tribes from village Khonoma of Kohima district, Nagaland devised Alder based *Jhum* cultivation which is sustainable and eco-friendly. They practice integration of terrace faming and Alder based *Jhuming*. *Alder nepalensis* is a non-leguminous deciduous or semi-deciduous tree belonging to the family *Betulaceae*. It can be easily grown on gravelly and unstable old cultivated land. Alder tree can grow up to a height of 30 m and 60 cm in diameter. It is a pioneer species of degraded lands and does not require fertile soil but prefers permeable soils. Alder is a fast growing tree usually grown at 500–3000 m of elevation, prefers moist, cool climates with mean annual temperature of 13-26°C (Kehie *et al*., 2017). Alder based *Jhuming* is a combination of terrace farming upto 1000 m from mean sea level, Alder based *Jhuming* upto 1000-1500 msl, and

[1]Ph.D. Scholar, [2]Principal Scietist, ICAR-Indian Agricultural Research Institute, New Delhi-110012
*Corresponding author email id: priyadarshani.priti@gamil.com

from 1500-3000 msl there is conserved forest area. On terrace area, they mainly grow Paddy. In *Jhum* area, the crops are grown as intercrop along with Alder tree. In the first year of *Jhuming* in the month of November-December, Alder trees are pollarded from the height of 2m and bushes & grasses are slashed and left for drying. Pollarded heads are covered with mud or straw to prevent it from drying. Alder tree has symbiotic relationship with *actinomycetes* of the genus *Frankia.* It improves the degraded *Jhum* lands in fallow period through nitrogen fixation (Rathore *et al*., 2010). The total litter yield of alder depends on the number of plants and amount of nitrogen (N) fixed varies between 48.3 kg/ha (60 trees/ha) to 184.8 kg/ha (625 trees/ha). Besides fixing atmospheric N, the litter added to the soil provides phosphorus, potassium, calcium and other nutrients through the addition of biomass (Sharma and Prasad, 1994; Sharma and Singh, 1994; Rathore *et al*., 2010). Success of this model is not only due to its agro-economic benefit but also because of village institutional arrangement which allows farmers to work together. Village has village development council to see administrative affairs, Nature conservation and Trogopan Sanctuary Committee (NCTSC) for conservation of forest, youth union to organize festivals and labour group to look after agriculture practices. The essence of this model lies in the "social learning platform" which they have made to transfer the knowledge from generation to generation. They have *Thesu* group which is a group of younger children of age 9-10, it is also known as "Age group". *Thesu* is formed on the occasion of their *Therakyni* festival, which is celebrated after 2 months of the sowing of agricultural crops. In this period labourers are free, so one labour is assigned to one *thesu* group who act as guide/parent of that group and he/she is responsible for teaching all agricultural practices, customs, rituals, folklores, sayings and beliefs of the village. Also, *thesu* group is provided with agricultural lands to gain practical knowledge. This arrangement maintains the legacy as well preserves the essence of the old-aged developed model. In order to measure the knowledge level of the farmers about this model and to know their understanding of the practices, a knowledge test was developed on Alder based *Jhum* cultivation.

METHODOLOGY

Knowledge test construction involves systematic generation of pilot test items from review of literature, expert review of pilot items, and calculation of pilot item properties (Sullivan and Dunton, 2004). Knowledge test development involves scientific steps *i.e.* item collection through preliminary screening, Items selection based on experts' judgments; Item Analysis (Difficulty Index, Discrimination Index), Testing Validity of the knowledge test, Testing reliability of the knowledge test, and Final Administration to the study area respondents. Nunnally and Berstein (1994) suggested to take more pilot items than anticipated number of items in the final version. Althouse (2000) suggested that we need to follow psychometric principles to develop a reliable test. For the present study, relevant items related to Alder-based *Jhuming*, terrace farming, practices followed in hill cultivation, village institutions, activities followed in village were selected from review of literature and pilot interview from the head of the village. With experts' opinion, items were refined and content validation was done. A total of 16 initial items were selected. Each item was assigned score of 1 for correct answer and 0 for incorrect answer. The knowledge test was developed by analyzing item properties *viz.* item difficulty index, discrimination indices, reliability and validity of the test. The items were administered to the 45 farmers of the Khonoma village of Kohima district, Nagaland. Khonoma village is famous for its unique Alder-based *Jhum* cultivation. It is located near 20 km west of Kohima city. The village has a total population of about 3000 belonging to 600 families. About 80 per cent of the population is involved in agriculture. The village is dominated by *Angami* tribes with three residential segments known as *Khel.* Being the hilly area, village has no proper land record. The terraces are mainly divided into plots with the help of stone as indication. Village institution is responsible for the conflict management. There is no intervention of external party for any type of conflict. The average plot per household is 3.3 for terrace and 2.4 for *Jhum*. Personal interviews were conducted to collect the data.

Item Difficulty Index, Item Discrimination, Internal consistency and Validity were calculated with standard

methodologies**.** Althouse (2000) defined item difficulty (p-value) as the proportion of respondents who has answered correctly. Difficult items possess low p-value whereas easy items have high p-value. So, to properly distinguish knowledgeable respondents, it is suggested to avoid items with very high and low difficulty index. Item difficulty index ($p_{i)}$ was calculated with formula:

pi = (number of people getting an item correct) / (number of people taking the test)

Item discrimination is a correlation between scores of items with respondent's total score. This correlation is known as Point-biserial correlation (Item-total correlation) and referred as discrimination index. It is used to distinguish between low scoring respondents and high scoring respondents. If low scoring respondents are getting particular item correct while high scoring respondents are missing that item, then there may be ambiguity in the item. Item discrimination index for each item was calculated. Cronbach's alpha was used to measure the reliability of the present test. The content validity was accomplished with expert's opinion, while discriminant validity was also established.

RESULT AND DISCUSSION

Item difficulty index

Analysis for item difficulty index revealed that difficulty index of items ranged between 0.57 to 0.93 (Table 1). Recommendations from researches say that standard difficulty index (p-value) should fall between 0.2 to 0.8. Kline (1993) in his study stated that items those are answered by more than 80 of the respondents and not answered by less than 20 of the respondents are not useful for consideration in the test. The items with p-value more than 0.8 are considered as very easy and item with p-value less than 0.2 are considered as very difficult. Whereas Althouse (2000) stated that items with p-value more than 0.95 should be considered as very easy and items less than 0.30 should be considered as very difficult and so, they should be subjected for revision. Mixture of items in item battery is desirable with p-value of the item battery between 0 to 1 whereas $p>0.9$ = very easy, $p=0.5$ is moderate difficult and $p<0.1$ = very difficult. Following the rules and suggestions from researches item number 6 (p value = 0.91), 10 (p value = 0.91), 11 (p value = 0.93) and 15 (p value = 0.93) were

Table 1: Item Difficulty Index

S. No.	Items	Difficulty index
1.	While practicing Alder based *Jhum* cultivation, up to what height terrace farming is done?	0.71
2.	From what height, the Alder based *Jhum* cultivation is done?	0.71
3.	Do you know the *Jhum* cycle of your village?	0.76
4.	Do you know about the height of Alder tree when it is pollarded?	0.78
5.	Do you know, at what height from ground Alder is pollarded?	0.8
6.	What is the average diameter of Alder tree considered for pollarding?	0.91
7.	Do you know, Alder tree provides which nutrient to the soil?	0.62
8.	In which month pollarding of Alder trees is done?	0.71
9.	Do you know why *Dzua* is done?	0.58
10.	Do you know, how many social institutions are engaged in promotion of forest conservation in your village?	0.91
11.	Can cardamom be grown as intercrop?	0.93
12.	Do you know why Liekhro is done?	0.78
13.	Do you know, what is the average height of Alder tree?	0.8
14.	Do you know, how the splitting in pollarded head of Alder can be avoided?	0.8
15.	Do you know about the average number of tourist visiting your village in a year?	0.93
16.	Do you know about *Dzukounya* spp of rice?	0.53

considered very easy and removed for final test (Table 1). So, a total of 12 items was retained for further analysis of the knowledge assessment. Similar methodology was adopted by Kumar *et al.* (2016).

Item Discrimination

The item discrimination value of an item indicates the degree to which a single item predicts the value of the item battery. It is the ability of each individual item to discriminate between respondent with different levels of knowledge by measuring its correlation score on each item with the overall test score. The difficulty index values range from -1 to 1. The higher the value, the better the item measure what is intended to measure. Polarity or rotation results in negative value of item discrimination, however, if rotation is corrected still it should be discarded or revised. Kline (1986) and Streiner & Norman (1992) have suggested item correlation of 0.2 as the cut-off-point below which item should be discarded or revised. Falvey *et al.* (1994) have presented in their study that item correlation above 0.3 is considered "good", between 0.2-0.3 as workable while item correlation below 0.2 as unacceptable. In the present study, item correlations ranged between 0.33 to 0.85 (Table 2) which could be considered as good. Therefore, the 12 items were retained for constitution of the knowledge test and for further analysis.

Internal consistency

Internal consistency for each item was calculated by Cronbach's Alpha. Threshold level for internal consistency has been recommended as 0.70 (Kline, 1993). The Cronbach's Alpha value for each item was found to be above 0.7 with overall internal consistency value of 0.904 (Table 2). As all items were under considerable range, they were administered for their validity.

Discriminant Validity

Item discrimination index was used to analyze whether item was able to discriminate a well-informed respondent from a poorly informed respondent (Yadav *et al.,* 2009). Fourie *et al.* (2010) suggested to divide known groups into two ranging from 25-50 per cent in each groups. In the present study, the sample respondents having mean score of knowledge above 0.9

Table 2: Item-total statistics

S. No.	Items	Scale mean if item deleted	Scale variance if item deleted	Corrected item-total correlation	Cronbach's alpha if item deleted
1.	While practicing Alder based *Jhum* cultivation, up to what height terrace farming is done?	7.8667	11.391	.797	.888
2.	From what height, the Alder based *Jhum* cultivation is done?	7.8667	11.391	.797	.888
3.	Do you know the *Jhum* cycle of your village?	7.8222	11.377	.853	.885
4.	Do you know about the height of Alder tree when it is pollarded?	7.8000	12.209	.572	.899
5.	Do you know, at what height from ground Alder is pollarded?	7.7778	11.813	.752	.891
6.	Do you know, Alder tree provides which nutrient to the soil?	7.9556	11.816	.597	.898
7.	In which month pollarding of Alder trees is done?	7.8667	11.573	.733	.891
8.	Do you know why *Dzua* is done?	8.0000	12.136	.483	.904
9.	Do you know why Liekhro is done?	7.8000	12.891	.331	.910
10.	Do you know, what is the average height of Alder tree?	7.7778	11.631	.824	.888
11.	Do you know, how the splitting in pollarded head of Alder can be avoided?	7.7778	12.722	.410	.906
12.	Do you know about *Dzukounya* spp of rice?	8.0444	12.134	.478	.905
	Overall Cronbach's alpha	**0.904**			

Table 3: Mean Knowledge score of respondents of the village

S. No.	Items	Mean score		t-value	p-value
		High group	Low group		
1.	While practicing Alder based *Jhum* cultivation, up to what height terrace farming is done?	1.0	.083	11.0	.000
2.	From what height, the Alder based *Jhum* cultivation is done?	1.0	.083	11.0	.000
3.	Do you know the *Jhum* cycle of your village?	1.0	.083	11.0	.000
4.	Do you know about the height of Alder tree when it is pollarded?	1.0	.42	3.924	.001
5.	Do you know, at what height from ground Alder is pollarded?	1.0	.33	4.690	.001
6.	Do you know, Alder tree provides which nutrient to the soil?	1.0	.17	7.416	.000
7.	In which month pollarding of Alder trees is done?	1.0	.083	11.0	.000
8.	Do you know why *Dzua* is done?	1.0	.17	7.416	.000
9.	Do you know why Liekhro is done?	1.0	.58	2.803	.010
10.	Do you know, what is the average height of Alder tree?	1.0	.25	5.745	.000
11.	Do you know, how the splitting in pollarded head of Alder can be avoided?	1.0	.58	2.803	.010
12.	Do you know about *Dzukounya* spp of rice?	.92	.17	5.361	.000

Table 4: Knowledge level in different age group

S. No.	Items	Very young farmers (<28.5 years) (Mean=41, SD=12.5) n=7 (%)	Young farmer (28.5-41.0) n=17 (%)	Middle aged farmer (41.0-53.6) n=14 (%)	Old aged farmer (>53.6) n=7 (%)
1.	While practicing Alder based *Jhum* cultivation, up to what height terrace farming is done?	85.7	89.5	64.3	28.6
2.	From what height, the Alder based *Jhum* cultivation is done?	85.7	89.5	64.3	28.6
3.	Do you know the *Jhum* cycle of your village?	85.7	94.7	71.4	28.6
4.	Do you know about the height of Alder tree when it is pollarded?	71.4	89.5	85.7	42.9
5.	Do you know, at what height from ground Alder is pollarded?	85.7	94.7	78.6	42.9
6.	Do you know, Alder tree provides which nutrient to the soil?	85.7	84.2	42.9	28.6
7.	In which month pollarding of Alder trees is done?	85.7	89.5	57.1	42.9
8.	Do you know why *Dzua* is done?	100.0	63.2	50.0	14.3
9.	Do you know why Liekhro is done?	42.9	89.5	78.6	85.7
10.	Do you know, what is the average height of Alder tree?	85.7	94.7	71.4	57.1
11.	Do you know, how the splitting in pollarded head of Alder can be avoided?	71.4	84.2	85.7	71.4
12.	Do you know about *Dzukounya* spp of rice?	85.7	57.9	50.0	14.3
	Average		**85.1**	**66.7**	**40.5**

were kept in high group while respondents scoring below 0.9 were kept in low group (Table 3). The results suggest that all items could discriminate the high and low groups significantly ($p<0.01$) (Table 3). Considering all the above parameters, the final test compromised of total of 12 item with internal consistency (Cronbach's Alpha) of 0.904 and discriminant validity.

Knowledge level of the farmers

The village under study had a social learning platform in the name of *Thesu* where a young farmer was assigned to the "age group" for teaching the technical and practical skills of cultivation as well as customs and rituals of the village. "Age group" included children of age 9-10 years. so, farming was inculcated in the people from early age. In order to analyze the knowledge level in different age groups, the farmers were categorized in four groups i.e. very young farmers (<28.5 years), Young farmers (28.5-41.0 year), Middle Farmer (41.0-53.6 year), Old Farmer (>53.6 year) (Table 4). The result showed that average knowledge among middle aged farmers was the highest (85.1) and the lowest among old farmers (40.5) (Table 4). As young farmers are actively engaged in agriculture related work and as they are mainly the teacher for *Thesu* group; their knowledge was found to be the highest. However, knowledge percentage for traditional practice like item number 9, was highest among the old aged farmers.

CONCLUSION

The knowledge test was developed with reliability coefficient of 0.904 and it had discriminant validity as the items could significantly differentiate the high and low scoring groups. It suggests that items generation should be based on comprehensive review and piloting. Items should fall within the range of recommended difficulty index, discrimination index, reliability and validity to ensure correct measurement of knowledge of any community about any technology. Items not fulfilling the criteria should be removed or revised for consistent and valid test. The result showed that average knowledge among middle aged farmers was the highest (85.1) and it was the lowest among old farmers (40.5). It also shows how village has arranged social learning platform to inculcate the essence of farming in children from early ages itself.

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