Applying the Method of Paired Comparison Technique to Determine the Most Critical Issue Associated with the Livelihood Security of the Tribal Farmers of Meghalaya

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Authors' contributions

This work was carried out in collaboration among all authors. Authors DT, JKC and RJS designed the study, performed the statistical analysis, wrote the protocol, managed the analyses of the study and wrote the first draft of the manuscript. Authors RS, LH and LD supervised the work, managed the literature searches and edited the manuscript. All authors read and approved the final manuscript.

Original Research Article	*Received 03 February 2019* *Accepted 12 April 2019* *Published 20 April 2019*

ABSTRACT

Ensuring livelihood security of the tribal farmers of Meghalaya has been the main focus of the policymakers. To accelerate the process, it is necessary to identify the most serious issue encountered by the farmers of the region. This paper presents a list of agricultural issues associated with the livelihood security of the farmers. Using survey data from beneficiary farmers of Tribal Sub-Plan (TSP) project of College of Post Graduate Studies in Agricultural Sciences (CPGSAS), Umiam, Meghalaya and College of Home Science (CoHSc), Tura, Meghalaya, Central Agricultural University, Imphal [CAU(I)], the method of paired comparison is applied to prioritize the list of issues. The data was collected in the year 2018 from 390 beneficiary farmers from Ri-Bhoi

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district and West Garo Hill of Meghalaya state. The result indicates that crop diseases and pest infestation were the most critical issue. Both present and future policymaker need to intervene according to the need base situation of the farmer to ensure their livelihood security.

Keywords: Livelihood security; Tribal Sub-Plan; paired comparison and prioritize.

1. INTRODUCTION

Meghalaya is one of the seven sister states of North East India which has Shillong as its capital. The state lies at a latitude of 25° 07'N to 25° 41'N and longitude of 91°21'E to 92°09'E. Geographically, Meghalaya is bestowed with hilly terrain and some valleys, where a diverse ethnic group of people dwells. The state has a total population of 29.67 lakh out of which 86.15 per cent are Schedule Tribes (2555861) [1]. The intricate, diverse and risk-prone agriculture is the peculiar characteristic of the livelihood of tribal farmers in the region. The type of agricultural practices in the region includes both settled cultivation and shifting (slash and burn, or Jhum) cultivation. The principal crops grown are rice (*Oryza sativa*), maize (*Zea mays*), potato (*Solanum tuberosum* Linn.), ginger (*Zingiber officinale* Rosc.), turmeric (*Cucurma domestica* Valeton), arecanut (*Areca catechu*), etc. and several vegetable crops. Typical fruit crop of the region includes pineapple (*Ananas comosus*), Khasi mandarin (*Citrus reticulata*), banana, etc. The natural forest also serves a purpose for the support of various flora and fauna found in the region. This, in turn, provides nutritious food and income opportunities for the livelihood of the people in the state. The region is famous for its rich organic land, abundant rainfall, and favorable climate which significantly contribute towards enhancing food and nutrition security, thereby, increasing the potential to improve farm income. Unfortunately, the growth potential of hill agriculture has remained under-exploited. The reason owing to lack of system-specific production technologies, poor infrastructure and underdeveloped institutions, notwithstanding the structural constraints imposed by difficult terrains, inaccessible habitations, diverse sociocultural and agricultural typologies, and small, scattered and fragmented land holdings [2]. The people also face uncertain agricultural productivity. This is due to vulnerability to flooding, drought, soil erosion, and heavy siltation, lack of market opportunities and remoteness and isolation. Some other factors for low agricultural productivity also include low usage of the growth augmenting inputs such as irrigation, high yielding variety seeds, chemical fertilizers, pesticides, positive measures, etc. [3].

There is an array of challenges faced by our farmers. In a study conducted in Rajasthan, constraints such as dependence on monsoon, vulnerable to insufficient knowledge and the high cost of agricultural inputs topped the list of constraints with a Rank Based Quotient (RBQ) value of 86.43, 72.86 and 72.98 regarding agro-ecological constraints, technical constraints and socio-economic constraints faced by the farmers [4]. In another study conducted in Uttar Pradesh and Haryana, unavailability of inputs, non-availability of labour, high cost of inputs, perishable nature of products, attack by pest had outdone the list of constraints regarding technical constraints, labour constraints, economic constraints, marketing constraints and environmental constraints with a Garrett score of 65.33, 51.93, 54.23, 58.125 and 64.1 [5]. To measure the level of awareness of Southern Tamil Nadu farmers on environmental problems due to the use of modern inputs in paddy cultivation, the paired comparison method was used and it was found that 23 per cent of farmers were highly aware of the environmental degradation caused by it [6]. Pairwise comparison is a handy method for ranking of items if the items to be ranked are not large. The preferences selected by the respondents among the set of all possible pairs, results to a perfect ranking order. In a study conducted in Tanzania, the pairwise ranking was used to rank socio economic activities based on their contribution to livelihood and to rank problems caused by mining activities as experienced by the local people [7]. This method is also used in the ranking of farmers objectives. In order to elicit and analyze the farmers' objectives and their link to the practice of overgrazing in Central Brazil, the paired comparison was used and the findings reported that transgenerational transfer and cattle ownership were the most dominant objectives [8].

The Government of India and other external agency have made efforts to include the tribal people in the growth process. One such effort is the Tribal Sub-Plan (TSP) project of College of Post Graduate Studies in Agricultural Sciences (CPGSAS), Umiam and College of Home Science (CoHSc), Tura, Central Agricultural University, Imphal [CAU (I)], Meghalaya funded

by ICAR, New Delhi which was officially launched in the year 2017. The broad objective of the sub-plan is to enhance livelihood and socio-economic conditions of the tribal farmers of North East Hill (NEH) states.

The present paper discusses some of the issues faced by the beneficiary tribal farmers of TSP in Meghalaya. The main objective of the paper is to prioritize the issues with the help of the paired comparison method.

2. MATERIALS AND METHODS

The study was conducted in Meghalaya where the TSP project of CAU(I) was endorsed in CPGSAS, Umiam, and CoHSc, Tura, CAU(I). The project encompassed two districts namely Ri-Bhoi and West Garo Hill (WGH) districts of Meghalaya. It was operated in 10 villages which were selected based on the baseline survey and PRA exercises done. Five agriculturally important villages each were selected from Umsning Community and Rural Development Block (CRDB) of Ri-Bhoi district and Rongram CRDB of WGH district for the project. The names of the ten villages of the two districts are as follows: (i) Palwi, (ii) Mawlein Mawkhan, (iii) Liarkhla, (iv) Sumer No. 4 and (v) Khweng of CRDB Umsning(A), Ri-Bhoi district under CPGSAS, and (i) Rangwalkamgre, (ii) Dumitdikgre, (iii) Galwang Chidekgre, (iv) Edenbari and (v) Sanchonggre of CRDB Rongram(B), WGH district under CoHSc.

A complete enumeration of respondents/ beneficiaries of TSP project of CAU, Imphal in the entire ten villages under different commodities/facilities was executed for the present study giving rise to a total of 390 beneficiary farmers (270 from Ri-Bhoi district and 120 from WGH district) (Fig. 1).

The list of issues regarding livelihood security of the tribal farmers to be prioritized was enlisted from beneficiary farmers, agricultural experts, and literature review. Further, all the identified issues were finalized based on a pilot study. Based on the pilot study a total of 7 issues were identified (Table 1).

To determine the relative importance of these qualities, a paired-comparisons approach was used [14]. Thurstone developed the law of comparative judgement for the ordering of stimuli along a psychological continuum [15]. In this method, pairs of stimuli in all possible combination are presented to the respondents and are asked to select one stimulus which is judged as more favorable over the other from each pair. The number of possible pairs which may be obtained is given by the formula below:

$$\frac{n(n-1)}{2}$$

Where n denotes the number of stimuli.

Table 1. List of agricultural issues associated with the livelihood security of the farmers

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Cost and timely availability of inputs	The High cost of input including seed, planting material, fertilizer, fuels at the right time, etc. [9]
Post-harvest management	Lack of storage facilities, perishable nature of the product, post-harvest loses, etc. [10]
Limited availability of skill training	Poor access to extension workers, lack of knowledge, poor extension services, lack of technical guidance, etc. [11].
Climate risk and uncertainty	Crop reduction due to floods, drought, and hailstones, unavailability of natural water bodies, fluctuating weather condition, etc.
Crop diseases and pest infestation	Heavy incidence of diseases and pest attack.
Marketing problems	Poor access to the market, price fluctuation of outputs, lack of good market price, lack of transport facility, middle man malpractices, etc. [12]
Livestock management	Frequently sick, infertility problems, lack of feeds, high rate of mortality, low productivity of livestock, etc. [13].

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MEGHALAYA
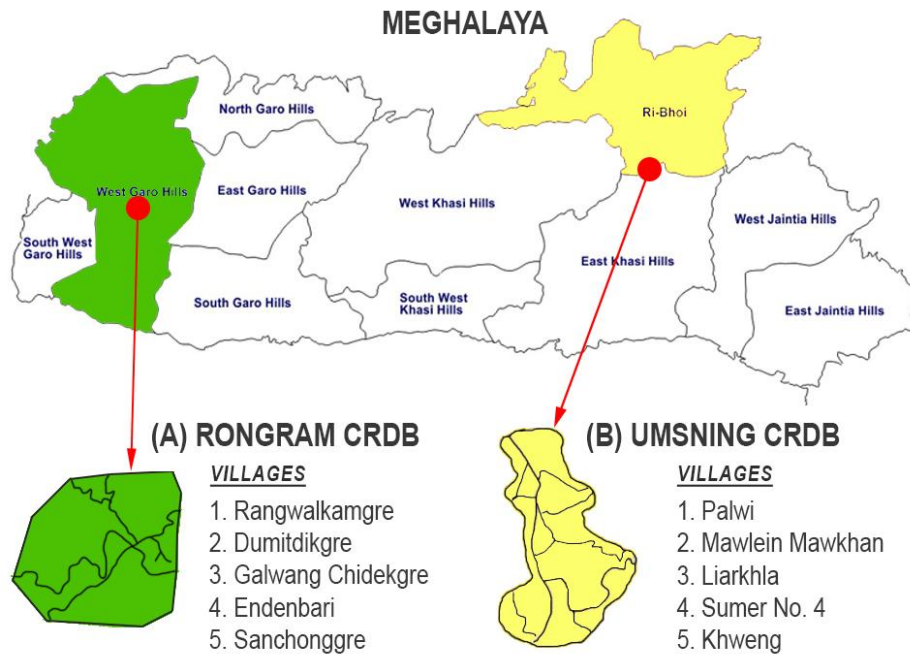
Fig. 1. Location of study area and research villages

As more number of pairs may confuse the respondents and increase the probability of error in judgement, the number of stimuli should be optimum i,e neither too many or too few [16]. Thus, the number of issues in the study is 7 which gave a total of 21 possible pairs. A pre-tested questionnaire was presented to the beneficiary farmers in which they were forced to choose one out of a pair which they valued the most. To eliminate response bias both the issues in each pair and the pair themselves are arranged randomly. The responses were tabulated in a frequency matrix consisting of the corresponding frequencies in which the column issue is judged more favorable than the row issue. This table gave rise to another matrix where the proportion of the frequencies were entered. The column sum of the cells was calculated. This matrix is again rearranged with the stimuli having the smallest column sum at the left and that with the highest at the right. The Z-score of each cell entries was obtained from the table of normal deviates giving rise to a Z-matrix. The corresponding column sum of the Z-score is found out after which mean Z-score is calculated. Adding the largest negative deviation of the mean Z-scores to each of the mean Z-score value, the scale value was obtained. A rank ordering of the relative values of the issues was generated from these scale values. A scale value

of 0 indicates an arbitrary zero point or the reference point.

3. RESULTS AND DISCUSSION

A total of 370 beneficiary farmers, 270 from Ri-Bhoi districts and 120 from WGH district of Meghalaya completed the survey. Of the total beneficiary farmers, 216 (55.38%) were females and 174 (44.62%) were males (Table 2). This clearly indicates that the high participation of women in agriculture in the region.

In the present study, paired comparison analysis was used to identify and rank the issues faced by the farmers. The overall scale value and the ranking of each issue by each beneficiary farmer group are listed in Table 3. The data revealed that crop diseases and pest infestation topped overall (Scale value 2.034) as well as in both the districts (Scale value 2.018 Ri-Bhoi district and 2.671 WGH district) based on the list of agricultural issues faced by the farmers. While the least important issue among the seven issues was post-harvest management overall as well as in both the district. Overall the following issues, cost and timely availability of inputs, climate risk and uncertainty, limited availability of skill training, livestock management are found between the two extreme issues.

Table 2. Distribution of beneficiary farmers under TSP

Gender	Ri-Bhoi District	WGH District	Total
Male	126	48	174 (44.62)
Female	144	72	216 (55.38)
Total	270	120	390 (100.00)

Figure in the parenthesis indicate the percentage

Table 3. Scale values and ranking of lists of agricultural issues

Issues	Scale value			Ranking		
	Ri-Bhoi	WGH	Overall	Ri-Bhoi	WGH	Overall
Cost and timely availability of inputs	1.240	1.209	1.070	2	4	2
Post-harvest management	0.000	0.000	0.000	7	7	7
Limited availability of skill training	0.555	0.697	0.454	5	6	5
Climate risk and uncertainty	0.991	1.380	0.951	3	3	4
Crop diseases and pest infestation	2.018	2.671	2.034	1	1	1
Marketing problems	0.760	2.096	0.964	4	2	3
Livestock management	0.135	0.723	0.134	6	5	6

The main advantage of this method over other method is that respondents are able to make a decision after comparing the stimuli in all the possible pairs and therefore, the last decision is thought to be of informed judgement.

Foreseeably, it was discovered that crop diseases and pest infestation were the most critical issue faced by the beneficiary tribal farmers of Meghalaya under TSP as reported in earlier studies also. This gave rise to concern among the farming community that the problem of crop diseases and pest infestation was prevalent and is still continuing. We have been able to explicitly demonstrate that the major issue that hinders to agricultural productivity and hence the livelihood of the farmer is because of the heavy incidence of diseases and attack by the pest. There is a strong desire among the beneficiary farmers in the study area to control the incidence of diseases and pest. The beneficiary farmers have reported a low yield of produce crops. The farmers have stated the case of ginger rhizome rot disease in the study area due to which they are unable to get good output.

It is perhaps not so surprising that cost and timely availability of inputs stood the second rank overall. No doubt under TSP, inputs are being provided free of cost but time is the another most important factor. Sometimes the inputs such as seeds are provided when the season for planting is almost over. On the other hand, while the farmers are busy attending their crops, they have limited time and resources to visit towns for the purchase of inputs. The farmers managed to obtain inputs from nearby local area which may or may not give good output.

Further, marketing problems are the next most serious issue (the third). Undoubtedly, the farmers in the region were facing the problems of access to the market, lack of marketing facilities, lack of regulated markets, etc. Indisputably, climate risk and uncertainty ranked the fourth position. The region witnessed frequent climatic hazards such as hailstones. Such hailstones not only destroy the crops but also bring loss to the property of the farmers [17]. This was followed by the limited availability of skill training. In some cases, the beneficiary farmers were unable to utilize the vermicompost unit due to lack of their knowledge in vermicomposting. In the next position, the livestock management issue was found. Most of the beneficiary farmers were having a piggery unit and backyard poultry unit. Since livestock rearing is an old age practice followed in the region, the people of the region faced fewer problems. Though problem such as foot and mouth disease of cattle, the pregnancy of piglets, etc exist in fewer numbers. Last but not least, post-harvest management issue is found.

4. CONCLUSION

In the study, we presented the application of the method of paired comparison for prioritizing the issues of farmers. It is confined to seven stimuli which give rise to 21 possible pairs. The stimuli are 1) Cost and timely availability of inputs, 2) Post-harvest management, 3) Limited availability of skill training 4) Climate risk and uncertainty, 5) Crop diseases and pest infestation 6) Marketing problems and 7) Livestock management. The result showed that overall crop diseases and pest infestation ranked the most serious problems followed by cost and timely availability of inputs, marketing problems, climate risk and uncertainty, limited availability of skill training, livestock management, and post-harvest management. Thus, the result provides an opportunity for the existing programmes to consider and intervene towards the most important issue faced by the farmers in the region. This not only serves importance to existing programmes but also provides a background for policymakers for future interventions. The prime focus on the most need-based issue and so on will help develop the agrarian economy in a positive direction and at a faster pace. To boost productivity in the future, it is essential to identify the issues faced by farmers irrespective of the different interventions. The farmers will not be able to effectively contribute to the agricultural development of the nation and improve their standard unless the challenges they confronted are talked well. Identifying such issues and their importance will provide a basis for a comprehensive evaluation.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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