

**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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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 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.

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Keywords: Livelihood security, Tribal Sub-Plan, Paired Comparison and Prioritize

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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* Valetton), 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

36 typologies, and small, scattered and fragmented land holdings [2]. The people also face
37 uncertain agricultural productivity. This is due to vulnerability to flooding, drought, soil
38 erosion, and heavy siltation, lack of market opportunities and remoteness and isolation.
39 Some other factors for low agricultural productivity also include low usage of the growth
40 augmenting inputs such as irrigation, high yielding variety seeds, chemical fertilizers,
41 pesticides, positive measures, etc. [3].

42 There is an array of challenges faced by our farmers. In a study conducted in Rajasthan,
43 constraints such as dependence on monsoon, vulnerable to insufficient knowledge and the
44 high cost of agricultural inputs topped the list of constraints with a Rank Based Quotient
45 (RBQ) value of 86.43, 72.86 and 72.98 regarding agro-ecological constraints, technical
46 constraints and socio-economic constraints faced by the farmers [4]. In another study
47 conducted in Uttar Pradesh and Haryana, unavailability of inputs, non-availability of labour,
48 high cost of inputs, perishable nature of products, attack by pest had outdone the list of
49 constraints regarding technical constraints, labour constraints, economic constraints,
50 marketing constraints and environmental constraints with a Garrett score of 65.33, 51.93,
51 54.23, 58.125 and 64.1 [5]. To measure the level of awareness of Southern Tamil Nadu
52 farmers on environmental problems due to the use of modern inputs in paddy cultivation,
53 the paired comparison method was used and it was found that 23 per cent of farmers were
54 highly aware of the environmental degradation caused by it [6]. Pairwise comparison is a
55 handy method for ranking of items if the items to be ranked are not large. The preferences
56 selected by the respondents among the set of all possible pairs, results to a perfect ranking
57 order. In a study conducted in Tanzania, the pairwise ranking was used to rank socio
58 economic activities based on their contribution to livelihood and to rank problems caused by
59 mining activities as experienced by the local people [7]. This method is also used in the
60 ranking of farmers objectives. In order to elicit and analyze the farmers' objectives and their
61 link to the practice of overgrazing in Central Brazil, the paired comparison was used and the
62 findings reported that transgenerational transfer and cattle ownership were the most
63 dominant objectives [8].

64 The Government of India and other external agency have made efforts to include the tribal
65 people in the growth process. One such effort is the Tribal Sub-Plan (TSP) project of College
66 of Post Graduate Studies in Agricultural Sciences (CPGSAS), Umiam and College of Home
67 Science (CoHSc), Tura, Central Agricultural University, Imphal [CAU (I)], Meghalaya funded
68 by ICAR, New Delhi which was officially launched in the year 2017. The broad objective of
69 the sub-plan is to enhance livelihood and socio-economic conditions of the tribal farmers of
70 North East Hill (NEH) states.

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

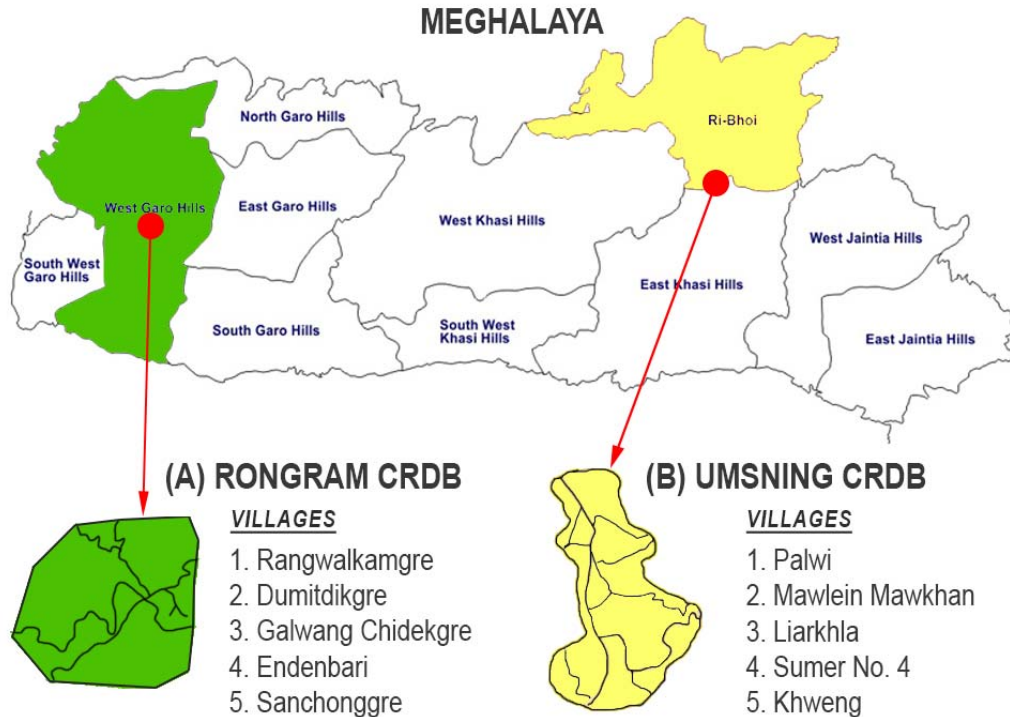
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75 2. MATERIAL AND METHODS

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

87 **complete** enumeration of respondents/beneficiaries of TSP project of CAU, Imphal in the
 88 entire ten villages under different commodities/facilities was executed for the present study
 89 giving rise to a total of 390 beneficiary farmers (270 from Ribhoi district and 120 from WGH
 90 district)(Fig. 1).
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92
 93 **Fig. 1. Location of study area and research villages**
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95 The list of issues regarding livelihood security of the tribal farmers to be prioritized **was**
 96 enlisted from beneficiary farmers, agricultural experts, and literature review. Further, all the
 97 identified issues were finalized based on a pilot study. Based on the pilot study a total of 7
 98 issues were identified (Table1).
 99

100 **Table1. List of Agricultural issues associated with the livelihood security of the**
 101 **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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104 To determine the relative importance of these qualities, a paired-comparisons approach was
105 used [14]. Thurstone developed the law of comparative judgement for **the ordering** of stimuli
106 along a psychological continuum [15]. In this method, pairs of stimuli in all possible
107 combination are presented to the respondents and are asked to select one stimulus which is
108 judged as more favorable over the other from each pair. The number of possible pairs which
109 may be obtained is given by the formula below:

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

110 Where n denotes the number of stimuli

111 As more number of pairs may confuse the respondents and increase the probability of error
112 in judgement, the number of stimuli should be optimum i.e neither too many or **too** few [16].
113 Thus, the number of issues in the study is 7 which gave a total of 21 possible pairs. A pre-
114 tested questionnaire was presented to the beneficiary farmers in which they were forced to
115 choose one out of a pair which they valued the most. To eliminate response bias both the
116 issues in each pair and the pair themselves are arranged randomly. The responses were
117 tabulated in a frequency matrix consisting of the corresponding frequencies in which the
118 column issue is judged more favorable than the row issue. This table gave rise to another
119 matrix where the proportion of the frequencies were entered. The column sum of the cells
120 was calculated. This matrix is again rearranged with the stimuli having the smallest column
121 sum at the left and that with the highest at the right. The Z-score of each cell entries was
122 obtained from the table of normal deviates giving rise to a Z-matrix. The corresponding
123 column sum of the Z-score is found out after which mean Z-score is calculated. Adding the
124 largest negative deviation of the mean Z-scores to each of the mean Z-score value, the
125 scale value was obtained. A rank ordering of the relative values of the issues **was** generated
126 from **these** scale values. A scale value of 0 indicates an arbitrary zero point or the reference
127 point.

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129 **3. RESULTS AND DISCUSSION**

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131 A total of 370 beneficiary farmers, 270 from Ri-Bhoi districts and 120 from WGH district of
 132 Meghalaya completed the survey. Of the total beneficiary farmers, 216 (55.38%) were
 133 females and 174 (44.62%) were males (Table2). This clearly indicates that the high
 134 participation of women in agriculture in the region.

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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)

137 *Figure in the parenthesis indicate the percentage*

138 In the present study, paired comparison analysis was used to identify and rank the issues
 139 faced by the farmers. The overall scale value and the ranking of each issue by each
 140 beneficiary farmer group are listed in Table3. The data revealed that crop diseases and pest
 141 infestation topped overall (Scale value 2.034) as well as in both the districts (Scale value
 142 2.018 Ri-Bhoi district and 2.671 WGH district) based on the list of agricultural issues faced
 143 by the farmers. While the least important issue among the seven issues was post-harvest
 144 management overall as well as in both the district. Overall the following issues, cost and
 145 timely availability of inputs, climate risk and uncertainty, limited availability of skill training,
 146 livestock management are found between the two extreme issues.

147 **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

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

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

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

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

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182 4. CONCLUSION

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184 In the study, we presented the application of the method of paired comparison for prioritizing
 185 the issues of farmers. It is confined to seven stimuli which give rise to 21 possible pairs. The
 186 stimuli are 1) Cost and timely availability of inputs, 2) Post-harvest management, 3) Limited
 187 availability of skill training 4) Climate risk and uncertainty, 5) Crop diseases and pest
 188 infestation 6) Marketing problems and 7) Livestock management. The result showed that
 189 overall crop diseases and pest infestation ranked the most serious problems followed by
 190 cost and timely availability of inputs, marketing problems, climate risk and uncertainty,
 191 limited availability of skill training, livestock management, and post-harvest management.
 192 Thus, the result provides an opportunity for the existing programmes to consider and
 193 intervene towards the most important issue faced by the farmers in the region. This not only
 194 **serves** importance to existing programmes but also provides a background for policymakers
 195 for future interventions. The prime focus on the most need-based issue and so on will help

196 develop the agrarian economy in a positive direction and at a faster pace. To boost
197 productivity in the future, it is essential to identify the issues faced by farmers irrespective of
198 the different interventions. The farmers will not be able to effectively contribute to the
199 agricultural development of the nation and improve their standard unless the challenges they
200 confronted are talked well. Identifying such issues and their importance will provide a basis
201 for a comprehensive evaluation.

202

203 **ETHICAL: NA**

204 **CONSENT: NA**

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UNDER PEER REVIEW