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RESEARCH ARTICLE

Farmers' Knowledge Assessment on Disaster Risk Reduction Practices of Flood Prone Areas of North Bank Plain Agro-Climatic Zone of Assam

Indrajit Barman[1] and Kausik Pradhan[2]

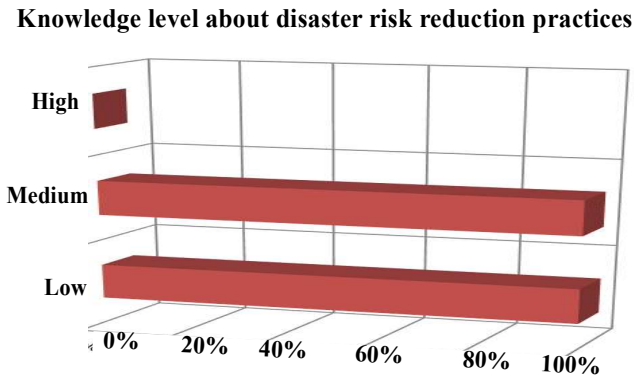
1. Asst. Prof., Deptt. of Ext. Edu., AAU, Biswanath Chariali, Assam,
2. Prof. & Head, Deptt. of Agril. Ext., UBKV, Cooch Behar, West Bengal, India

Corresponding author's email: indrajit.barman@aau.ac.

HIGHLIGHTS

- Knowledge assessment on disaster risk reduction practices is required to improve the adaptive capacity for future farm disaster eventualities
- A total of nineteen disaster reduction agricultural practices are identified
- The study implies that there is a need of farm disaster mitigation led extension education and services

GRAPHICAL ABSTRACT



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ABSTRACT

Context: FAO states that disasters have an outsized impact on the agriculture sector, leading to large-scale economic losses and causing physical damage to the lands, resources and livelihood assets. Farmers' knowledge on disaster risks reduction practices plays major role in sustainable agricultural production.

Objectives: The study was to assess the farmers' awareness and knowledge level on disaster risk reduction practices and study socio-economic attributes of farmer respondents as well as to find out the relationship between disaster risk reduction practices with socio-economic attributes of the respondents. Dhemaji district under North Bank Plain Agro-Climatic Zone of Assam

Methodology: A multi-stage, purposive cum random sampling design was used in the study for selecting 120 respondents. Knowledge Test was used to assess the farmers' knowledge level on disaster risk reduction practices

Results and Discussion: The study revealed that majority of the respondent farmers had low level of knowledge on disaster risk reduction practices. Correlation analysis of the independent variables of the study with knowledge of farmers on disaster risk reduction practices revealed that four independent variables, viz., size of land holding, age, education and risk bearing ability were positively and significantly correlated with disaster risk reduction practices. The study implies that there is a need of farm disaster mitigation led extension and existing agricultural extension and advisory service efforts need to be strengthened to enhance the knowledge of farmers on farm disaster risk reduction practices.

In the present e-era, knowledge is very important concept not only to utilize the available expertise but also to retrieve it as per the needs and situations. Knowledge is a familiarity, awareness or understanding of someone or something, such as facts, information, descriptions or skills, which is acquired through experience or education by perceiving, discovering or learning (Chauhan *et. al*., 2015). Floods, droughts, storms, earthquakes, fires and severe weather conditions have significant, widespread and long-lasting impacts on the agricultural sector. A recent FAO study found that between 2006 and 2016, the agriculture sector absorbed approximately 23 percent of all damages and losses caused by natural hazard-induced disasters in developing countries (FAO, 2018). If not prevented, these impacts will continue to have major negative implications on food security and poverty around the globe. There are multiple pathways to reduce the impacts of natural hazard induced disasters on the agriculture sector, at different levels – including farm level. Prevention and Mitigation are considered as key elements of the disaster risk management framework for Agriculture (OECD/FAO, 2021)**.**

Several farm disaster mitigation practices are developed, available and being disseminated through various extension and advisory service agencies for the farming community. Numerous studies have been conducted on the adoption of agricultural technologies in developing countries, particularly focussing on socio-economic situations and farm attributes (Feder *et al.* 1985; Doss and Morris 2000; Lapar and Ehuri, 2004). There are many factors that influence adoption decision like individual farmer's behaviour based on the self-perception towards new technologies (Burton 2004; Cramerer and Loewerstein, 2004; Garforth, *et al.* 2004; Rehman *et al.,* 2007; Azman *et al*., 2013; Datta and Mullainathan, 2013 and Devi *et al*., 22). An analysis of adoption studies stated that there are three paradigms of reasons why some farmers adopt new technologies and others do not. These are the innovation-diffusion paradigm; the economic constraints paradigm and the adopter-perception paradigm (Adesina &Zinnah,1993; Prager & Posthumus, 2010). The adopter-perception paradigm allows for a level of subjectivity by contending that it is the perceived need to innovate and the perceived attributes of innovations `that determine adoption behaviour (Kivlin and Fliegel, 1967; Adesina and Zinnah,1993 and Noopur *et al.,* 2023). Farmers' knowledge levels on agricultural technologies are found medium to low as reported by many research studies (Gour, S.*et al*.2015; Mohapatra, L.*et al*.2016; Sultana, A.*et al*., 2016 and Raksha and Chauhan, 2015). It is stated that farmers' high awareness and knowledge level on developed agricultural technologies facilitate technologies application in the field. Farmers' knowledge assessment on disaster mitigation practices is needed to enhance the technologies adoption for improving their adaptive capacities by making FPO (Chandegara *et al.,* 2023)**..** With this context, a study is designed to assess the farmers' awareness and knowledge level on disaster risk reduction practices and study socio-economic attributes of farmer respondents as well as to find out the relationship between disaster risk reduction practices with socio-economic attributes of the respondents

METHODOLOGY

The present study was carried out in Dhemaji district under North Bank Plain Agro-Climatic Zone of Assam (940 12' 18" E and 95041' 32" E longitudes and 270 05' 27" N and 270 57' 16" N latitudes,). A multi-stage, purposive cum random sampling design was adopted for the study in order to select 120 respondents. Data were collected with the help of a pretested, structured research schedule, using the personal interview method. A total of nineteen agricultural disaster risks reduction practices were considered for assessing the awareness level based on experts' opinion. Agricultural knowledge was defined by Haverkort (1988) as "the set of concepts, meanings and skill developed over time by individuals or group through the processing of information." English and English (1958) conceptualized knowledge as "a body of understood information possessed by an individual or by a culture". Bloom *et.al*. (1956) defined knowledge as "those behaviour and test situations which emphasized the remembering either by recognition or by recall of ideas, material or phenomena." A knowledge test developed by Sultana *et al*. (2020) was used to assess the knowledge level of respondents on disaster risks reduction agricultural practices. There were 26 statements in the knowledge test administered to respondents in the study. The total score on the test had a theoretical range of 0 to 26.The knowledge level of a respondent on disaster risks reduction agricultural practice was indicated by the total score received by him/her on the test. The answers for the questions in

the knowledge test were in dichotomous categories. In computing the knowledge scores of the respondents, a correct answer to a question was given one score and zero score for incorrect answer. The total score obtained on the test was taken as the respondent's score on the variable. Based on the mean ($\bar{X}$) and standard deviations (S.D.) of the obtained scores, respondents were classified into three categories as shown below:

Category	Score Range
Low Knowledge Level	Below($\bar{X}$-1SD)
Medium Knowledge Level	($\bar{X}$-1SD) to($\bar{X}$+1SD)
High Knowledge Level	Above ($\bar{X}$+1SD)

The statistical techniques and tests such as frequency, percentage, mean, standard deviation, co-efficient of variation and Pearson's product moment correlation coefficient were used in the study for analysis and interpretation of data.

Fig. 1.Dhemaji District/Locale of the study

RESULTS

Socio-economic attributes of the respondents: A total of eight independent socio-economic attributes *viz*., age, education, family size, size of land holding, annual income, annual expenditure, economic motivation and risk bearing ability, were considered for the study. The respondents were categorized on the basis of descriptive statistics in relation to each attribute.

Age, Education and Family size: A perusal of Table 1 reveals that majority of the respondents (55.80%) belonged to the middle age category followed by young age category (30.00%). Only 14.16per cent of the respondents belonged to the old age category. The mean value (31.92) indicates that on an average the respondents belonged to young aged category. The coefficient of variation (19.79%) indicates that the respondents were moderately homogeneous with respect to their age. The Table 1 also reveals that majority of the respondents (30.00%) had primary level education and twenty per cent respondents had formal education up to middle school level, followed by those having education up to high school level (15.83%). Significantly, 13.34 per cent of the respondents were illiterate. A few respondents (9.16%) had higher secondary level of education. Only 3.33 per cent of the respondents were found to be graduates or above. The coefficient of variation (65.36%) indicates that the respondents were highly heterogeneous with respect to their education. The finding shows that the majority of the respondents had relatively low level of formal education, as indicated by the mean value (2.57). As revealed by table, majority of the respondents in the study area had medium size (39.16%) to small size (40.84%) of family. Only 10.84 per cent of the respondents had large size of family. The coefficient of variation (37.03%) indicated that the respondents were moderately heterogeneous with respect to their family size.

Size of land holding, annual income and annual expenditure: Data presented in the Table 2 reveals that majority of the respondents (55.00%) had medium size of operational land holding (1-2 ha) followed by small size of operational land holding (below 1 ha) with 27.50 per cent of total respondents. Only 17.50per cent of the respondents belonged to the large size of operational land holding category having more than 2 ha of cultivating land. The value of coefficient of variation (46.37%) indicated that the respondents were heterogeneous with respect to their operational land holding size. The Table also highlights that 52.50 per cent of the respondents had annual income in the range of Rs. 100,000-200,000/- per year and 36.66 per cent of the respondents falling in the range of Rs. 22,000 – 100,000/- per year. A small size of the respondents (13%) had annual income above Rs. 2, 00,000/-. The mean value (1.35) indicates the medium annual income level of the respondents, while the coefficient of variation (49.62%) indicated that the respondents were heterogeneous with respect to their annual income. It is vivid from the table that 56.66 per cent of the respondents had annual expenditure in the range of Rs. 100,000-200,000/- per year and 40.84 per cent of the respondents

Table 1. Distribution of respondents according to their socio-economic attributes

Variable	Score range	No.	%	Mean	S.D.	C.V.
Age (Years)						
Young	22 to 35	36	30.00			
Middle aged	36 to 59	67	55.84	31.92	6.32	19.79
Old	Above 60	17	14.16			
Education						
Illiterate	0	16	13.34			
Can read only	1	10	08.34			
Can read and write/primary level	2	36	30.00			
Middle school level	3	24	20.00	2.57	1.68	65.36
High school level	4	19	15.83			
H .S. /P .U. level	5	11	9.16			
Graduate /diploma or above	6	4	03.33			
Family size						
Small family	size up to 4	49	40.84			
Medium family	size 5-7	58	39.16	5.32	1.97	37.03
Large family	size 8 and above	13	10.84			
Size of operational land holding(ha)						
Small	<1.0	33	27.50			
Medium	1.0-2.0	66	55.00	1.38	0.64	46.37
Large	>2.0	21	17.5			
Annual income (Rs in Lac)						
Low	< 1.0	44	36.66			
Medium	1.0 to 2.0	63	52.50	1.35	0.67	49.62
High	>2.0	13	10.84			
Annual expenditure (Rs in Lac)						
Low	< 1	49	40.84			
Medium	1 to 2	68	56.66	1.08	0.62	57.40
High	>3	03	2.50			
Economic motivation						
Low	Up to 24.52	16	13.34			
Medium	Between 24.52 to 38.06	81	67.50	31.29	6.77	21.63
High	Above 38.06	23	19.16			
Risk bearing ability						
Low	Up to 25.11	23	19.16			
Medium	Between 25.11 to 36.75	78	65.00	30.93	5.82	18.82
High	Above 36.75	19	15.84			

falling in the range of Rs. 18,000 – 100,000/- per year. A small size of the respondents (2.5%) had annual expenditure above Rs. 200,000/-. The mean value (1.08) indicates the medium to low annual expenditure level of the respondents, while the coefficient of variation (57.40%) indicated that the respondents were moderately heterogeneous with respect to their annual income.

Economic motivation and Risk bearing ability: The findings related to economic motivation and risk bearing ability are presented in Table 1. It is evident from the table that majority of the respondents (67.50%) had medium level of economic motivation, followed by 19.16% with high level of economic motivation. Only 13.34 per cent of the respondents were found to have low level of economic motivation. The coefficient of variation (18.84%) indicated that the respondents were relatively homogenous with respect to their economic motivation. The standard deviation figure (6.77) also shows that respondents by and large spread around the mean value (31.29)

which explained medium strength of economic motivation. The Table highlights that majority of the respondents (65.00%) had medium level of risk bearing ability, followed by 15.84 per cent with low level of risk bearing ability. Only 15.84 per cent of the respondents were found with high level of risk bearing ability. The standard deviation value (5.82) and the coefficient of variation (18.82%) indicated that the respondents were homogenous with respect to their risk bearing ability. It is stated that high annual income and more operational landholdings increase the risk bearing ability of the farmers. On both these aspects the respondents were poor and hence they did not have high risk bearing ability.

Awareness Level of the respondent farmers on disaster risks reduction agricultural practices: The findings presented in Table 2 reveal that there were different levels of awareness among the respondent farmers regarding the disaster risks reduction agricultural practices considered in the study. All of the respondent farmers (100.00%) were found to be aware of the disaster risks reduction agricultural practices, viz., cultivation of flood tolerant rice varieties, practising mixed cropping and inter cropping and diversification of farming system. The percentage of respondent farmers varied from 7.50 per cent to 100.00 per cent as regards to their level of awareness regarding the other disaster risks reduction agricultural practices. Majority of the farmers respondents from 62.50 per cent to 85.00 per cent were unaware regarding the disaster risks reduction agricultural practices, considered under study.

Knowledge Level of the respondent farmers on disaster risks reduction agricultural practices: In the present study respondent's knowledge level on disaster risks reduction agricultural practices was measured with the help of a test developed by Sultana *et.al*. (2020). The knowledge level of a respondent on disaster risks reduction agricultural practices was indicated by the total score received by him/ her on the test. The answers for the questions in the knowledge test were in dichotomous categories. In computing the knowledge scores of the respondents, correct answer to a question was given one score and for incorrect answer was given zero score. The total score on the test had a theoretical range of 0 to 26. Based on the mean ($\bar{X}$) and standard deviations (S.D.) of the obtained scores, respondents were classified

Table 2. Distribution of respondents according to their level of awareness on disaster risks reduction agricultural practices

Disaster reduction agricultural practices	Aware	Unaware
Cultivation of flood tolerant rice varieties	120(100%)	0(0%)
Cultivation of drought tolerant rice varieties	24(20%)	96(80%)
Cultivation of short duration sali rice cultivar for dry spell management	29(24.16%)	91(75.84%)
Cultivation of medium duration sali rice cultivar for dry spell management	21(17.5%)	99(82.50%)
Crop diversification for flood water management	32(26.66%)	88(73.34%)
Crop diversification for dry spell management	18(15.00%)	102(75.00%)
Cultivation of short duration sali rice cultivar for post flood situation	39(32.50%)	81(67.50%)
Cultivation of Short duration sali rice cultivar for pre flood situation	36(30.00%)	84(70.00%)
Cultivation of short duration boro rice (summer season) varieties for escaping flood	23(19.16%)	97(80.84%)
Cultivation of short duration pulses such as green gram, black gram, cowpea and millet for escaping drought like situation	17(14.16%)	103(85.84%)
Cultivation Maize in the driest period of the year	22(18.33%)	98(81.67%)
Practicing rain water harvesting in farm ponds for growing rabi crops	45(37.50%)	75(62.50%)
Practicing rain water harvesting in farm ponds in raising seedling of Sali rice	39(32.50%)	81(67.50%)
Use of organic manure (vermicompost/compost) for drought/ dry spell management in sali rice	21(17.50%)	99(82.5%)
Application of NPK for drought management in sali rice	9(7.50%)	111(92.50%)
Practicing protected cultivation of high value crops against hail storm	18(15.00%)	102(85.00%)
Practising in-situ rain water harvesting for moisture conservation (mulching)	36(30.00%)	84(70.00%)
Practicing mixed cropping and inter cropping	120(100%)	0(0%)
Diversification of farming system	120(100%)	0(0%)

Table 3. Distribution of respondents according to their level of knowledge on disaster risks reduction agricultural practices

Categories (Score range)	No.	%
Low level of knowledge (Up-to 17)	16	86.66
Medium level of knowledge (17-21)	104	13.34
High level of knowledge (Above 21)	0	0

into three categories as stated on the Table 3. The results obtained by administering the knowledge test are presented in Table 3. It is evident from table that majority of the respondent farmers (86.50%) had low level of knowledge on disaster risks reduction agricultural practices, followed by 13.50 per cent respondents with medium level of knowledge. None of the farmers were found with high level of knowledge on disaster risks reduction agricultural practices.

Correlation coefficient between perception of farmers on disaster risk mitigation practices and the selected attributes of the respondents: The findings of the Table 4 indicates that size of land holding is significantly correlated at the 0.01 level and the other variables, i.e., age, education and risk bearing ability are correlated at the 0.05 level with knowledge of farmers of farmers on disaster risk mitigation practices.The strength of the relationship, as indicated by the 'r' values, suggest that the relationship is fairly strong with size of land holding while it is of moderate strength for the remaining three correlated variables. The relationships are found to be non-significant for the other four independent variables, *i.e.,* family size, annual income, annual expenditure and economic motivation with knowledge of farmers on disaster risk mitigation practices.

Table 4. Correlation coefficient between perception of farmers on disaster risk mitigation practices and the selected attributes of the respondents

Variable	(r)	't' value
Age	0.213	2.36811528*
Education	0.282	3.19288942*
Family size	-0.024	-0.26078185
Size of land holding	0.469	5.76840425**
Annual income	0.059	0.64202246
Annual expenditure	0.063	0.68571733
Economic motivation	-0.119	1.30192201
Risk bearing ability	0.234	2.61447743*

**Significant at the 0.01 level of probability
*Significant at the 0.05 level of probability
Degrees of freedom (df) = 118

DISCUSSION

A productive human capital profile that is predominantly in the young to middle age range shows potential for socio-economic development under comparable circumstances. But given the low level of formal education and illiteracy, skill development should be the main focus of capacity building in the agriculture disaster management. This finding is supported by Sonowal *et al.* (2021). There exist similarities between the income and expenditure patterns of the people, as is depicted by Table 1. It is logical to say that lower incomes would invite lower expenditure levels. It is stated that high annual income and more operational landholdings increase the risk bearing ability of the farmers. On both these aspects the respondents were poor and hence they did not have high risk bearing ability.

Low level of awareness on farm disaster risks reduction practices may be attributed to low level of education, poor mass medium exposure, lack of extension contact and training facilities etc. A massive extension programme meant for farmers and youth on farm disaster risks reduction practices may be organized to keep their awareness level high to face the farm production uncertainties in future.Lack of knowledge, inadequate exposure to mass media, poor extension contacts and training resources, among other factors, may be the cause of the low level of awareness of farm catastrophe risks reduction techniques. As the Table 3 indicates that majority of the respondent farmers (86.50%) had low level of knowledge on disaster risks reduction agricultural practices and to maintain farmers and young people's knowledge of agricultural disaster risk reduction techniques high so they can confront future output uncertainties, a large-scale extension program may be arranged. It is important to increase the knowledge level of farmers to keep themselves ready for any future farm disasters and uncertainties, and sustainable agricultural development. Extension Education level and risk bearing ability of farmer has to be increased with extensive and holistic agricultural disaster extension programme. The findings of the present study are substantiated by the study of Suman, R.S. (2017); Chauhan, N.M. (2018); Ngadong, A. and Longkumer, J. (2018); Tribeni, G. *et al*. (2018); Pravallika, G.J. and Mazhar, S.H. (2021); Jaiswal, U.K. *et al*. (2023) and Nagamani, P.R. *et al. (*2023).

CONCLUSION

Most of the respondent farmers were unaware and had low level of knowledge about disaster risk reduction agricultural practices.Adaptive capacities of farmers and rural youth can be improved with disaster risk mitigations agricultural practices to face the challenges of farm disaster through skill-oriented training and extension education programmes. Appropriate agricultural technology interventions suited for hazards affected areas may be planned keeping in view the farmers' low annual income, marginal to small size operational land holding and knowledge on farm disaster mitigation practices.

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