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Attributes of CRIJAF Nail Weeder as perceived by the jute growers in West Bengal

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ABSTRACT

Weed infestation is one of the major problems faced by farmers in jute cultivation. ICAR-Central Research Institute for Jute and Allied Fibres has developed an innovative technology CRIJAF Nail Weeder to address the problem of weeding and thinning operations in the jute field. In this regard, the study was conducted to determine the perception of the jute growers towards its attributes. It was found that the weeder is relatively more advantageous, compatible, simple to use and give prominent results. The technology effectiveness index of the weeder was found to be 83.96 that shows affirmative perceptions of the jute growers towards the innovation. This indicate that a considerable number of jute growers would prefer to take up the innovative machinery, i.e., Nail Weeder for weeding and thinning purposes in jute crop.

***Keywords*:** Adoption, ICAR-CRIJAF, innovative technologies, Nail Weeder, perceived attributes.

In 2020-21, jute production in India was highest with 1807.26 thousand metric tons (Anon., 2022). In India,West Bengal holds the second position among the jute growing states after Bihar with production of 162.10 bales with 2340 kg ha^{-1} productivity in 2020-21 (Anon., 2022). Cultivation of jute is labor intensive and is also a source of income for millions of small and marginal farm-families. Jute cultivation is carried out in 87 districts of India among which 33 districts are prominent ones. The majority of these districts are situated in West Bengal viz. Murshidabad, Nadia,North 24 Parganas, Maldah, Howrah, etc. (Jha *et al*., 2022).

Weeding is the most important problem in jute cultivation that may cause yield loss upto 70 per cent in jute (Ghorai *et al*., 2004). Naik and Karmakar (2016) reported that weeding and thinning constitute the costliest and energy intensive field operations in jute cultivation. The conventional weed control technique employed by the jute growers is hand-weeding preferably by wheel hoe or blade hoe as it reduces the probability of toxic residues in the crop fields and also due to lack of knowledge of chemical herbicides among farmers (Adenawoola *et al*., 2005). Because of higher labor wages, hand-weeding comprises around 30-40 per cent of the total production cost in jute cultivation (Islam, 2014). Increasing the cost of cultivation is not remunerative to the farming systems as the crop is mainly grown by the small and marginal jute growers.

Therefore, to solve this problem, ICAR-Central Research Institute of Jute and Allied Fibres (CRIJAF) has developed CRIJAF Nail Weeder to economize the cultivation cost by reducing the labor requirement for weeding by 65-80 per cent (Ghorai *et al*., 2010). But, before the commercial dissemination of technology, the assessment of the perceived attributes of a technology should be done to increase its rate of adoption (Chavan *et al*., 2017). The perception of farmers differs to a great extent as compared to that of the experts or researchers. The experts mainly concentrate on accuracy of information, practicability of information, use of language, profitability, clarity of information, economic parameters, technical details and procedural details, etc., whereas the prime focus of the farmers is towards the high relevance for materials required, technical details, precautions to be taken, clarity of information, procedural details, practicability and accuracy of information and use of illustrations etc. In this way different technologies are perceived differently by different stakeholders i.e., experts and farmers (Nain *et al*., 2019). Therefore, to measure the perception of the jute growers towards the innovative technology of CRIJAF Nail Weeder developed by ICAR-CRIJAF for weeding in the jute field, the present study has been taken up.

MATERIALS AND METHODS

The present investigation was conducted in Kumra village under Habra block in North 24 Parganas district and Brahmapur village under Haringhata block in Nadia district where ICAR-CRIJAF has disseminated the innovative technology, CRIJAF Nail Weeder to the practicing jute cultivators since 2013-14. From each

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village, 40 jute growers who had adopted the technology of CRIJAF Nail Weeder were selected through random sampling method; thus, comprising of a sample size of 80 respondents. Exploratory research design was followed to carry out the present study as the study aims to determine the extent to which the jute growers perceived the innovative technology.

Perception has been operationalised in the present study as practical understanding of the jute growers regarding the utility and interpretation of various aspects of the manually driven CRIJAF Nail Weeder during its adoption. The way how the attributes of a technology is perceived by a farmer is classified into five attributes i.e., relative advantage (the extent to which an innovative technology is seen as being superior to the old one), compatibility (the extent to which a technology is in line with the existing norms, past experiences and needs of the adopters), complexity (the degree to which an idea/object is perceived as relatively difficult to understand or use), observability (the extent to which the consequences of an innovation are prominently visible to others) and the degree to which a material technology could be experimented into their farmas trialability. These five attributes affect the adoption rate in a social system.

An index was developed to measure the perceived attributes of CRIJAF Nail Weeder. Initially, 33 items were collected after discussion with experts, extension specialists, scientists of ICAR-CRIJAF and relevant literature. Finally, 28 statements were selected after scrutinizing and editing as per criteria developed by Edwards (1969). Then all the 28 items were mailed to 50 judges who were agricultural experts, extension specialists, and relevant experts of research institutes and agricultural universities. The judges were requested to rate the statements according to its relevancy in a 3-point continuum viz. most relevant, relevant and not relevant. Out of 50 judges 31 replied and finally, 19 items related to perceived attributes of CRIJAF Nail Weeder, which had a relevancy rating score of more than equal to 0.60. By dividing the total obtained score with the maximum obtainable score from those 31 judges, the relevancy rating scores were calculated. In this way out of 19 items, 7 items for relative advantage, 4 items for compatibility, 3 items for complexity and 5 items for observability have been selected for the final administration.

Reliability test: Reliability test was done for all 19 items. For this purpose, a schedule consisting of the selected items were used for interviewing a non-sample of 30 jute growers. The responses of the items were obtained on a three-point continuum i.e, agree, undecided and disagree with scores 3, 2 and 1 respectively. After administration, the results were calculated using SPSS v 26 and the coefficient of internal consistency (Cronbach's Alpha) was found to be 0.82 which denotes high reliability of the developed index.

Validity test: Validity means whether an instrument is able to measure what it claims to measure. Testing the content validity of the index was measured by expert's judgment technique. And the items were selected based on the criteria of more than 60 per cent agreement. So, the constructed index was said to be valid.

Then the statements were administered to all the 80 jute growers in a 3-point continuum, i.e., agree, undecided and disagree with scores of 3, 2 and 1respectively to measure their perception of the machinery i.e., CRIJAF Nail Weeder. The summation of the individual score in each sub items elicited by the individual farmer gives the total perception score for individual respondent.

Perceived attributes of each technology index

$$\frac{\sum actual\ score\ obtained}{\sum maximum\ possible\ score} \times 100$$

Technology effectiveness is operationalised as the average *perceived attributes index* of the technology that determines its rate of adoption in a positive way.

$$Technology\ effectiveness = \frac{Relative\ advantage + compatibility + non\ -\ complexity + obsevability}{5}$$

By personal interview method using structured interview schedule the data were collected during April-June, 2021. The responses were recorded and tabulated in order to carry out the statistical analysis. The findings were appropriately interpreted and the conclusions and inferences were drawn.

RESULTS AND DISCUSSION

Relative Advantage of CRIJAF Nail Weeder as perceived by the jute growers

Data in Table 1 represented that all the respondents perceived that CRIJAF Nail Weeder weed out the unwanted flora and controls the weeds in an effective

Table: 1 Perceived attributes index of CRIJAF Nail Weeder N=80

Sl.No.	Attributes perceived by the adopters	Mean Perception Scores	Standard Deviation	Perceived Attributes Index
	Relative advantage			
1.	Effective weed control	3.00	0.00	**100**
2.	Soil mulching	2.78	0.50	**92.5**
3.	Low man power requirement	2.94	0.33	**97.92**
4.	Improve soil aeration through pulverization	2.76	0.43	**92.08**
5.	Low cultivation cost	2.93	0.35	**97.50**
6.	Suitable for mixing fertilizers	2.73	0.48	**90.83**
7.	Subsidy	2.45	0.81	**81.67**
				Average Relative Advantage Index = 93.21
	Compatibility			
8.	Compatible with different soil types	2.15	0.89	**71.67**
9.	Compatible with the existing culture and social system	3	0.00	**100**
10.	Suitable to weed out different weed flora	2.83	0.50	**94.17**
11.	Economic compatibility	2.76	0.58	**92.08**
				Average Compatibility Index = 89.48
	Complexity			
12.	Difficulty in operating on different soil types	1.83	0.88	**60.83**
13.	Difficulty in understanding of operating the machinery	1.00	0.00	**33.33**
14.	Difficulty of Availability and accessibility	1.43	0.69	**47.5**
				Average Complexity Index = 43.19
	Observability			
15.	Smooth operation and usage	2.93	0.35	**97.50**
16.	Reduction of thinning frequency	2.9	0.41	**96.67**
17.	Improved soil health status	2.93	0.27	**97.50**
18.	Effective control of weeds	3	0.00	**100**
19.	Effective fertilizer mixing and soil cover between rows	2.7	0.51	**90**
				Average Observability Index = 96.33

and efficient manner. Ghorai *et al*. (2012) reported that using CRIJAF Nail Weeder at 4-5 days after sowing of jutecould control 80 to 85% of composite weeds flora within the field. Majority i.e, 96.25 per cent of the respondents agreed that the labor has subsequently been reduced due to the adoption of CRIJAF Nail Weeder. Ghorai *et al*. (2010) reported that Nail Weeder reduced the labor requirement for weeding by 65-80 per cent. Among the jute growers, 76.25 per cent opined that due to improved soil aeration through pulverization of soil by the tynes of Nail Weeder the soil health status has been improved. Pulverization of soil maintains soil temperature and preserve soil moisture making it conducive for multiplication of beneficial micro-organisms that enhances soil productivity (Moreno and Moreno,2008). About 81.25 per cent of the respondents reported that the machine could be used to conserve soil moisture by soil mulching technique. The inter-row weeding acts as a soil mulch and hence help in conservation of moisture during dry months and lower the soil temperature up to 5cm soil depth (Chakraborty *et al.*, 2021). Almost, 95 per cent respondents realized the reduction in the cost of cultivation for jute farming and 96.25 per cent respondents reported a reduction in the labor requirement for intercultural operations. Conventional weeding in jute is responsible for 40 per cent of the cultivation cost and fiber yield is reduced upto 70 per cent causing jute farming to produce a poor net return (Ghorai *et al*., 2004). Jha *et al*., (2022) found reduction in labor requirement and increase in fiber yield by using this Nail Weeder. Majority (73.75 per cent of respondents) reported that the tynes of Nail Weeder can be utilized for mixing fertilizers. But only 65 per cent of them agreed that adequate subsidy was provided to them for adoption of the technology.

Compatibility of CRIJAF Nail Weeder as perceived by the jute growers

Table 1 revealed that cent per cent of the farmers agreed upon the compatibility of the weeder with the existing culture and social system of the village. The use of the implement would not affect their traditional beliefs, customs and values and hence the society would have no objection rather it would permit them to use it. Also 87.5 of them opined that the weeder is very suitable to weed out the different species of weeds with much ease. CRIJAF Nail Weeder could uproot the jute field grassy weeds (*Cynodon dactylon*), sedges (*Cyperus rotundus*) and broadleaf weeds (*Eclipta alba*) that could reach upto 90 per cent infestation (Ghorai *et al*., 2013). The weeder technology is very well compatible from the economic point of view also opined by 83 per cent of respondents.The cost of the implement is approximately 1800/- for each piece, making it economically compatible for the majority of the small and marginal jute growers.

Complexity of CRIJAF Nail Weeder as perceived by the jute growers

It is clearly indicated in the Table 1 that 31.25 per cent of the respondents found relatively difficult to operate the implement in various types of soil. In the line sown jute crops the Nail Weeder could be operated as a mechanical weed control in sandy loam soil in texture with 44% sand, 28 % silt and 28 % clay (Ghorai *et al*., 2016). Cent per cent of the respondents did not find any difficulty in understanding the skills and techniques that is required in the operation of the machinery. The tool has to be operated at the field capacity stage with to and fro movement (KRISHI, 2022). Therefore, no complex knowledge and skills are required on the part of farmers to operate the machinery. Whereas, 81.25 per cent respondents did not undergo any difficulty in availing and access the Nail Weeder to control the weeds during the peak season.

Observability of CRIJAF Nail Weeder as perceived by the jute growers

The data in Table 1 revealed that 95 per cent of the jute growers opined that this tool smoothly runs and operate in their field at the field capacity situation. Similarly, 93.75 per cent of respondents observed clearly the direct impact of the implement in reducing the frequency of thinning operations. Frontline demonstrations on the machinery realized a reduction in drudgery and cost of thinning and weeding operations (Jha *et al*., 2022). Majority, i.e.,92.5 per cent respondents evidenced improved soil health and better growth of plants. The Nail Weeder can reduce the usage of chemical herbicide and also pulverizes the soil. This results in the multiplication of the beneficial soil-micro organism population which further enhances soil productivity (Banerjee *et al*., 2020). All the respondents noticed the effectiveness of the machine in controlling different kinds of weeds in their fields. The Nail Weeder was helpful in controlling most of the weeds like sedges,grassy weedsand the broad-leaf weeds infesting the jute fields (Jha *et al*., 2022). Rather, 72.5 per cent of respondents clearly noticed the eligibility of the tool in mixing fertilizers and used them for covering the seeds with soil.

Technology effectiveness index of Perceived Attributes of CRIJAF Nail Weeder

The index value of perceived attributes of the weeder was calculated using the formula and indicated in Table 1. The relative advantage index of the technology was 93.21, followed by the compatibility index value of 90.75. The index value of complexity was found to be 43.19. The observability index was calculated to be 96.33.

$$Technology\ effectiveness = \frac{Relative\ advantage + compatibility + non-complexity + obsevability}{5}$$

$$= \frac{93.21 + 89.48 + 56.81^{*} + 96.33}{4} = 83.96$$

(* Complexity index is 43.19, it means 56.81per cent (100–43.19) technology was found not complex, hence in the calculation index of non-complex was considered)

The above technology of CRIJAF Nail Weeder exhibits the overall technology effectiveness index as 83.96. Since this technology has a higher relative advantage and compatible to the social system and less complex, a considerable number of sampled farmers prefer to take up the innovative machinery, i.e., CRIJAF Nail Weeder for weeding and thinning in jute fields.

Similar results were evidenced that the other similar implements viz. grubber weeder, twin wheel hoe weeder and fertilizer applicator were perceived as appropriate interventions in terms of attributes like relative advantage, simplicity, observability, compatibility, trialability, utility, cost and applicability (Singh *et al*., 2006).

CONCLUSION

It comes to farmers to take the decision whether to use or reject any innovation developed through research and development processes. In this regard perception of the farmers play a major role in determining whether they are going to utilize them in their own farming situations. The present study concluded that the farmers

perceived the innovative technology of CRIJAF Nail Weeder as relatively advantageous, compatible with their present situations, less complex in operating the implement as well as gives prominent results. Due to these affirmative responses from the jute growers, it could be predicted that they are interested to take up the innovation and integrate it into their day-to-day farming operations for thinning and weeding operations in jute fields. This would reduce their drudgery, labor requirement as well as the cost of cultivation of jute and further lead to enhancement of the fiber yield. This led to improvement of the jute cultivation scenario as well as acts as a support system in the market competition of jute fibers with other synthetic ones. More use of jute fibers would lead to the reduction in environmental degradation and also acts a remunerative venture for the jute growers in West Bengal.

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