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Extent of adoption behaviour related to improved jute production practices in Murshidabad district of West Bengal

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ABSTRACT

The study was conducted in the Murshidabad district of West Bengal to evaluate the adoption of improved practices towards improving yield and quality of jute. The state and district were purposively selected. Across the district, two blocks were chosen randomly, and from each block, two villages were selected at random. A total of 120 respondents were intervened through the computer-based research randomizer technique. Improved jute production practice index (IJPPI) was developed with 6 improved practice indicators of jute cultivation. A structured interview schedule was used to collect data through direct observation, personal interviews, and focus group discussion. Statistical analyses were performed by mean, frequency, percentage, standard deviation, standard error etc. Results showed that the respondent farmers had a low adoption level in overall IJPPI (0.223). A colour-coded stratified radar chart was developed for the distribution of respondents according to the contribution of each indicator to the overall IJPPI. The IJPPI extents were found to be the following in the study area, in relation to its 6 indicators: seed and sowing (64%), nutrient management (25.83%), weeding (25.83%), fibre extraction and retting (7.0%), insect-pest and disease management (6.25%) and cropping system (0.83%). So, the index value for almost all the indicators in the study area was very low except the seed and sowing indicator. The study area requires significant development in almost every segment. Improved production practices must be incorporated into jute cultivation to reduce stress in enhancing fibre yield and production costs.

Keywords: *Colour-coded stratified radar chart, IJPPI, nutrient management, seed and sowing indicator, weeding indicator.*

In general, jute fibre is produced primarily from two species of the genus Corchorus, that are *Corchorus capsularis* L. (White jute), and *Corchorus olitorius* L. (Dark or Tossa jute) (Islam *et al*., 2015; Islam and Ali, 2017). It belongs to the family Malvaceae (earlier that was Tiliaceae) (Chand and Fahim, 2021). The fibre of jute is popularly known as 'golden fibre' (Rahman *et al*., 2017; Majumder *et al*., 2020) for its length and golden-brown colour (Hao *et al*., 2018). The fibres have worldwide commercial, and domestic use due to having some unique characteristics. It has a long staple length, silky luster, low extensibility, high tensile strength, breathability, thermal and acoustic insulation, antistatic properties, and fire resistance. It can also be blended with both natural and synthetic fibres easily (FAO, 2019; NJB, 2021). Jute is grown mainly in Eastern and Northern states of India, like West Bengal, Assam, Odisha, Tripura, Uttar Pradesh, and Bihar. West Bengal is placed in first position among them in terms of acreage as well as production of jute cultivation (Kumar *et al*., 2014; Bag *et al*., 2016). In West Bengal, the production of jute is mainly confined to the districts such as Murshidabad, Cooch Behar, Nadia, Hooghly, North 24 Parganas, Dakshin Dinajpur, and Malda (Singh *et al*., 2019).

An initiative was taken by the Government of India, "Jute-ICARE (Jute Improved Cultivation and Advanced Retting Exercise)" in 2015 to popularize and launch some of the improved and better agronomic package of practices towards improving the yield and growing good quality jute (PIB, 2017; CRIJAF, 2020). The improved production practices for jute include - Use of short duration, high yielding, and pre-mature flowering resistant varieties like JRO204, JRO524, JRO878, JRO7835, line sowing of jute seeds through multi-row seed drill, weeding in jute field by nail weeder or wheel hoeing, use of herbicide brush for application of non-selective herbicides in line sown jute, testing of soil and use of target yield based recommended fertilizer and its doses, application of talc-based microbial consortium 'CRIJAF SONA' for retting to reduce the duration by 6-7 days and to improve fibre quality, use of manual jute fibre extractor, power-operated fibre extractor for fibre extraction, etc. (Sarkar *et al*., 2016; Kundu, 2016; Satpathy *et al*., 2019; Singh *et al*., 2019). Adopting these improved technologies and practices had a positive result

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on jute cultivation. The impact was evidenced by an increase in the average yield (20.5%), improvement in fibre grade or quality (1–2 grade), and a supplemental income, i.e., return on investment (350-500q) (Satpathy *et al*., 2017). Therefore, it is essential to determine the adoption of all these technologies towards improving yield and quality of jute fibre, thus enhancing profit.

MATERIALS AND METHODS

The current research was taken place in the Murshidabad district of West Bengal during 2020-2021. The state of West Bengal was purposively chosen for this study. The state alone contributed around 80% of the total jute acreage and 84% of total jute production in 2019-20. West Bengal also had the highest productivity (2.8 t ha^{-1}) among the other states of the country (MA&FW, 2020). Murshidabad was chosen for the study as it had the highest acreage and production of jute in West Bengal (Open Government Data (OGD) Platform India, 2014). Two blocks viz.,Raninagar-I and Jalangiof Murshidabad were selected through simple random sampling method to avoid the biases and to obtain precise data. Total of 4 villages, two from each selected block, were selected by lottery method. By selecting 30 respondents from each village, a total of 120 respondents were administered. Data wasgatheredthrough personal interviews, focused group discussion, and direct observation in different phases.The Improved jute production practice index (IJPPI) was constructed by following Alfares&Duffuaa (2009) method and Sullivan et al. (2006) method, propounded by Lal et al. (2017). An exhaustive list of 6 indicators was prepared for the IPJJ index by consulting several literatures, discussion with experts, progressive farmers, etc. Out of the 6 indicators of IJPPI, fibre extraction, and retting indicator had the highest weightage (96.84), trailed by weeding (88.93), seed and sowing (81.02), insect-pest and disease management (76.02), nutrient management (59.68), and cropping system indicator (55.20). The significance of this methodology is that the weight was scored as 100 for an indicator ranked as 1, therefore, no legitimate value is lost. The scores were normalized before being combined in order to integrate the indicators of the IJPPI that were based on multiple units of measurement, which indicates they had to be put on the same scale value. The following formula was used to determine scores for each indicator in this study (Sullivan et al., 2006).

$$Z\ ind\ i = \frac{X_i - X_{min}}{X_{max} - X_{min}} \quad (1)$$

Where, Z indi = Value of the normalized indicator i, X_i = The original values for the indicator i, X_{max} = The highest value and X_{min} = The lowest value

As proposed by Sullivan et al., (2006), the composite score of IJPPI was derived by multiplying the score of each indicator by their corresponding weightage.

$$IJPPI_j = \frac{\sum_{j=1}^{j=n} Wi\ Z\ indi_j}{\sum_{j=1}^{j=n} Wp}$$

$IJPPI_j$ = IJPPI value of j respondent

$Z\ indi_j$ = The value of the normalized indicator i for the j respondents

Ó W_i = The summated value of weightage of all i indicators

The respondent farmers were assorted into the 3 categories (low, medium, and high) according to the normalized score obtained by them, except fibre extraction and retting technology (FER) indicator and cropping system (CS) indicator. The farmers were divided into 2 categories- low and high for those two indicators. The respondents were also divided into low, medium and high categories as per their overall index value by following Mean $\pm\frac{1}{2}$ SD method.

RESULTS AND DISCUSSION

In the present study, the "Improved Jute Production Practice Index (IJPPI)" was conceived as a term consisting of 6 indicators, i.e.,seed and sowing indicator, weeding indicator, nutrient management indicator, insect-pest and disease indicator, fibre extraction and retting indicator and cropping system indicator. Under the following subheadings, the distribution of respondents in each indicator of the IJPPI in the study locale has been reported.

1. Seed and Sowing indicator

From a close analysis of Table1, showed that the majority of the respondents (85%) were fallen under medium level of adoption of improved seed and sowing practices, whereas 10.83% were ata low level and only very few of the respondents (4.17%)had a high level of adoption for this indicator. So, it can be inferred that most respondents have a medium to low level of adoption for seed and sowing indicators. In the study area, most of them were using hybrid yield varieties of jute with the recommended seed rate. This finding was supported by Mahmood et al., 2013 who reported that almost 100% of the farmers were using recommended doses of wheat seed. However, very few farmers were found to be using the best variety,'JRO 204 (Suren)', in terms of productivity (Satpathy et al., 2020; ICAR, 2021). Most farmers claimed that only 'JRO 524

(Navin)' variety was available in the open market. Only few of the farmers were following line sowing method and using seed drills for the purpose.As claimed by farmers, they were compelled to go for broadcasting because no seed drills were available in their local marketplaces (Chapke, 2009). Mandal et al. (2012) also found that very few (20%)of the jute growers adopted the seed drill due to the penurity of improved technologies as one of the possible reasons behind it.

2. Weeding indicator

Table 1 made it clear that almost all the farmers (91.67%) had a medium level of adoption for improved weeding practices; it was trailed by a meager percentage of respondents in high (5%) and low (3%) categories of adoption for this indicator. As most farmers in the study area followed the broadcasting method of seed sowing, there was no scope for running a nail weeder or wheel hoe to the jute field. Most of them were only using post-emergence herbicides. They did not even know about pre-emergence herbicides. Only a few were using both pre and post-emergence herbicides in the study area. None of the respondents had exposure to use herbicide applicator/ brush which is used to apply non-selective herbicides and control the broad-leaved weeds.

3. Nutrient management indicator

Most of the farmers (90%) were in the low level of adoption category, trailed by the same number of respondents (5%) having high and low level of adoption for this indicator, Table 1. Though a good number of farmers was applying balanced dose of fertilizer in jute field, most of them did not have the opportunity to test their soil to know the nutrient status of their field and apply nutrients accordingly (Christie et al., 2018).

4. Insect-pest and disease indicator

From Table 1, it was apparent that the lion's share of the respondents (88.33%) having low level of improved management practices for insect-pest and diseases. It was followed by the respondents who had medium and high adoption levels for this indicator, accounting for 10.83% and 0.83%, respectively. Fewer jute growers were practising integrated pest management (IPM) (Kabir and Rainis, 2015). Most of them were not using any mobile application or artificial intelligence for insect-pest and disease management like 'JAF Safe'. Most of them did not even have an android phone or were exposed to internet facilities.

5. Fibre extraction and retting technology indicator

Data presented in Table 1 revealed that a large portion of the respondents (76.67%) had a low category of adoption of improved fibre extraction and retting technologies. Only 23.33% of respondents were having high category adoption for this indicator. Although, the overall extent of this indicator was very low (7%) in the study area. None of the respondents was found to be used any improved technology to extract the jute fibre. All the respondents were found to be followed 'Single plant extraction method' after retting of jute. As they do not extract the fibre through any mechanical extractor before retting, there was no scope for ribbon retting. Further, there is a chance of the breakage of the jute sticks if extracted through a mechanical extractor. As claimed by the respondents, the broken jute sticks had no market value. Besides, there was no paper and pulp industry around the study locale, so they could sell their broken jute sticks to those industries. Thus, a high labour cost was needed to incur by the jute growers. Because Dutta (2012) observed that the contribution of harvest and post-harvest operations in labour cost was the maximum (44.43%). It was observed that a few of the farmers started to use microbial consortium 'CRIJAF Sona' powder to accelerate the retting process of jute as well as improve the quality of fibre.

6. Cropping system indicator

Table 1 disclosed that almost all the farmers (99.17%) were in a low category in cropping system indicator. Only 0.83% of the respondents were in the high category of adoption. The farmers of the study area did not follow intercropping of jute with green gram. Most of them did not know about it (Chapke, 2009).

The overall value for "Improved Jute Production Practice Index" of an individual farmer was determined by considering the scores for different indicators of IJPPI. Each indicator was multiplied by its corresponding weightage to find out the overall score for the index.

Besides, they were not even following line sowing method, which is a pre-requisite for intercropping.

According to this categorization (Table 2), the largest share of the farmers (44.17%) were having a low level of IJPPI value, trailed by 30.83% and 25% of the respondents had a medium and high range of IJPPI value, respectively. The mean IJPPI value in the study locale was 0.223.

From the above findings, we may infer that most farmers (75%) had a low to medium level of IJPPI value. Most of them were having poor performance in adopting the improved production practices of jute. This might be due to a lack of awareness about the improved technologies, non-availability of various inputs in the market, shortfall of prices of jute fibre, marginal land holding size of the farmers etc.

Distribution of the respondents on the basis of contribution of different indicators to the overall IJPPI

In Fig. 1., a colour-coded stratified radar chart has been drawn depicting the distribution of the respondents

Table 1 : Distribution of respondents based on value of different indicators of IJPPI

Sl no.	Indicators	Categories	Frequency (Percentage)	Mean±SE (Range)
1.	Seed and Sowing indicator	Low (≤0.33) Medium (0.34-0.67) High (>0.67)	13 (10.83) 102 (85) 5 (4.17)	0.64±0.0117 (0.33-1)
2.	Weeding indicator	Low (0) Medium (0.01-0.25) High (>0.25)	4 (3.33) 110 (91.67) 6 (5)	0.2583±0.0078 (0-0.5)
3.	Nutrient management indicator	Low (≤0.5) Medium (0.6-0.75) High (>0.75)	108 (90) 6 (5) 6 (5)	0.2583±0.0285 (0.5-1)
4.	Insect-pest and Disease indicator	Low (0) Medium (0.01-0.5) High (>0.5)	106 (88.33) 13 (10.83) 1 (0.84)	0.0625±0.0163 (0-1)
5.	Fibre extraction and Retting technology indicator	Low (0) High (0.29)	92 (76.67) 28 (23.33)	0.07±0.0111 (0-0.29)
6.	Cropping system indicator	Low (0) High (1)	119 (99.17) 1 (0.83)	0.0083±0.0083 (0-1)

Table 2.Distribution of respondents based on the value of overall IJPPI

Item	Categories	Frequency (Percentage)	Mean±SE	(Range)
Overall IJPPI	Low Medium High	(≤0.188) (0.189-0.259) (>0.259)	53 (44.17) 37 (30.83) 30 (25.00)	0.223±0.0064 (0.108-0.440)

based on the contribution of different indicators to the overall IJPPI. The upper half portion of the chart was coded with green colour and the lower half with red colour. The green zone and the red zone depict the top and least score of the indicators in the study area, respectively. Previously, radar charts had been used by various researchers. But in the chart used by Lal (2014), Lal et al. (2015) and Kale et al. (2019), no systematic pattern was followed to classify different zones required for symmetricity and uniformity. So, every researcher should follow a specific pattern in which the upper half should always be green zone and the lower half should

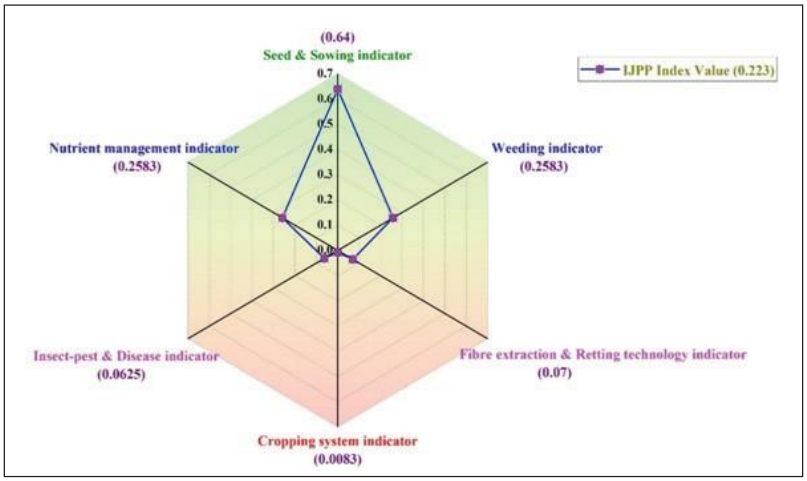

Fig. 1: Colour-coded stratified radar chart for the distribution of the respondents based on the contribution of different indicators to the overall IJPPI

be red zone. In the chart developed by Kale et al. (2019), a specific pattern should have been followed for denoting the three different categories of states. The highly progressive and least progressive states should be denoted by green and red colour, respectively. Preferably, the moderately progressive states should be distinguished by yellow colour. But it was reversed in case of Kale et al. (2019). Moreover, the radar chart was not divided into green and red zones. The data presented in Fig. 1 revealed that the seed and sowing indicator had the highest index value (0.64), as shown in the green zone, while the cropping system indicator had the lowest index value (0.0083), as shown in the red zone. The nutrient management and weeding indicators had equal index values (0.2583). The index values of 'fibre extraction and retting technology indicator' and 'insect-pest and disease indicator' were much less, 0.07 and 0.0625, respectively. Therefore, it can be deduced that the index value for almost all the indicators in the study area was very low except the seed and sowing indicator. The study area requires significant development in almost every segment.

CONCLUSION

The study revealed that most of the jute growers of the study area had a low level of adoption for all the improved practice indicators except for seed and sowing and weeding indicators. Most of them had poor performance in the overall improved jute production practice index. Very few farmers had a high level of adoption of improved production practices of jute. Because most of the farmers in the study locale were following traditional and inefficient management practices for jute production. Therefore, short-duration training programmes and filed level demonstrations can be organized for the farmers to impart technical knowledge and encourage the use of improved technologies. Moreover, jute is a labour-intensive crop, and itis becoming a less-profit enterprise. That's why improved production practices must be incorporated in jute cultivation to reduce production costs and stress in enhancing jute fibre yield. The colour-coded radar chart depicted that seed and sowing indicator (0.64) contributed the maximum and cropping system indicator (0.0083) contributed the least to the IJPPI. This chart can be used for uniformity, symmetry and to follow a specific pattern in the scientific data representation.

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