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Factors Driving Jute to Maize Shift in Uttar Dinajpur, West Bengal

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ABSTRACT

Jute is an important crop that contributes a pivotal role in the economy and supports the livelihoods of the farmers of the Northern part of West Bengal. However, farmers in the region are gradually shifting away from traditional jute cultivation to adopting maize as their preference and the study investigated the factors influencing transformation. Responses were collected from 60 farmers of Chopra Block using a structured interview schedule during the peak season of maize cultivation in 2019. Principal Component Analysis was used to extract significant factors explaining the motives behind farmers' preference for maize over jute crops. The study envisages that the factors including lack of capital, remunerative market price, high labor costs, poor soil quality and inadequate irrigation water, unavailability of improved seed varieties, high input costs, and inadequate market facilities are the key factors for discouragement of cultivation of jute. The government should develop some supportive infrastructure like providing high-quality maize seeds, conducting awareness programs to educate the farmers about the benefits and byproducts of maize, and offering knowledge about export and import markets. Capacity building and extension approaches can aid the transition and foster positive contributions to the agricultural sector of the locality.

INTRODUCTION

The agricultural sector continues to be vital for development, especially in developing countries where the sector is significant in terms of both total income and labour force (Shetty et al., 1990). The Northern part of West Bengal has a variety of productive soil and weather condition makes the people dependent on agriculture. Farmers produce mainly cereals, pulses, oil seeds, vegetables, and jute. The state is a significant contributor to the production of jute in India. It accounts for approximately 65 per cent of the raw jute acreage in the country. It plays a crucial role in the jute industry, with 61 out of the 78 composite jute mills located in West Bengal. These mills have a total of 48 thousand looms with 7.5 lakh spindles. The production of jute goods in West Bengal and its contribution to the total production of jute in the country is substantial (Ministry of Textiles, 2022). Jute was once referred to as the "Golden Fibre" because of its significance to the country (Ray et al., 2022). Rural areas in West Bengal's northern region are undergoing fast change as demand- and market-driven agriculture creates new prospects (Haque et al., 2022). However, due to several factors, the area in West Bengal where the jute crop is grown is rapidly decreasing (Sarkar & Majumdar, 2016; Chatterjee et al., 2022). Along with the reasons *viz.* lack of an appropriate market system, uncertainty over crop returns, labor-intensive crops, high labour costs, insufficient retting infrastructures, and a lack of input availability at the local level are also hindered the cultivation of jute (Islam et al., 2015; Rahman, 2017; Akter et al., 2020). Consequently, the farmers of this region are replacing the jute crop with maize. In this respect, the process of adoption is considered the central concept of the researchers in

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the field of diffusion of innovation. It has been defined by Rogers (1962) as a mental process through which an individual passes from first hearing about an innovation to final adoption.

One of the most adaptable developing crops, maize is grown for a variety of reasons during many seasons and ecologies (Dass et al., 2012). With a yield of 2525490 tonnes, maize is grown in West Bengal on an area of 361339hectares (Directorate of Economics and Statistics, 2023). Pre-kharif maize is becoming more and more popular among farmers in North Bengal, mainly because it has the highest yield potential due to the availability of nutrients from prior crops (Chhetri et al., 2018). Cropping sequences is a rotation system approach in crop production that enable the available natural resources to be preserved and more efficiently utilized. According to Siddiqui & Afzal (2018), the area planted with maize has significantly expanded as a result of greater economic benefit, but the area planted with jute has significantly decreased and its cropping order has changed as a result of higher profits of Uttar Dinajpur district. Previously the cropping sequence of some parts of North Bengal was paddy-vegetable- jute, now the new cropping pattern of some parts of North Bengal is paddy-vegetable-maize. The West Bengal government, acknowledging the maize production potential, earned the "Krishi Karman Award" from the Union Government for 2017-18, a recognition they had secured for five consecutive years, spanning from 2011-12 to 2015-16. The study is likely to reveal key factors influencing the preference for maize cultivation over jute, aiding the understanding of farmers' choices and agricultural dynamics in the region which may help to support agricultural transitions and enhance farmers' livelihoods.

METHODOLOGY

With an ex-post-facto and exploratory research design, the study's goal was to identify the variables that discourage the growing of jute and encourage the adoption of maize farming. The study was conducted in the Chopra block of Uttar Dinajpur district. The methodology suggested by Kerlinger (1966); Ray & Mondal (2011) was followed with modifications. Chopra block was selected purposively. Two villages, viz. Satramgach and Sadhuramgach, were selected, and 30 farmers from each village were selected through a random sampling method. Thus, a total of 60 farmers were selected for this study as respondents. The data were collected from the farmers by personal interview method with the help of structured interview schedule during the month of October to December 2019. To make the results comprehensible and understandable, the data were coded, tabulated, analyzed, and presented in tables. Initially, thirty-six items were identified after going through related literature and expert suggestions from related disciplines, as per guidelines set up by Edwards (1969). Out of thirty-six factors, twenty-eight factors were finally selected and presented to the respondent in four points continuums *viz.* fully agreed, partially agreed, not agreed at all, and can't tell with weights 4, 3, 2, 1 respectively. The data were analyzed using descriptive statistics, which are useful for summarizing data. Descriptive statistics are divided into two main categories: central tendency (such as the mean) and variability (like standard deviation). These metrics help represent either the entire dataset or a subset of it. Later, the Principal Component Analysis (PCA) was utilized, which is also the method used by Gupta et al., (2020); Gupta et al., (2021); Paine et al., (2021) & Sahoo et al., (2023). PCA is a technique for reducing the number of dimensions in large data sets by condensing a large collection of variables into a smaller set that retains most of the large set's information. Statistical Package for Social Sciences (SPSS), version 23.0 software was used to perform Principal Component Analysis.

RESULTS AND DISCUSSION

Table 1 describes the findings, which show that the data were suitable for principal component analysis (BTS at 583.667, level of significance at P = 0.000). The KMO test for sampling adequacy yielded a value of 0.603, indicating that there was sufficient data to support substituting jute with maize. The two tests demonstrate that the principal component analysis method is appropriate.

Table 1. KMO and Bartlett's test

Kaiser-Meyer-Olkin measure of sampling adequacy (KMO)		0.603
Bartlett's test of sphericity (BTS)	Approx. chi-square	583.667
	df	351
	Sig.	0.000

Figure 1 illustrates graphically and lists the 10 components that affected the shifting from jute to maize farming. Eigenvalue represents the variance or importance of the data that is accounted for by a corresponding factor or component. Higher eigenvalues indicate that the associated factor explains more variance in the data. In contrast, lower eigenvalues suggest that the corresponding factor contributes less to explaining the variance. The scree plot representing the 10 components which are greater than 1.000 eigenvalue implies that more than one factor is relevant in describing the relationships between the items of the factorial component.

Table 2 depicts that the ten components have the eigen value greater than 1.000. For the first component there was an Eigen value of 4.269, a variance and cumulative percentage of 11.041 and 11.041, respectively. The three factors i.e., lack of capital/finance at right time (0.800), low harvest price (0.719) and lack of zone-specific technological know-how's (0.793) combined to form the component. Component one is labeled as "lack of capital and the remunerative market price of jute" which minimize the jute cultivation. The second component was labeled as "high labour cost during crop season" where three factors have high loading *viz*, lack of sufficient family manpower, adverse climatic situationand large size of holding. The second component had an Eigenvalue of 2.463, a percentage of the variance of 6.933, and a percentage of cumulative of 17.975 and was labeled as "high labour cost during crop season" where three factors have high loading *viz*, lack of sufficient family manpower (0.729), low harvest price (0.829) and large size of holding (0.797). Similar findings to the present study, Chapke (2009); Biswas (2001) also found that over 80 per cent of farmers lack awareness regarding improved production technologies. This lack of awareness is attributed to the absence of a well-organized market and grading system, which is reported to be at 93 per cent. Labor-intensive jute cultivation, involving all activities from sowing to fibre extraction, faces higher cultivation costs due to recent increases in human labor prices caused by shortages and higher wages. (Haldar, 2021)

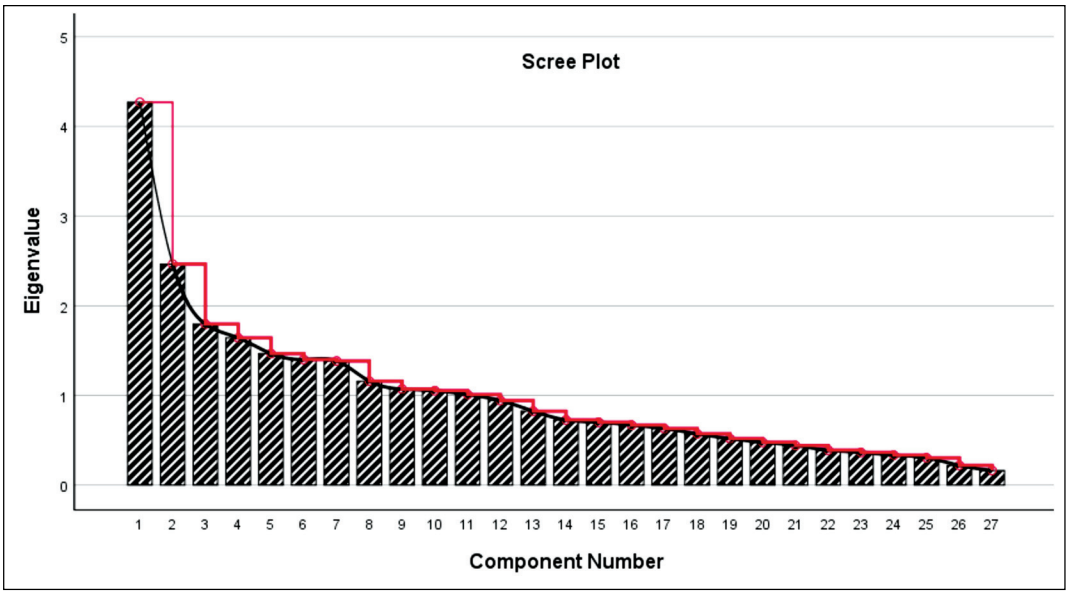

Figure 1. Scree plot of strategic conglomeration of variables into factor

The third component, "poor quality of soil and lack of irrigation water," was derived with an eigenvalue of 1.797. This component's two constituents, "poor quality of land" (0.805) and "lack of irrigation water" (0.880), both showed high loadings. The insufficient availability of irrigation water and subpar soil quality ranks as the third most crucial factor driving shifts in crop choices, leading to the preference for maize over jute in the surveyed region due to jute's water-intensive retting process. In addition to the substantial water demand for the retting procedure, the conventional method of obtaining water for jute processing results in poor water quality. Frequently, the water is unsuitable for reuse in other agricultural activities (Das et al., 2014). Insufficient bodies of water for irrigation and retting (both 28 and 42%) are also noted by Chapke (2009). The fourth component has a variance percentage of 6.481, an eigenvalue of 1.643, and a total variance of 31.338. Due to a high loading of factors, component 4 is labeled as "lack of suitable and improved variety of seed," specifically "lack of seed of suitable variety of crops" (0.719) and "situation of land" (0.750). Similar findings reported by Pathak (2001) that lack of good-producing jute variety seeds, soil issues, terrain, and a lot of weeds in the field.

Component 5 was marked as having a "high input cost of cultivation", and two of its factors have high loading, high input costs (0.801), and limited mechanical power availability (0.666) during crop season. The cumulative variance explanation for this component is 37.752 per cent, and it is associated with an eigenvalue of 1.468.'Jute production has become a non-profit enterprise due to rising costs of agricultural supplies and manpower, and traditional jute farmers are gradually switching to more remunerative crops like maize, according to Naik et al., (2016). Due to the high loading of the two components, lack of management skill (0.812), and lack of market facilities (0.608), component 6 is labeled as "absence of market facilities". This component's cumulative variance was 43.771, while the overall variance was 6.018 and eigenvalue of 1.401. Similar findings were revealed by Chapke (2009) that jute farmers face constraints like no appropriate regulated market, absence of managerial skills, middle man in jute market.'. Farmers did not receive the required remuneration because the market price of jute dropped.

Due to significant loadings of the components such as lack of crop insurance (0.817) and lack of knowledge about financial institutions (bank, co-ops, etc.) (0.744), component 7 was labelled as "absence of awareness about crop insurance, financial practices." The seventh component had an Eigenvalue of 1.386, a percentage of the variance of 5.826, and a percentage of cumulative of 49.597. Crop insurance and advanced practices helps in adverse condition of cultivation like low production, adverse climate condition etc. But the farmers of the village were not aware about crop insurance, advanced practices. Similar findings were revealed by Prasad and Choudhary (2022) that boro rice farmers in Bihar did not embrace boro rice production technique due to the absence of financing availability accounting for 81.66 per cent of the identified factors. The eighth component had an Eigenvalue of 1.160, a percentage of the variance of 5.812, and a percentage of cumulative of 55.408. there were three factors in this component. Factors covered by this

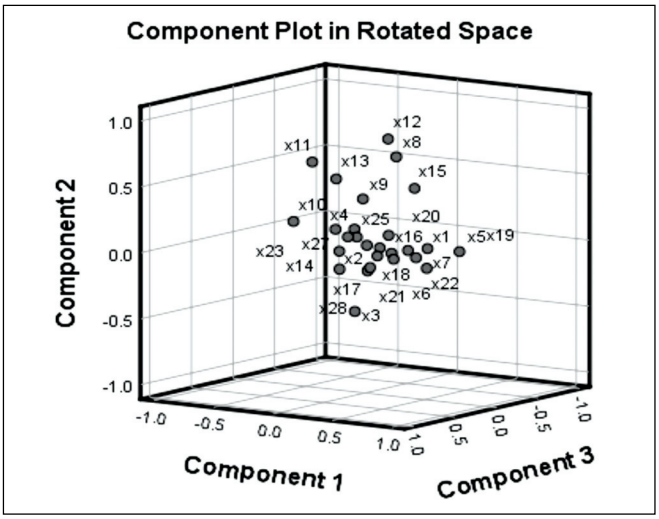

Figure 2. Component plot in rotated space strategic conglomeration of variables into factor

Table 2. Principal component analysis (varimax rotation), factor loading and communalities for factors influencing shifting from jute to maize cultivation

Rotated component matrix											Commu-nalities
	Component										
Variables	1	2	3	4	5	6	7	8	9	10	
Lack of capital and remunerative market price of jute											
Lack of capital/finance at right time (x_8)	0.790										0.800
Low harvest price (x_{11})	0.743										0.719
Lack of zone-specific technological know-how's (x_{12})	0.748										0.793
High labour cost during crop season											
Lack of sufficient family man power (x_{16})		0.585									0.729
Adverse climatic situation (x_{26})		-0.564									0.829
Large size of holding (x_{27})		0.855									0.797
Poor quality of soil and lack of irrigation water											
Poor quality of soil/ land (x_{10})			0.656								0.805
Lack of irrigation water (x_{14})			-0.904								0.880
Lack of suitable and improved variety of seed											
Lack of seed of suitable variety of crops (x_3)				-0.754							0.719
Situation of land (x_9)				0.658							0.750
High input cost of cultivation											
High(input) cost of cultivation (x_4)					0.752						0.801
Low availability of mechanical power during crop season (x_5)					-0.709						0.666
Absence of market facilities											
Lack of managerial ability (x_{19})						0.749					0.812
Lack of market facilities (x_{20})						-0.697					0.608
Absence of awareness about crop insurance, financial practices											
Lack of crop insurance (x_{22})							0.759				0.817
Lack of knowledge about financial institutions (bank, co-operatives, etc.) (x_{28})							-0.726				0.744
High capital for jute cultivation											
Lack of capital/finance for crop cultivation (x_1)								0.559			0.736
Lack of orientation improved crop culture (x_2)								-0.633			0.769
Low availability of insecticide, herbicide (x_{21})								0.783			0.824
Absence of suitable technological knowledge											
Lack of improved technological know-how's (x_{17})									-0.649		0.786
Illiteracy/little education of the farm family head (x_{18})									0.813		0.822
High incentive and organic manure											
Low availability of organic manure at disposal (x_7)										0.820	0.705
Lack of man power at the time of crop operation (x_{24})										0.509	0.651
Eigen value	4.27	2.46	1.80	1.64	1.47	1.40	1.37	1.16	1.07	1.05	
Percentage of variance	11.04	6.93	6.88	6.48	6.41	6.02	5.83	5.81	5.55	5.41	
Percentage of cumulative	11.04	17.97	24.86	31.34	37.75	43.77	49.60	55.41	60.96	66.36	

component lack of capital/finance for crop cultivation (0.736), lack of orientation improved crop culture (0.769), and, low availability of insecticide, herbicide (0.824). the component labeled as "high capital for jute cultivation". Similarly, Chapke (2009) found in his respective study that farmers face problems like low cost for jute cultivation, lack of awareness about the improved crop culture.

As a result of the factors' high loadings, component 9 was labelled as "lack of appropriate technological knowledge." The head of the farm household is illiterate or has limited education (0.786) and lacks advanced technological knowledge (0.822). The ninth component had an Eigenvalue of 1.071, a percentage of the variance of 5.548, and a percentage of cumulative of 60.957. The component 10 was made up of two factors i.e., low availability of organic manure at disposal (0.705) and lack of manpower at the time of crop operation (0.651)" This component's eigenvalue is 1.053, and its cumulative variance explanation is 66.362. Chapke (2009) reported a similar finding. Major labor-related challenges faced by farmers include the need for more work during jute retting operations (81%) and high labour costs during peak seasons, such as weeding and harvesting (79%). During the busy season, almost 23 per cent of farmers reported a workforce shortage.

Figure 2 indicates this graphically, showing how the components plotted in space rotated present a clearer presentation in which both the position of data pertaining to the factorial component and the relationship between data provided by the variables of factors influencing the shifting from jute to maize cultivation.

CONCLUSION

Traditionally, farmers have been growing jute, but due to its low production, limited profitability, high labour cost, inadequate market facilities and unattractive market prices, they have increasingly turned to maize cultivation. To sustain maize cultivation in the respective locality, the Government should develop some supportive infrastructure and promote capacity building. These include providing high-quality maize seeds, conducting awareness programs to educate farmers about the benefits and byproducts of maize, and offering knowledge about export and import markets. Implementation of such initiatives may facilitate the adoption and distribution of maize technology among farmers, leading to an overall improvement in agricultural practices and economic outcomes in the region.

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