Type of article: Original research Article

A study on the knowledge level and extent of adoption of plant protection measures against blast disease of rice by the farmers of Indian Sundarbans

ABSTRACT

The study was conducted to know the knowledge and adoption level of plant protection measures against blast disease among 80 respondent paddy growers in the blocks of North and South 24 Parganas of Sundarbans. About 48.75% of the respondents had medium knowledge. Majority of the respondents (75%) knew about blast disease of rice and its key identifying symptom. The 67.5% farmers were having the knowledge about the fungicides used against the disease (Tricyclazole 75 WP, Carbendazim 50 WP, Hexaconazole 5EC), and 22.5% of the farmers knowing about the recommended dose of fungicide application. The 28.75% of the respondents also knew that the fungicide should be applied at the first appearance of the disease. Further, it has been found that the adoption level of plant protection measures against blast disease of rice was medium (47.5%). Nearly 53.75% of the respondents practicing rice cultivation were in the middle age group of 31-50 years. Most of the respondent had either 0.13-0.27ha (22.5%) or 0.40-0.67ha (37.5%) landholding wherein they were practicing rice cultivation. Almost all the respondents (100%) possessed Knapsack or hand sprayer for fungicide application. Climatic vagaries, lack of knowledge about to the number of sprays and concerning technology application, non-availability of fungicide on time, lack of facility at the nearby place were the major constraints as expressed by 95, 83.75, 85, 90, and 95 per cent of respondents, respectively. The high cost of chemicals and expensiveness and non-availability of labour during peak cropping period were also the major constraints as expressed by 60 and 83.75 per cent of the respondents, respectively. There was a significant relationship between age, education, landholding, social, mass media and participation in extension activities with knowledge and adoption levels of the farmers of the Indian Sundarbans.

Keyword: Adoption level, blast disease, knowledge level, plant protection measures, rice, Sundarbans

INTRODUCTION

Rice, as a cereal grain, is the staple food for a large part of the world's human population including more than 100 countries worldwide (Liu *et al*., 2018). It is anticipated that the rice consumption around the world will continue to grow steadily at around 1.1% per annum according to a report published by market research firm IndexBo. The rice production in India was 172.8 million metric tons in 2018 and is projected to register a CAGR of 2.7% during the forecast period, 2020-2025 (Mordor Intilligence, 2020). Major Rice producing states in India are West Bengal, Uttar Pradesh, Andhra Pradesh, Punjab, Tamil Nadu, Odisha, and Bihar. West Bengal is the largest producer of Rice in India. The total production of rice during 2017-18 was 14.97 million tonnes with a share of 13.26% in all India production (Prasad, 2019).

Sundarbans, the southern-most part of West Bengal under Coastal and Saline agro-ecological zone is the largest delta on planet Earth. The livelihoods of the rural people in

Sundarbans are predominantly dependent on agriculture, which occupies a substantial proportion of the land area. The agrarian economy of Sundarbans is primarily dominated by rice-based farming system, where generally the rice-rice-fallow system is being practiced year after year. There are many constraints such as salinity, impeded drainage, lack of irrigation potential, lack of proper communication for marketing of produce etc. Besides, most of the areas are mono-cropped with rice. Sustainable agriculture is an essential component of economic growth which ultimately seeks to sustain farmers, resources and communities by promoting farming practices and techniques that are economically viable, environmentally sound and socially supportive. The economic growth and progress actually depend to a large extent on the improvement of agricultural technology and the adoption of agricultural innovations by the farmers. Therefore, it is necessary to change the attitude of the farmers so that they may shift from traditional to modern methods of farming. For this purpose, it is essential to disseminate the useful technical know-how from lab to land to the millions of farmers.

The farmers should be kept abreast with the latest technological innovation in the field of agriculture and subsequent motivation through aggressive extension activities towards the adoption of new technologies and modern farm practices. Their knowledge and experience also help them or compel them to adopt new technologies to keep agricultural practices ongoing and to maintain their livelihood properly. With burgeoning population and pressure on limited land resource, the need of the hour is to increase the production and productivity of crop to mitigate poverty, hunger and malnutrition. In order to increase the production and productivity of crop, it is quite evident that every effort should be drawn towards the enhancement of adoption of improved farm practices to its greatest level. The prerequisite to the adoption process is the knowledge of the recommended technologies. The basic input for achieving higher productivity through the assimilation of technological knowledge is one of the important components of behaviour and as such, it plays a major role in covert and overt behaviour of human beings. Knowledge of technology is the basic requirement as it gives impetus to adopt the technology. The adoption of any technologies depends on the individual development and acceptance of modern agricultural technology is the prime attention for increasing crop production. It is generally observed that all the farmers do not use recommended practices. It is the experience of the extension workers that many practices including plant protection measures in spite of their merits are not being accepted widely by the farmers. Some technologies record very slow rate of adoption. It is, therefore, a question as to why one practice is more readily adopted than the other. One of the possible answers is some innate characteristics of the practice, which may speed up or retard its rate of adoption. The differential rate of adoption of farm technologies by the farmers is generally attributed to some of the personal and socio-economic characteristics of farmers (Awotide *et al*., 2016).

Rice blast is responsible for yield losses of about 10% to 30% annually (Wilson and Talbot, 2009, Ashkani *et al*., 2015, Sakulkoo *et al*., 2018). Under favourable environmental conditions, it can cause havoc to the entire rice crop within 15 to 20 days and cause yield losses of up to 100% (Musiime *et al*., 2005). Thus, it poses a crucial challenge to rice production thereby threatening global food security. In Sundarbans, blast disease in rice is one of the important diseases. Plant protection measures for the management of blast disease of rice plays a vital role in modern agriculture. Fertilizers, plant protection measures, irrigation and improved seeds are the key elements of modern agriculture. In the absence of adequate plant protection measures, the positive contribution of improved seeds, fertilizers and irrigation to output could completely nullify and farmers may incur heavy losses. Thus, in this perspective, the study was

undertaken to know the knowledge and adoption level of different plant protection measures for the management of blast disease of rice by the farmers of the Sundarban region.

MATERIALS AND METHODS

The study was conducted in the randomly selected villages in the blocks of North and South 24 Parganas of Sundarbans to know the knowledge and adoption level of plant protection measures for the management of blast disease of rice. Four villages namely Hiranmyapur (Basanti CD block), Kachukhali (Gosaba CD block), Jogeshganj (Hingalganj CD block), Radhanagar (Sahara Radhanagar) (Sandeshkhali I CD block) were selected during 2016-17. These villages were purposively selected since these villages were dominated by rice based farming system and also based on the criteria of blast diseases incidence level. In each selected village, list of farmers cultivating rice crop during 2016-17 was prepared and from each village 20 farmers were selected randomly. Thus, 80 paddy growing farmers spread over four villages of Sundarbans constituted the total sample size for the study. Based on the objectives, variables and available literature on the topic an interview schedule was prepared in English language taking into consideration that questions do not include ambiguous and contradictory statements. In this way the research schedule was constructed to collect the necessary information. The author personally interviewed the respondents included in the sample. The importance and objectives of the study were clearly explained to all the respondents. They were assured that all the information furnished by them will be used for the research study only. The qualitative data was quantified by using various statistical tools and working out different scores in order to find out the nature of association between dependent and independent variables.

1. Independent Variables

1.1 Age

It is one of the basic characteristic of an individual linked with his maturity, physical fitness and productivity. At the time of interview, chronological age was considered as it is a convenient and often very good predictor of health status, disease burden and physical capability. The respondents according to age were classified into three categories.

a. Up to 30 years - Young
b. 31 to 50 years - Middle Age
c. 50 years and above - Old Age

1.2 Education

The level of formal education attained by an individual tends to influence the extent to which an individual is exposed to new ideas and outer world. According to formal education, the respondents were classified into following categories.

a. Upto 8th class
b. 8th to Higher secondary
c. Graduate and above

1.3 Land Holding

The land holding refers to the actual land owned by the family of farmers in bigha (1 bigha = 33 decimal) that was converted into hectare (ha). According to the extent of land possessed by them, the respondents were classified into five categories.

a. Upto 0.13ha
b. 0.13-0.40ha
c. 0.40-0.67ha
d. 0.67 -1.33ha
e. Above 1.33ha

1.4 Source of irrigation

The source of irrigation is operationalised as the number of source of irrigation possessed by an individual farmer. The score was worked out by assigning one score to shallow pumps, two score to stored rain water in the ponds and score three to canal (*khal*) - big water bodies. Frequency and percentages were used to present the data.

1. Shallow pumps
2. Stored rain water in the ponds
3. Canal (*Khal*)- Big Water Bodies

1.5 Possession of Plant Protection Equipments

The possession of plant protection equipments is operationalized as the number of plant protection equipments owned by an individual farmer. The score was worked out by assigning one score to each respondent having participation in one social organization and zero score was assigned to the respondent with no participation. Frequency and percentages were used to present the data. The plant protection equipments taken into consideration were:

a. Knapsack Sprayers
b. Foot sprayers
c. Power sprayers
d. Weighting machines
e. Measuring cylinder/cap
f. Duster

1.6 Social participation

Social participation refers to the participation of a respondent in various formal and informal organizations. The different social media sources were listed and the respondents were asked to indicate their participation in each of these activities. The score was worked out by assigning one score to each respondent for participation in one social organization score and zero score was assigned to the respondent with no participation. Frequency and percentages were used to present the data. The various social organizations considered were:

1. Village panchayat
2. NGO
3. Co-operative society/bank
4. Farmer's Club

1.7 Mass media participation

This refers to the exposure of an individual farmer to different mass media and the degree of participation in them. The different mass media sources were listed and the respondents were asked to indicate their participation in each of these activities. The score was worked out by

assigning one score to each respondent for utilizing one mass media and zero score was assigned to the respondent with no utilization of mass media. Frequency and percentages were used to present the data. The various mass media considered were:

1. Reading / Listening newspaper
2. Listening to radio (agricultural programmes)
3. Farm magazines/ leaflets
4. Television

1.8 Extension participation

It refers to the extent of participation of the farmers in different extension activities conducted during the year 2016-17 in the area. A list of extension activities was prepared and respondents were asked to indicate their participation in each one of them. The score was worked out by assigning one score to each respondent for participation in one extension activity and zero score was assigned to the respondent with no participation in extension activity. Frequency and percentages were used to present the data. The various extension activities considered were:

1. Participation in demonstrations
2. Participation in extension meetings with ADA, Panchayat, Cooperative society, Companies, NGO
3. Participation in field days on farmer's field
4. Participation in Krishimela / Kisan mela / Agricultural fair

2. Dependent Variables

2.1 Knowledge

This refers to the farmers understanding or the body of information understood and retained by the farmers about recommended plant protection measures in rice cultivation. In this study, all the important plant protection measures for management of blast disease of rice were listed in consultation with the experts in this field. A total number of 21 common recommended plant protection measures in rice crop were selected based on the judgment of specialists. The relevant answers for these items were obtained with the help of package of practices and paddy crop experts of the Visva-Bharati, Palli-Shiska Bhavana, Department of Plant Pathology. Each correct knowledge item was credited with one score and zero score was given to wrong answer. Thus, the maximum score that one could get was 21 and the minimum being zero. The total knowledge score for each respondent was calculated by summing up the number of items correctly answered by an individual respondent. Based on the total scores obtained, the knowledge index was worked out as follows:

$$\text{Knowledge index} = \frac{\text{Number of correct response}}{\text{Total number of knowledge items}} \times 100$$

Respondents were further categorized into three groups of knowledge level based on Mean ($\bar{x}$) and Standard deviation (SD).

Chart 1: Categorized into three groups of knowledge level based on Mean ($\bar{x}$) and Standard deviation (SD).

Category	Criteria	Mean score
Low	< $\bar{x}$ - ½ SD	<35.87
Medium	$\bar{x}$ - ½ SD to $\bar{x}$ +½ SD	35.87 – 55.67

High	< $\bar{x}$ + ½ SD	>55.67

2.2 Adoption

Adoption is a mental process in which an individual passes from first hearing of an innovation to its final adoption. The term adoption in this study means the use of recommended plant protection measures against blast disease of rice for getting expected benefits. In this case, same procedures were followed for listing up the 17 recommended common plant protection measures for managing the blast disease of rice in consultation with the subject specialists. The relevant answers for these items were obtained with the help of package of practices and paddy crop experts. Each full adopted item was credited with two score, one score for the partially adopted item and zero score for non-adoption. Thus, the maximum score that one could get was 17 and the minimum being zero. The maximum and minimum scores obtained for each respondent were 17 and 0. The total adoption score for each respondent was calculated by summing up the number of items correctly answered by an individual respondent. Based on the total scores obtained, the adoption index was worked out as follows:

$$\text{Adoption quotient} = \frac{\text{Adoption score of respondent x100}}{\text{Maximum adoption score one could get}}$$

Chart 2: The respondents were categorized into three categories (low, medium, high) based on Mean ($\bar{x}$) and Standard deviation (SD).

Category	Criteria	Mean score
Low	< $\bar{x}$ - ½ SD	<25.81
Medium	$\bar{x}$ - ½ SD to $\bar{x}$ +½ SD	25.81 – 42.43
High	< $\bar{x}$ + ½ SD	>42.43

3. Statistical Analysis

The data collected was processed, quantified, categorized and tabulated. The established parameters like mean, frequency, percentage and Karl Pearson's correlation coefficient were calculated.

RESULTS AND DISCUSSION

The data presented in Table 1 indicate that majority of the respondents (53.75%) belonged to middle age group. Since, respondents between 31 to 50 years of age group are physically active and accordingly have the better physical capability, good vigour and also more responsibility towards family than the younger ones. This might be the important reason to find that majority of the respondents were in the age group of 31 to 50 years. The results are in line with the research findings reported by earlier workers (Reshmy, 1998, Lakshmisha, 2000 and Babanna, 2002). Data presented in Table 1, further indicate that 20 per cent of the respondents have received education upto 8th class, 35 per cent upto higher secondary and 45 per cent were graduates and above. The literacy rate has improved lot because of the impetus provided by various government schemes to arrest school dropout rates. Since, literacy is the key to socio-economic progress, so parents in order to improve the future prospect of their children have come in the way of getting them better education. The results revealed that the land holders in the category of 0.13-0.67ha was more (37.5%), followed by 0.13-0.40 ha category (22.5%), upto 0.13 ha (18.75%), 0.67-1.33ha (15%) and above 1.33ha (6.25%). The possible reason for low land holdings might be that the ancestor land was fragmented into smaller and smaller sized land

holdings. Further, climate change is triggering a silent yet drastic livelihood changes in the agricultural fields and water bodies of Sundarbans. As agriculture and fishing become increasingly unviable in the island conglomerate battered by extreme weather events and salt water ingression, a sizeable number of farmers are turning into migrant labours or are forced to work in the hundreds of brick kilns that have mushroomed on both sides of the border. These farmers, earlier tending to crops and fishes, are now finding refuge in construction and mining jobs in faraway in the Indian states of Kerala, Gujarat, Karnataka and Maharashtra. In spite of having a fewer acres of land holding, they did not find sufficient time to devote to agriculture because of engagement into occupations other than agriculture. Perusal of Table 1 reveals that almost all the farmers possessed kanpsack sprayer and measuring cylinder/cap (100%) for fungicide application followed by possession of weighting machine (15%), foot sprayers (10%), power sprayers (7.5%). None of them possessed duster. Most of the farmers used stored rain water in ponds (71.25%) for irrigation followed by canal irrigation (22.5%) or shallow pump (6.25%).

Table 1: Socio-economic profile of paddy growers

n=80

Variables	**Category**	**Respondents**	
		Frequency	**Percentage**
1.Age	Upto 30 years (Young)	10	12.5
	31 – 50 years (Middle)	43	53.75
	50 years and above (Old)	27	33.75
2.Education	Upto 8th class	16	20
	8th to Higher Secondary	28	35
	Graduate and above	36	45
3.Land holding	Upto 0.13ha	15	18.75
	0.13-0.40 ha	18	22.5
	0.40-0.67ha	30	37.5
	0.67 -1.33ha	12	15
	Above 1.33ha	5	6.25
4.Plant protection equipments possessed	Knapsack Sprayers	80	100
	Foot sprayers	8	10
	Power Sprayers	6	7.5
	Weighting machines	12	15
	Measuring cylinder/cap	80	100
	Duster	0	0
5.Source of irrigation	Shallow pump	5	6.25
	Stored rain water in the ponds	57	71.25
	Canal (*Khal*)- Big Water Bodies	18	22.5

The data presented in Table 2 indicate that 85 % per cent of the respondents listened to radio as a source to get information followed by newspaper (56.25%), farm magazines and television. Radio, the most popular mass media was possessed by majority of the respondent as it is portable

less costly and without any strain to eyes. It has the power to create awareness and can make a difference in the lives of listeners. Nobody used mobile phone to gather information. These findings get support from the studies conducted by Raghavendra (1997) and Lakshmisha (2000), who reported that mass media considered as credible source of information by majority of the respondents studied.

The data presented in Table 2 indicate that majority of the respondents (90%) participated in Krishimela, exhibitions to enrich their knowledge and for motivation. Besides, such exhibition gives the farmers much needed exposure to plethora of farm implements, different technologies, demonstration of a unique transplantation methods, demonstration on the mixed cropping system in horticulture, demonstration unit on duck and fisheries, exhibition on vermicompost containers, honeybee rearing and innovative methods of farming, especially cultivation of vegetables etc. Similarly, most of the respondents (81.25%) also participated in field trips, extension meetings organized by ADA, Panchyat, cooperative society, different agro-chemical companies, NGO for their benefit. The participation of the respondents in other activities was comparatively less because of lack of motivation and less interest. The results were in line with the findings of Nityashree and Siddaramaiah (1993), whereas Balasubramani (1997) found that the majority of the farmers' participation in extension activities was very low.

The data presented in Table 2 indicate majority of the farmers (87.5%) were associated with Co-operative society/bank followed by fellow farmers (68.5%) and NGO (52.5%). For rest of the organization the association of the respondents was low. This implied that the participation in Co-operative society/bank was very high as compared to other selected organizations. This is because this organization plays a vital role in improving the economic and social condition. It offers short-term and medium-term loan to the members/farmers at sensible interest rates to meet their different needs. It offers credit to the farmers for agriculture function at cheap and simple terms.

Table 2: FARMERS PARTICIPATION IN VARIOUS EVENTS

n=80

Participation type		**Respondents**	
		Frequency	**Percentage**
Mass media participation	Reading / Listening newspaper	45	56.25
	Listening to radio (agricultural programmes)	68	85
	Farm magazines/ leaflets	34	42.5
	Television	20	25
	Mobile	0	0
Extension activities	Demonstrations	16	20
	Extension meetings by ADA, Panchyat, cooperative society, Companies, NGO	65	81.25
	Farmers' Field days	17	21.25
	Krishimela /Exhibition	72	90
Social activities	Village panchayat	25	31.25
	NGO	42	52.5
	Co-operative society/bank	70	87.5
	Farmer's Club	23	28.75

	Fellow farmers	55	68.75

The data presented in Table 3, Fig.1 indicate that the 48.75 % of the respondent had medium level, 27.5% low level and 23.75% high level of knowledge regarding recommended plant protection measures for management of blast disease of rice. Further, perusal of Table 4 revealed that 91.25% of the respondent knew the name of the blast disease of rice locally known as *Jhalsa* as this is one of the major diseases in rice in their area. Also, 75 % of the respondents were aware of the key identifying symptom of blast disease of rice. About 67.5% of the respondent knew that for management of blast disease of rice, fungicides like Tricyclazole 75 WP (Beam) and Hexaconazole 5 EC (Sitara) are used but only 22.5% respondent knew about the recommended dose of these fungicides application for control of blast of rice. Also, 35% of the respondent knew about seed treatment with fungicide for control of blast disease of rice. Few of the respondents also knew about the time and stage of the crop for fungicide application. Cultural practices like use of resistant variety, use of good quality disease free seeds, alteration in the time of transplanting date to skip the incidence of blast disease were known by few respondents especially by the farmers practicing SRI method of rice cultivation and those farmers who had 30-40 years of farming experience. Role of fertilizer in providing major (N, P, K) and minor nutrients (Zn, Si) and subsequently their role in blast disease management was also known by very few respondents. Indiscriminate use of nitrogenous fertilizer enhances the blast disease of rice where Zn and Si were found to prevent the blast disease of rice. About 43.75% respondents had knowledge about the correct dose of fertilizer application. It is better to acquire knowledge in every practice as it enhances better adoption level. The findings were in conformity with the observations of Balasubramani (1997) and Raghavendra (1997).

Table 3: Knowledge level of the respondents about recommended plant protection measures for management of blast disease of rice

(n=80)

Knowledge level	Frequency	Percentage
Low (<35.87)	22	27.5
Medium (35.87 – 55.67)	39	48.75
High (>55.67)	19	23.75
Total	80	100

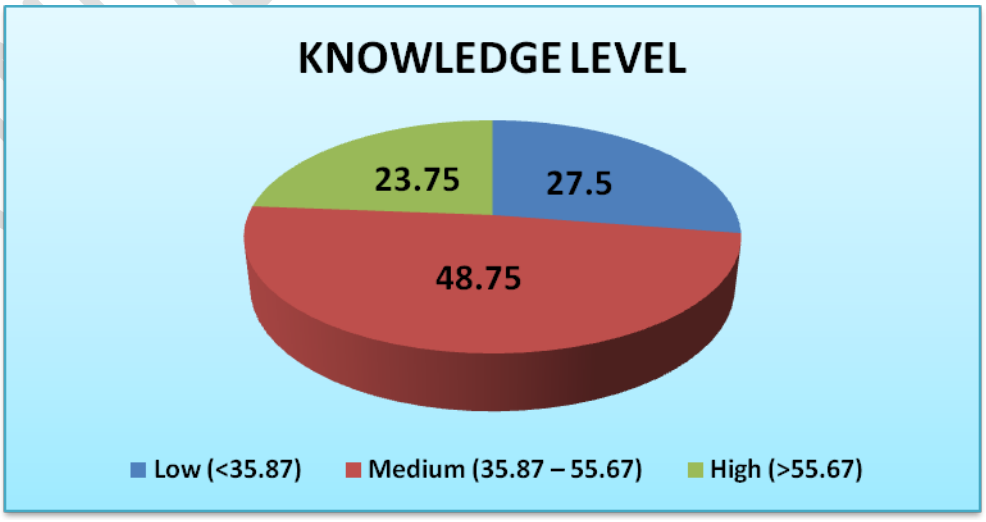

Fig. 1. Knowledge level of the farmers of Sundarbans about the plant protection measures for management of blast disease of rice

Table 4: Knowledge of individual component of blast disease management practices in rice cultivation

(n=80)

Sl. No.	Knowledge level	Frequency	Percentage
1.	Disease Resistant Varieties	2	2.5
Nursery raising techniques			
2.	Good quality seeds free from diseases	25	31.25
3.	Seed Treatments for blast disease	28	35
4.	Recommended dose for seed treatment	10	12.5
5.	Recommended time of seed sowing in seed bed	80	100
Seedling transplantation			
6.	Alternation of transplanting date to overcome blast disease	15	18.75
7	Number of seedlings per hill		
a	5-7 seedlings/hill	29	36.25
b	3-4 seedlings/hill	46	57.5
c	1-2 seedlings/hill	5	6.25
8	Recommended Spacing	57	71.25
9	Water Management: Maintenance of water level in transplanted field	23	28.75
	Farm yard manure application		
10	Quantity and Quality of FYM (Rate/ha)	8	10
11	Time & Method of applying FYM	78	97.5
Chemical fertilizers			
12	Recommended Quantity/rate of chemical fertilizers application	35	43.75
13	Method of application	35	43.75
14	Micronutrient Zinc application	21	26.25
15	Silicon fertilizer application	0	0
16	Names of diseases -Blast of rice (*Jhalsa*)	73	91.25
17	Key Identifying Symptom -Blast of rice	60	75
18	Fungicides for Blast of Rice (Tricyclazole 75% WP, Carbendazim 50 WP, Hexaconazole 5 %EC)	54	67.5
19	Recommended Dose - Blast disease of Rice	18	22.5
20	Time of spraying of fungicide (Morning/evening)	7	8.75
21	Stage of application of fungicide		
a	At first appearance of disease	23	28.75
b	At First appearance and at 15 days interval after first appearance depending upon severity of disease	10	12.5
c	2-3 times throughout the cropping season	29	36.25

The adoption of plant protection measures and ultimately its degree of success depends on various factors such as farmer's knowledge, situational factors, socio-psychological characteristics of farmers, the characteristics of innovation itself, complexity of practices, timely availability of inputs, relative advantage, compatibility etc. Further, these measures will be adopted more widely when it is considered superior to the alternative solution that it replaces. The relative advantage might be measured in economic terms also. The data presented in Table 5, Fig. 2 revealed that the adoption level of the plant protection measures for management of blast disease of rice by the respondents was medium in 47.5% respondents, low in 32.5% and high in 20.0%. Further, the findings of the present study in Table 6, revealed that considerable percentage (46.25%) of the paddy growers have fully adopted plant protection measures like use of fungicides - Tricyclazole 75 WP, Carbendazim 50 WP, Hexaconazole 5 EC for control of blast disease of Rice whereas 21.2% adopted partially. However, very low percentage (12.5%) of the paddy growers adopted fully the recommended dose of fungicides application for blast disease control and 10% adopted partially. Only 5 % of the paddy growers applied fungicides either in the morning or evening when the air drift is low and 6% of the paddy growers used the recommended method of fungicide application, first at 15 days interval and subsequent spraying at 15-21 days interval depending upon the severity of the disease. None of the paddy growers used resistant variety, nor used quality seed free from disease; neither used seed treatment for management of blast disease of rice. Full adoption of recommended dose of fertilizer was very low (8.75%) which is otherwise very important for blast disease management as recommended dose is directly proportional to judicious use of nitrogenous fertilizer. Only 35% of the respondent have adopted partially. Further, application of Zn and silicon based fertilizer plays a significant role in management of blast disease of rice but it has been found that very few respondent (6.25 %) have applied zinc fertilizer as cheated zinc at recommended dose whereas 12.5 % of the respondent have adopted this practice partially. It has been found that none of the farmers were aware about the role of silicon in blast disease management in rice and thus have also not applied any form of fertilizer or any source containing Si in rice cultivation. Due to various reasons like non-availability of plant protection inputs, lack of technical knowledge regarding plant protection etc. the adoption of plant protection measures was low. The findings of the study were in accordance with the results of Vasanthakumar (2000) and Manjunath (2010).

Table 5: Adoption level of the respondents about plant protection measures against blast disease in rice cultivation

(n=80)

Adoption level	**Frequency**	**Percentage**
Low (<25.81)	26	32.5
Medium (25.81 – 42.43)	38	47.5
High (>42.43)	16	20.0
Total	80	100

Mean = 34.12 SD = 16.62

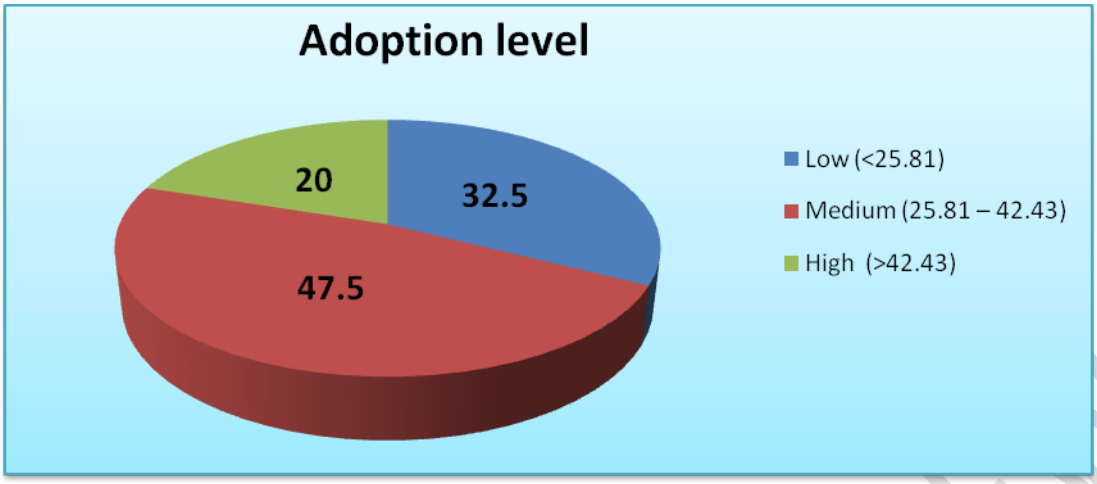

Fig. 2. Adoption level of the farmers of Sundarbans about the plant protection measures for management of blast disease of rice

Table 6: Extent of adoption of important plant protection measures against blast disease of rice

S. No.	Plant Protection Practices	Adoption level of respondents				n=80	
		Full adoption		Partial adoption		Non adoption	
		Frequency	%	Frequency	%	Frequency	%
1.	Disease Resistant Variety	0	0	0	0	80	100
2.	Good quality seeds free from disease	0	0	22	27.5	58	72.5
3.	Seed Treatments	0	0	12	15	68	85
4.	Recommended dose for seed treatment	0	0	7	8.75	73	91.25
5.	Recommended time of seed sowing in seed bed	80	100	0	0	0	0
6	Alternation of transplanting date to overcome incidence of blast disease of Rice	0	0	0	0	80	100
7	Recommended seedlings/hills						
a	3-4 seedlings/hill	46	57.5	0	0	34	42.5
b	1-2 seedlings/hill	5	6.25	0	0	75	93.75
8	Recommended Spacing	28	35	11	13.75	41	51.25
9	Water Management: Maintenance of water level in transplanted field	0	0	0	0	0	0
10	Quality , Quantity and method of application of FYM	6	7.5	67	83.75	7	8.75
11	Recommended Quantity and method of chemical fertilizers application	7	8.75	28	35	45	56.25
12	Micro nutrient Zinc application	5	6.25	10	12.5	65	81.25
13	Silicon fertilizer application	0	0	0	0	0	0
14	Use of fungicides against Blast of	37	46.25	17	21.25	26	32.5

	Rice (Tricyclazole 75% WP, Carbendazim 50% WP, Hexaconazole 5 % EC)						
15	Recommended dose of Fungicide against Blast disease of Rice	10	12.5	8	10	62	77.5
16	Time of spraying of fungicide (Morning/evening)	5	6.25	2	2.5	73	91.25
17	Recommended method of application of fungicide against blast of rice.	6	7.5	14	17.5	60	75

The results presented in Table 7 revealed the relationship of independent variables with knowledge level of the respondents about plant protection measures against blast disease of rice. The variables such as age, land holdings, possession of plant protection equipments, participation in extension activities and mass media utilization exhibited positively significant relationship at 1 % level of significance with the knowledge level of plant protection measures against rice blast disease. The variables like source of irrigation and social participation showed non-significant relationship with knowledge level with respect to plant protection measures of paddy crop in particular against blast disease. It has been found that the independent variable education exhibited negative significant relationship with the knowledge level of plant protection measures against blast disease of rice. The younger generation with high level of education level are least interested in the field work due to their perception that farming is antiquated and unprofitable profession. The image of agriculture traditionally has been more about subsistence; you produce enough for you to eat.

Table 7: Relationship between selected socio-psychological characteristics of paddy growers and their knowledge level of plant protection measures against blast disease of rice

(n=80)

Sl. No.	Socio-psychological characteristics	Karl Pearson's value
1	Age	0.459**
2	Education	-0.329**
3	Land holding	0.403**
4	Possession of Plant Protection equipment	0.358**
5	Sources of irrigation	0.148
6	Social participation	0.107
7	Mass media participation	0.291**
8	Extension Participation	0.353**

**Correlation is significant at the 0.01 level (2-tailed), *Correlation is significant at the 0.05 level (2-tailed).

The results presented in Table 8 revealed the relationship of independent variables with adoption level of the respondents about plant protection measures against blast diseases of rice crop. The variables such as age, land holding and participation in extension activities exhibited positive and significant relationship with the adoption level of plant protection measures against blast disease of rice at 1% level of significance whereas possession of plant protection equipments, mass media and social participation had significant and positive co-relation with adoption level at 5% level of significance. However, the variable education, exhibited negative and significant

correlation. The variable, source of irrigation, showed non-significant relationship with adoption level of plant protection measure against blast disease in rice crop.

Table 8: Relationship between selected socio-psychological characteristics of paddy growers and their adoption level of plant protection measures of paddy crop

(n=80)

Sl. No.	Socio-psychological characteristics	Karl Pearson's value
1	Age	0.350**
2	Education	-0.221*
3	Land holding	0.303**
4	Possession of Plant Protection equipment	0.277*
5	Sources of irrigation	0.171
6	Social participation	0.266*
7	Mass media participation	0.246*
8	Extension Participation	0.379**

**Correlation is significant at the 0.01 level (2-tailed), * Correlation is significant at the 0.05 level (2-tailed).

Constraints in the adoption of plant protection measures for management of blast disease of rice

With regard to constraints in adoption of plant protection measures for management of blast disease of rice, the respondents expressed the following constraints as presented in Table 9. Climatic vagaries (95%) were a major constrain in adoption of plant protection measures in paddy cultivation. About 90 per cent of the farmers expressed that the required pesticides are not available on time due to problem of transportation, lack of requiring facilities at nearby places (95%). Further, the complicated name of chemicals or lack of knowledge about chemicals (97.5%) was also a stumbling block in adoption of the management practices for blast disease of Rice. It has also been found that the farmers lack knowledge with regard to technology application (85%) and hence face difficulty in disease management due to lack of knowledge about the number of sprays (83.75%). High rate of inflation has impacted the price of the pesticides, labor cost etc. but in proportion to inflation the income of the farmers has not increased. Thus, due to high cost of the farm inputs including chemical pesticides (60%), expensive labor (83.75%), lack of finance (55%), the farmers are unable to adopt the various plant protection measures for management of blast disease of rice. With respect to various extension activities which are a triggering factor in adoption of plant protection measures, it has been found that due to lack of proper demonstration and field visits (98.75%), lack of training (82.5%), lack of awareness about the various schemes launched by Governments for Aman and Aus paddy (30%) there are gaps in adoption of plant protection measures. It has also been found that there was lack of incentives to innovative farmers (6.25%) and due to poisonous and ill effect of the pesticides to cattle and human health, the adoption level is low.

Table 9: Distribution of farmers according to the constraints faced by respondents in adoption of plant protection measures for management of blast disease of rice.

(n=80)

Sl. No.	Constraints	Frequency	Per cent
1	Erratic rainfall, flood and submergence, lack of irrigation facilities	76	95
2	Non availability of input on time due to problem of transport	72	90
3	Lack of requiring facility at nearby places	76	95
4	Complicated name of chemicals or lack of knowledge about chemicals	78	97.5
5	Lack of knowledge with regard to technology application	68	85
6	Difficulty in disease management due to lack of knowledge about number of spray	67	83.75
7	High cost of farm inputs (like seed, fertilizers, pesticides etc.)	48	60
8	Lack of Finance due to illegal practices and bribery by govt. officials for providing loans, services, subsidy etc.	44	55
9	Expensive labour and non-availability of labour during peak rice season	67	83.75
10	Lack of field demonstrations with respect to blast disease management	79	98.75
12	Poor farmers- extension officers linkage	60	75
13	Lack of trainings	66	82.5
14	Lack of awareness about the various schemes launched by Governments for Aman and Aus paddy	24	30
15	Lack of incentives to innovative farmers	5	6.25
16	Poisonous and ill effect to cattle and human beings	28	35

CONCLUSION

The study reveals gap in the knowledge level about the plant protection measures for management of blast disease of rice and its adoption. Hence, there lies the vast scope for bridging this gap. It can be concluded from above findings that majority of the respondents belonged to medium level of knowledge and adoption regarding recommended plant protection measures against blast disease of rice in paddy cultivation. Though, the paddy is cultivated by all the farmers in the study area but their scientific knowledge about the recommended plant protection measures for management of blast disease of rice is still in infancy stage. There should be efforts to close the gaps among researchers; various organizations which focus on overall development of agriculture and policy traditionally focus on education, training, and/or dissemination of information within each separate arena. Even when such activities are effective, they have the potential to change only one group. Thus they generally fall far short of producing systemic change. Changing the system will require these groups working together to ask and answer the right questions and to jointly commit to implementation. Hence it is imperative that State Department of Agriculture, University of Agricultural Sciences, Agro chemical based companies and NGOs should make integrated and concerted extension efforts to provide required knowledge about recommended plant protection measures to the paddy growers and thereby motivating farmers for adoption.

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