Constraints in Aromatic Rice Cultivation: Insights from Smallholder Farmers of Northern Bangladesh

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Abstract

Though Bangladesh a south asian country takes pride in being home to exclusive fine aromatic rice, it has done precious little to retain this much-valued product. The traditional varieties with excellent aroma are almost at the verge of extinct from the fields. The purpose of this study was to determine farmers' constraints in aromatic rice production, and to explore the relationship between the selected characteristics of the farmers with their constraints in aromatic rice production. Data were collected using pre-designed and pre-tested structured interview schedule from a sample of 92 farmers out of 653 farmers selected by simple random sampling procedure. The data collection was done in Uthrail unions of sadar upazila under Dinajpur district. Besides the usual descriptive statistical parameter, Pearson's Product Moment Correlation Coefficient (r) was used for the statistical analysis. About three-fourths (67.3 percent) of the respondents had faced medium constraint while 20.7 percent had low constraints and only 12.0 percent had faced high constraints. Among the constraints, "Diseases" (CFI= 270.6) was found the first ranked constraints in aromatic rice production faced by the farmers. The lowest constraints in aromatic rice production faced by the farmers was 'Erosion' (CFI= 78.2) among the selected constraints. According to the computed value of correlation coefficients (r), among ten selected characteristics of the farmer's age, education, family size, farm size and annual income had no significant relationship with farmers' constraints in aromatic rice production. On the other hand, area under aromatic rice cultivation, agricultural knowledge, extension media contact, training received and aspiration had positive significant relationship with farmers' constraints in aromatic rice production.

Key Words: Constraints, Aromatic rice, Farmers' and Northern Bangladesh

Introduction

The slogan "rice is life" is most appropriate for Bangladesh as it is the most widely consumed grain and key to the food security of the nation. In Bangladesh, there are about more than 7,000 varieties of rice are grown in various parts of the country (Shamsi, *et al.*, 2010). In general, rice is classified by its length, thickness and aroma. The length of long-grain rice is four to five times that of its width. One of the more exotic varieties in the long-grain is the aromatic East Indian Basmati and Kalijira rice. It was mentioned by various historians that Bengal was famous for spices, Kalijira and Moslin fabrics. Rice is the staple food of half the world's population that contributes to 20% of the total man caloric intake (Bhattacharjee *et al.*, 2002). Nevertheless, total caloric intake for the Asian population is around 40% to 80% where 95% of world rice production comes from Asian countries such as China, India, Indonesia, Bangladesh, Vietnam and India. The biggest rice exporter is Thailand with 9.8 million tons of rice export per year (BRF, 2015). World trade figures are very different to those for production, as only about 5% to 7% of rice produced is traded internationally. Due to the small volume, the price of rice can rise sharply when something happens to the major exporter countries such as the uncertainty of the climate conditions that will affect the rice production (Ghosh, 2008; Walker, 2008) and impose restricting export. Fragrant rice (Basmati and Jasmine type) shows the highest price in the world market and accounts for about 15% to 18% of world trade. About 70 percent of the world's poor live in rural areas and mostly depend on agriculture as the main source of income and employment (World Bank, 2010). Rice alone contributes of 97% of the food grain production in Bangladesh (BBS, 2013). The quantity of rice traded is relatively small, about 4 to 5 percent of total production. Among different groups of rice, transplant aman (T. Aman) rice cover about 49.11% of total rice area and it contributes to 38.11% of the total rice production in the country (BBS, 2013). In Bangladesh, rice dominates over all other crops and covers 75% of the total cropped area (Rekabdar, 2004) of which around 27% is occupied by fine rice varieties (BBS, 2003).

Different varieties of rice have different characters. Rice grain is categorized into coarse, medium coarse and fine with different color based on physical properties. Some of them have special appeal for their aroma. There are two type of transplant aman rice viz. coarse and fine rice and some of the fine rice are aromatic. The major aromatic varieties identified are Kalijira, Chinigura, Kataribhog, BR5, Bashful, BRRI dhan 34, BRRI dhan 37, BRRI dhan 38 (Bashmotitype), Khaskani, Badshabhog, Dudshagar, Tulshimala, Khirshabhog, Horibhog, Parbatjira, Khasha, Modhumadab, Tilkapur, Chinikanai, Khirkon and Shakhorkora. Some of the features of Kataribhog rice are: this variety is fine quality rice, scented, and sweet to taste, nutritious, delicious. Aromatic rice is generally low yielding (Gangaiah and Prasad, 1999) but they are considered best in quality and also highly valued. Aromatic rice is now an important commodity in international trade having small grain with pleasant aroma. Aromatic rice of

Bangladesh on account of its high export potential and its taste as well as better eating quality like polau, khir, firny, paish, chira, khoi, biriany etc. have great demand. Milled aromatic rice is also used as popular food in ceremonies like marriage day, Eid day etc. According to Bangladesh Rice Exporters Association (BREA) statistics, Bangladesh exported 700 metric tons of aromatic rice in 2001, 780 metric tons in 2002, 1000 metric tons in 2003, and 3300 metric tons in 2004. Export value of aromatic and fine rice stood at 200,000 US dollars in 2003-2004 fiscal years. So, the production of aromatic rice in the country is economically profitable.

The above facts indicate that there is a need for an investigation aiming at an understanding on the constraints faced by the farmers in aromatic rice cultivation. However, very few systematic investigations have been done in this context. Hence, the researcher undertook a study relating to the constraints faced by the farmers in aromatic rice cultivation. The research work was conducted with the following objectives:

a)   To determine and describe the selected characteristics of farmers. The characteristics were: age, education, family size, farm size, area under aromatic rice cultivation, annual income, agricultural knowledge, extension media contact, training received and aspiration.

b)   To determine farmers' extent of constraints in aromatic rice production.

c)   To explore the relationship between the selected characteristics of the farmers with their constraints in aromatic rice production.

d)   To know the suggestions provided by the farmers to overcome the constraints.

Methodology
Study areas
The present study was conducted in 7 no Uthrail union of Sadar upazila under Dinajpur district. There are 13 upazilas in Dinajpur district. Among these, sadar upazila is one of the agriculturally important upazila where rice, wheat, maize, vegetables are intensively cultivated along with plantation. Most of the farmers of this area are directly and/or indirectly engaged in agricultural activities and few people are service holders and businessmen.

Design of the study
Designing the research for the present study was taken in a scientific manner. Firstly, different research themes are collected and analyzed followed by research problem formulation. Reviews were studied to select appropriate variables and preparation of questionnaire. Pretesting of the interview schedule was done before final data collection. Finally data were collected, analyzed and report was prepared.

Data collection tools and technique
In order to collect desired information, an interview schedule was prepared keeping the objectives of the research in mind. The schedule was prepared in Bangla for better understanding of the respondents. The questions included were simple and direct to ascertain the opinion of the farmers regarding a number of aspects. Simple random sampling procedure was followed in this study. Dinajpur district was purposively selected due to a number of reasons: Firstly, the districts have the highest percent and area under Kataribhog rice and secondly investigator's familiarity in the area, language and culture of the people. Among the 13 Upazilas, Dinajpur sadar was selected by purposive sampling procedure because aromatic is mostly cultivated in this upazila. One union of sadar upazila namely 7 no. Uthrail was selected by random sampling procedure from 10 unions. An up-to-date list of 653 aromatic rice producing farmers was prepared with the help of the Upazila Agriculture Office of the DAE. From these farmers, 92 (about 15 percent) were selected as the sample by using simple random sampling procedure. A reserve list of 10 farmers (about 10 percent) was prepared so that these farmers could be used for interview in case any farmer included in the original sample was not available in spite of utmost effort during collection of data.

Measurement of farmers' constraints in aromatic rice production
Farmers' constraints in aromatic rice production were the major focus of the study. Thus farmers' constraint in aromatic rice production was the focus issue of this research work. The respondent was asked to express their opinion on the extent of constraints in each of 15 mentioned constraints along a 4-point rating scale; 'not at all (0)', 'low (1)', 'medium (2)', and 'high (3)'. The responses of the scale was given scores as 3 for 'high', 2 for 'moderate', 1 for 'low' and 0 for 'not at all'. The summation of the scores against all the 15 mentioned constraints express the farmers' opinion towards constraints.

For comparative analysis of constraints a "Constraints Facing Index" was calculated by using the following formula:

Constraints Facing Index (CFI) = C_{hi} x 3 + C_{mo} x 2 + C_l x 1 + C_{na} x 0

Where,

C_{hi} = Percentage of farmers opined constraint as high

C_{mo} = Percentage of farmers constraint as moderate

C_l = Percentage of farmers opined constraint as low

C_{na} = Percentage of farmers opined constraint as not at all.

In respect of any perception "Constraints Facing Index" could range from 0 to 300, where 0 indicating no constraint and 300 indicating high constraint.

Statistical analysis

The analysis was performed using Statistical Package for Social Science (SPSS) computer package. Descriptive analysis such as range, number, percentage, mean, standard deviation and rank order were used whenever necessary. For clarity of understanding tables were also used for presenting the data. Pearson's Product Moment Correlation Co-efficient (r) was used to examine the relationships of independent variables of the respondents with the perception of the farmers towards constraints in aromatic rice production.

Results and Discussion

The results of the study are presented in this chapter with the help of proper statistical analysis along with their logical interpretations. This study has been conveniently presented in three sections according to the objectives. The first section deals with the selected characteristics of the farmers. The second section deals with the perception of the farmers towards constraints in aromatic rice production and the third section deals with the relationships between the selected characteristics of the farmers with the perception of the farmers towards constraints in aromatic rice production.

Characteristics of the Respondents

Many characteristics of farmers may have influence to their constraints in aromatic rice production. However, only 10 characteristics namely age, education, family size, farm size, area under aromatic rice cultivation, annual income, agricultural knowledge, extension media contact, training received and aspiration are included in this study. It was assumed that the farmers with their constraints in aromatic rice production would vary according to their various characteristics. The salient features of the different characteristics have been presented in Table 1.

Table 1. Salient features of the selected characteristics of the farmers (N=92)

Characteristics	Scoring method	Range Observed (Possible)	Categories	Respondents No.	Respondents Percent	Mean	SD
Age	No. of year	10-60 (Unknown)	Young aged (≤35)	44	47.8	38.17	12.06
			Middle aged (36-50)	33	35.9		
			Old aged (>50)	15	16.3		
Education	Year of schooling	0.0-17 (Unknown)	Illiterate (0)	32	34.8	5.63	5.13
			Can sign only (0.5)	2	2.2		
			Primary level (1-5)	10	10.9		
			Secondary level (6-10)	34	37.0		
			Above secondary level (>10)	14	15.2		
Family size	No. of members	2-9 (Unknown)	Small (≤ 3)	9	9.8	5.71	1.87
			Medium (4-6)	50	54.3		
			Large (>6)	33	35.9		
Farm size	Hectare	0.07-8 (Unknown)	Marginal (0.02-0.20)	5	5.4	1.53	1.70
			Small (0.21-1.0)	46	50.0		
			Medium (1.01-3.0)	28	30.4		
			Large (>3.0)	13	14.1		
Area under aromatic rice cultivation	Hectare	0.04-8 (Unknown)	Marginal (0.02-0.20)	24	26.1	1.30	1.29
			Small (0.21-1.0)	26	28.3		
			Medium (1.01-3.0)	36	39.1		
			Large (>3.0)	6	6.5		
Annual income	('000' Tk.)	40.2-840 (Unknown)	Low income (≤50)	22	23.9	188.17	183.84
			Medium income (51-250)	48	52.2		
			High income (>250)	22	23.9		
Agricultural knowledge	Score	8-18 (0-25)	Fair (≤8)	15	16.3	13.40	3.00
			Good (9-16)	66	71.7		
			Excellent (>16)	11	12.0		
Extension media contact	Score	2-29 (0-36)	Low (≤12)	19	20.7	14.32	7.26
			Medium (13-24)	57	62.0		
			High (>24)	16	17.4		
Training received	No. of days	0-10 (unknown)	No (0)	44	47.8	1.43	2.17
			Short (≤2)	32	34.8		
			Medium (3-7)	12	13.0		
			Long (>7)	4	4.3		
Aspiration	Score	10-29 (6-30)	Low (≤10)	15	16.3	23.35	6.36
			Medium (11-20)	67	72.8		
			High (>20)	10	10.9		

Age

The age of the respondents ranged from 10 to 60 years with a mean of 38.17 and standard deviation of 12.06. According to age the farmers were classified into three categories are 'young aged' (up to 35), 'middle aged' (36-50) and 'old aged' (>50) based on their observed score (Table 1).

Data contained in Table 1 reveals that about half (47.8 percent) of the respondents were young aged compared to 35.9 percent of the respondents belonged to the middle-aged categories and 16.3 percent were in the old aged category. These findings indicated that the majority of the farmers were young aged. The findings imply that the aromatic rice farmers were young and middle-aged groups.

Education

The educational qualification scores of the farmers ranged from 0.0 to 17, the mean being 5.63 and standard deviation 5.13. Based on educational qualification scores the respondents were classified into five categories such as 'illiterate' (0) 'can sign only' (0.5), 'primary level' (1-5), 'secondary level' (6-10) and 'above secondary level' (>10) as presented in Table 1.

Data presented in Table 1 indicate that highest proportion (37.0 percent) of the farmers had secondary education, 34.8 percent were illiterate, 2.2 percent were can sign only, 10.9 percent had primary education and 15.2 percent of the farmers had above secondary education level. The finding indicated that 65.2 percent of the respondents were educated. The average literacy rate in Bangladesh is 72.76 percent (Dhaka Tribune, 2017). So, the education rate of the study area is lower than the average literacy rate in the country.

Family size

The family size scores of the farmers ranged from 2 to 9. The average family size was 5.71 with a standard deviation of 1.87. The respondents were classified into three categories like 'small' (≤3), 'medium' (4-6) and 'large' (>6) are presented in Table 1.

The data furnished in the Table 1 revealed that more than half (54.3 percent) of the respondents had medium family size, 9.8 percent had small family size and 35.9 percent had large family. The national average family size in Bangladesh is 4.85 (BBS, 2014) which is near the mean value of the present study (5.71). It is quite logical that prevalence of joint family system in the study area might have also contributed to the large family size.

Farm size

The farm size scores of the farmers ranged from 0.07 to 8, the average being 1.53 and standard deviation 1.70. The farmers were classified into four categories as 'marginal' (0.02-0.20), 'small' (0.21-1.0), 'medium' (1.01-3.0) and 'large' (>3.0) as shown in Table 1.

Data presented in Table 1 show that exactly half (50.0 percent) of the respondents were small farm size, 5.4 percent were marginal farm size, 30.4 percent had medium farm size and 14.1 percent had large farm size. Most of the farmers had medium farm size. Moreover, it enriches their perception towards improved farming practices and enlightens power of understanding and abilities to analyze facts and situations to make appropriate decisions on farming activities.

Area under aromatic rice cultivation

The farm size under aromatic rice cultivation scores of the farmers ranged from 0.04 to 8, the average being 1.30 and standard deviation of 1.29. The farmers were classified into four categories as 'marginal' (0.02-0.20), 'small' (0.21-1.0), 'medium' (1.01-3.0) and 'large' (>3.0) as shown in Table 1.

Data presented in Table 1 show that most of the (39.1 percent) of the respondents were medium farm sized, 26.1 percent were marginal farm size, 28.3 percent had small farm size and 6.5 percent had large farm size. Most of the farmers (67.4 percent) had small to medium farm size. This means that the aromatic rice growers are the scenario on the basis of farm size.

Annual income

The family income scores of the farmers ranged from 40.2 to 840 with a mean of 188.17 and standard deviation of 183.84. Based on the annual income the farmers were classified into three categories such as 'low income' (≤50), 'medium income' (51-250), 'high income' (>250) as shown in Table 1.

Data furnished in Table 1 indicate that a little more than half (52.2 percent) of the farmers had medium income compared to 23.9 percent under low and only 23.9 percent under high income group. The overwhelming (76.1 percent) of the respondents were under low to medium income category.

Agricultural knowledge

Agricultural knowledge scores of the growers varied from 8 to 18 against a possible range of 0 to 25. The average agricultural knowledge score was found to be 13.40 and standard deviation was 3.00. Based on the observed overall knowledge scores, the respondents were classified into three categories as 'fair' (≤8), 'good' (9-16), and 'excellent' (>16) as shown in Table 1.

Data presented in Table 1 shows that about three-fourths of the (71.7 percent) of the respondents had good agricultural knowledge compared to 16.3 percent had fair knowledge and only 12.0 percent had excellent agricultural knowledge. A respondents who receives high level of education but less involvement in farming might possess lower knowledge than the growers who is actively involved in farming for a long period of time.

Extension media contact

The extension contact scores of the farmers ranged from 2 to 29, against the possible score 0 to 36. The mean and standard deviation were 14.32 and 7.26 respectively. The respondents were classified into three categories based on their extension contact as 'low' (≤12), 'medium' (13-24) and 'high' (>24) as shown in Table 1.

Data presented in Table 1 shows that majority (62.0 percent) of the farmers had medium extension media contact, 20.7 percent had low extension contact and 17.4 percent had high extension contact. The findings indicate that above three-fourths (79.4 percent) of the farmers had medium to high extension media contact. This may be due to the reason that the respondents contact highly with different extension media.

Training received

The training received scores of the respondents ranged from 0 to 10 with a mean of 1.43 and standard deviation of 2.17. According to the training received scores, respondents were classified into four categories like 'no training' (0), 'short' (≤2), 'medium' (3-7) and 'long' (>7) in Table 1.

Data presented in the Table 1 revealed that 47.8 percent of the respondents had no training followed by 34.8 percent received short training, 13.0 percent received medium training and 4.3 percent received long training. Training increases skills and knowledge which makes the respondents much more competent in performing different activities.

Aspiration

The aspiration scores of the farmers ranged from 10 to 29 against the possible range 6 to 30 with a mean and standard deviation of 23.35 and 6.36 respectively. Based on their aspiration scores, the respondents were classified as 'low' (≤10), 'medium' (11-20) and 'high' (>20) which is presented in the Table 1.

It is revealed from the Table 1 that the highest proportion (72.8 percent) of the respondents had medium aspiration, 16.3 percent of the respondents had low and only 10.9 percent of the respondents had high aspiration respectively. Findings showed that majority of the farmers possessed their aspiration and the result might be due to the effect of better educational qualification, better communication system of the respondents.

Farmers' Constraints in Aromatic Rice Production

For having the better understanding regarding farmers constraints in aromatic rice production, it was necessary to have an idea about the comparative constraints in 15 selected constraints. For this purpose, Constraint Facing Index (CFI) was computed. The computed CFI of the 15 constraints ranged from 78.2 to 270.6 against a possible range from 0 to 300 which are arranged in rank order according to their CFI as shown in Table 2.

Table 2. Distribution of farmers according to constraints of aromatic rice production

Sl. No.	Constraints	Percentage of farmers				*CFI	Rank order
		Not at all	Low	Medium	High		
A.	**Biotic constraints**						
1.	Weeds	3.3	6.5	20.6	69.6	256.5	2
2.	Rodents	4.3	8.7	35.9	51.1	233.8	4
3.	Diseases	0	1.1	27.2	71.7	270.6	1
4.	Insects	2.2	20.7	12	65.1	240	3
B.	**Abiotic constraints**						
5.	Drought	28.3	15.2	48.9	7.6	135.8	12
6.	Erosion	37	48.9	13	1.1	78.2	15
7.	Heat Stress	31.5	48.9	13	6.6	94.7	13
8.	Soil Fertility	23.9	19.6	52.2	4.3	136.9	11
C.	**Socioeconomic constraints**						
9.	Difficulties to access to credit	5.4	25	52.2	17.4	181.6	7
10.	Unavailability of labour	13	14.1	63	9.9	169.8	10
11.	High price of seed	60.9	8.7	17.4	13	82.5	14
12.	Low market price	7.6	21.7	52.2	18.5	181.6	8
13.	High transportation cost	10.9	16.3	48.9	23.9	185.8	6
D.	**Extension service related constraints**						
14.	Insufficient regular information from extension worker	8.7	20.7	35.9	34.7	196.6	5
15.	Lack of new technology in aromatic rice cultivation	5.4	18.5	66.3	9.8	180.5	9

*CFI= Constraints Facing Index

Data in Table 2 indicate that "Diseases" (CFI= 270.6) was found the first ranked constraints faced by the farmers. All the farmers of the study are aromatic rice cultivars. They cultivate aromatic rice for high profit but high yielding varieties are not available all time. 'Weeds' was found as the second ranked (CFI= 256.5) constraints faced by the farmers. The result may be due to that weed control is the vital factor for good yield of crop. 'Insects' (CFI= 240.0) was emerged as the third most important constraints among the selected constraints. The farmers opined that insect reduce the yield of rice. The lowest constraints faced by the farmers was 'Erosion' (CFI= 78.2) among the selected constraints. The result may be due to that there have very little challenges about erosion.

Overall farmers' constraints in aromatic rice production

Overall constraint scores for 15 selected constraints in aromatic rice cultivation could theoretically range from 0 to 45, where 0 indicating no constraint and 45 indicating high constraint. However, the observed constraint scores of the respondents ranged from 18 to 34 with a mean of 26.25 and standard deviation 3.24. Based on their constraint scores, the respondents were classified into three categories viz. 'low' (up to 23), 'medium' (24-30) and 'high' (above 30) has been presented in the Table 3.

Table 3. Distribution of the farmers according to their overall constraints in aromatic rice production

Categories (score)	Respondents (N=92)		Mean	Standard Deviation
	Number	Percent		
Low (up to 20)	19	20.7		
Medium (21-30)	62	67.3	26.25	3.24
High (above 30)	11	12.0		

Data furnished in the table 3 revealed that near about three-fourths (67.3 percent) of the respondents face medium constraint while 20.7 percent had low constraint and only 12.0 percent had high constraint. The average (mean) value of the constraint indicates that the respondents in average had medium constraints faced in aromatic rice cultivation. So, from this finding, it can be said that the desired level dissemination of aromatic rice cultivation technology will not occur if the constraints of the respondents are not minimized by the concerned authority.

Relationship between the Selected Characteristics of the respondents and farmers' constraints in aromatic rice production

This section deals with the relationship between the 10 selected characteristics of the respondents and farmers' constraints in aromatic rice production. The relationships were computed by using the Pearson's product moment correlation co-efficient(r). The co-efficient of correlation (5 percent level) was used to test the null hypothesis and analysis is presented in Table 4.

Table 4. Relationship between dependent and independent variables

Dependent variable	Independent variables	Pearson Correlation (r) values with 90 df
Farmers' constraints in aromatic rice production	Age	-0.032
	Education	-0.131
	Family size	0.082
	Farm size	0.096
	Area under aromatic rice cultivation	0.227*
	Annual income	-0.047
	Agricultural knowledge	0.277**
	Extension media contact	0.264*
	Training received	0.214*
	Aspiration	0.300**

* = Correlation is significant at the 0.05 level, ** = Correlation is significant at the 0.01 level

Age and farmers' constraints in aromatic rice production

The correlation coefficient between age of the respondents and farmers' constraints in aromatic rice production was -0.032 (Table 4). Based on the computed 'r' value the relationship between age and farmers' constraints in aromatic rice production was negative. Hence, the concerned null hypothesis could not be rejected. Thus, it could be said that the age of the respondents had no significant role on farmers' constraints in aromatic rice production.

Education and farmers' constraints in aromatic rice production

The correlation coefficient between education of the respondents and farmers' constraints in aromatic rice production was -0.131 (Table 4). Based on the computed 'r' value the relationship between education and farmers' constraints in aromatic rice production was negative and not significant with 90 degrees of freedom. Hence, the

concerned null hypothesis could not be rejected. Thus it could be said that the educational qualification of the respondents had no significant relationship with the farmers' constraints in aromatic rice production.

Family size and farmers' constraints in aromatic rice production
The computed value of correlation coefficient (r) between family size of the respondents and farmers' constraints in aromatic rice production was 0.082 (Table 4). Based on the computed 'r' value the relationship between family size and farmers' constraints in aromatic rice production was positive and not significant with 90 degrees of freedom. Hence, the concerned null hypothesis could not be rejected. Thus, it could be said that the family size of the respondents had no relationship with the farmers' constraints in aromatic rice production.

Farm size and farmers' constraints in aromatic rice production
The computed value of correlation coefficient (r) between farm size of the respondents and farmers' constraints in aromatic rice production was 0.096 (Table 4). Based on the computed 'r' value the relationship between farm size and farmers' constraints in aromatic rice production was positively not significant with 90 degrees of freedom. Hence, the concerned null hypothesis could not be rejected.

Area under aromatic rice cultivation and farmers' constraints in aromatic rice production
The computed value of correlation coefficient (r) between area under aromatic rice cultivation of the respondents and farmers' constraints in aromatic rice production was 0.227 (Table 4). Based on the computed 'r' value the relationship between farm size under aromatic rice cultivation of the respondents and farmers' constraints in aromatic rice production was positive and significant with 90 degrees of freedom at 0.05 level of probability. Hence, the concerned null hypothesis could be rejected. The data revealed that the higher the farm size under aromatic rice cultivation the higher constraints of the farmers in aromatic rice production.

Annual income and farmers' constraints in aromatic rice production
The computed value of correlation coefficient (r) between annual income of the respondents and their farmers' constraints in aromatic rice production was -0.047 (Table 4). Based on the computed 'r' value the relationship between family income of the respondents and farmers' constraints in aromatic rice production was negative and not significant with 90 degrees of freedom. Hence, the concerned null hypothesis could not be rejected. Thus, it could be said that the family income of the respondents had no significant relationship with constraints in aromatic rice production.

Agricultural knowledge and farmers' constraints in aromatic rice production
The computed value of correlation coefficient (r) between agricultural knowledge of the respondents and farmers' constraints in aromatic rice production was 0.277 (Table 4). Based on the computed 'r' value the relationship between agricultural knowledge farmers' constraints in aromatic rice production was positively significant at 0.01 level of probability with 90 degrees of freedom. Hence, the concerned null hypothesis could be rejected. Thus it could be revealed that the higher agricultural knowledge the higher constraints in aromatic rice production.

Extension media contact and farmers' constraints in aromatic rice production
The correlation coefficient between extension media contact of the respondents and their farmers' constraints in aromatic rice production was 0.264 (Table 4). Based on the computed 'r' value the relationship between extension contact of the respondents and farmers' constraints in aromatic rice production was positively significant at 0.05 level of probability with 90 degrees of freedom. Hence, the concerned null hypothesis could be rejected. Thus it could be revealed that the higher extension media contact the higher constraints in aromatic rice production.

Training received and farmers' constraints in aromatic rice production
The correlation coefficient between training received among the respondents and their farmers' constraints in aromatic rice production was 0.214 (Table 4). Based on the computed 'r' value the relationship organizational participation of the respondents and constraints of aromatic rice production was positively significant at 0.05 level of probability with 90 degrees of freedom. Hence, the concerned null hypothesis could be rejected. Thus, it could be revealed that the higher training received the higher the farmers' constraints in aromatic rice production.

Aspiration and farmers' constraints in aromatic rice production
The correlation coefficient between aspiration of the respondents and their farmers' constraints in aromatic rice production was 0.300 (Table 4). Based on the computed 'r' value the relationship aspiration of the respondents and farmers' constraints in aromatic rice production was positively significant at 0.01 level of probability with 90 degrees of freedom. Hence, the concerned null hypothesis could be rejected. Thus, it could be revealed that the higher aspiration the higher the farmers constraints in aromatic rice production.

Suggestions offered by the farmers to overcome the constraints
Many suggestions were offered by the farmers to overcome the constraints in aromatic rice production. These are given in Table 5.

It is evident from the data contained in the table 5 that 'Develop high resistance varieties to pests and diseases' (70.65 percent) were found as the most important suggestions to overcome the problems in aromatic rice production. The lowest numbers of farmers opined that 'Easy access of credit facility from bank' (22.82 percent) among the mentioned suggestions.

Table 5. Rank order of suggestions offered by the farmers to overcome the constraints in aromatic rice production

Sl. No.	Suggestions	Respondents	
		Number	Percent
1.	Develop high resistance varieties to pests and diseases	65	70.65
2.	Quality seed and fertilizer should be available	57	61.95
3.	Marketing channel of aromatic rice should be developed	43	46.73
4.	Organizing more training program for the farmers	37	40.21
5.	Easy access of credit facility from bank	21	22.82

Conclusions

Based on the findings and their logical interpretations in the light of relevant facts the researcher has drawn the following conclusions:

1. "Diseases" (CFI= 270.6) was the first ranked constraints faced by the farmers whereas 'Erosion' (CFI= 78.2) was the last ranked constraints faced by the farmers. Based on this findings it may be concluded that this scenario may be due to that farmers faced disease oriented problem frequently and farmers remain concerned more on this issue but erosion is not familiar at farmers level.

2. About three-fourths (67.3 percent) of the respondents had faced medium constraints while 20.7 percent had low constraints and only 12.0 percent had high constraints in aromatic rice cultivation. From this findings it can be concluded that majority of the farmers are aware about the constraints they faced during production of aromatic rice.

3. Among the ten selected characteristics of the farmer's, area under aromatic rice cultivation, agricultural knowledge, extension media contact, training received and aspiration showed positive significant relationship with farmers constraints in aromatic rice production. So, this may be concluded that these characteristics of the farmers should be taken under consideration and played important role in case of constraints faced by the farmers.

Recommendations

The following recommendations were made on the basis of the findings, related conclusions and their logical interpretations.

1. The farmers' constraints in aromatic rice production should be overcome by taking adequate measures. Different Government and Non-Government authority should take initiatives so that the participants get the financial help and necessary agricultural inputs at very easy and short process. Necessary supports for the farmers to increase household income are essential from the authority.

2. Relatively younger farmers who are more democrats in decision making, thus relatively younger target participant could be selected for aromatic rice cultivation because they can easily take decision in any challenging situation.

3. The farmers mentioned a number of constraints in different extent which they faced during aromatic rice cultivation. The authority should consider these facts during formulation of any program.

4. Adequate training of the farmers will help to mitigate the constraints in aromatic rice production.

5. Government should take special emphasis on the necessary supportive measures for ensuring easy availability of inputs needed for aromatic rice production at reasonable prices.

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