



## Problems Faced by BARI aam3 (Amrapali) Growers in Naogaon and Chapainawabganj Districts of Bangladesh

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### ABSTRACT

BARI aam3 is a popular mango variety widely cultivated in Bangladesh. Currently there are some voices raised by the growers against its cultivation difficulties. The present research aims to find out the problems confronted by BARI aam3 growers and examine the contribution of the selected characteristics of the BARI aam3 growers to their problems. The study was conducted in Porsha upazila under Naogaon district and Nachole upazila under Chapainawabganj district. The study areas were selected purposively since the farmers of those areas cultivated BARI aam3 intensively. Data were collected from 111 farmers following proportionate random sampling technique. Descriptive statistics, multiple regression and stepwise multiple regression analysis were used for data analysis. Major findings reveal that majority of the respondents faced medium problems in BARI aam3 cultivation followed by low and high problems, respectively. The 'crack of fruit in the heavy rain' was the top ranked problem followed by natural disaster, disease and insect infestation and irrigation problem. Respondents' age, training experience, extension contact, organizational membership, cosmopolitanism, innovativeness and knowledge on mango cultivation technique had significant contribution to their problems faced in BARI aam3 cultivation. Among the predictors respondents' knowledge on mango cultivation technique was the most significant contributing factor to their problems faced in BARI aam3 cultivation. The concerned authority may arrange more functional training, make provisions for more agricultural advices and assistance, disseminate new agricultural technologies and engage the older farmers in mango cultivation to solve their problems.

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## Introduction

Bangladesh Agricultural Research Institute (BARI) is the leading agricultural research institute in Bangladesh which deals with research of multiple crops and generates technologies for the use of farmers. Among the varieties released by BARI 17 mango varieties were included which have special characteristics (Bangladesh Agricultural Research Institute [BARI], 2021). Mango (*Mangifera indica* L.) is the most popular and generally eaten fruits in the tropical areas (N'Guettia *et al.*, 2014). Mango belongs to the Anacardiaceae family (Ahmed *et al.*, 2008). Bangladesh is one of the major mango producing countries (Islam *et al.*, 2018). According to (Food and Agriculture Organization [FAO], 2019) the production of mango in Bangladesh was 1692.3 thousand tons in 2018. The world mango production was 52084.1 thousand tons in 2018. Kowsari *et al.* (2014) reported that mango cultivation was perceived by the farmers as profitable and environment friendly. BARI aam3 (Amrapali) is a popular mango variety which was introduced in 1971. This mango variety gained remarkable popularity and is being cultivated in various locations of Bangladesh. Dr. Pijush Kanti Majumdar developed this mango variety as a hybrid variety of 'Dasher' and 'Neelum' at the Indian Agriculture Research Institute in Delhi ("Amrapali (mango)," 2021). Amrapali mango variety was later released by Bangladesh Agricultural Research Institute as BARI aam3 in 1996 in Bangladesh through introduction (Azad *et al.*, 2020). Some major problems of BARI aam3 cultivation were disease and insect infestation, dropping of fruits and flowers, scarcity of better varieties/seedling/grfts etc. (Sampa *et al.*, 2019). A few researches have been conducted regarding BARI aam3 (Amrapali) cultivation and there is limited research on the problems faced by the farmers in Amrapali cultivation. Therefore, the present study was conducted to explore the problems faced by BARI aam3 growers, identify the possible suggestions to solve the problems as perceived by them and examine the contribution of the selected characteristics of the BARI aam3 growers to their problems.

## Methodology

The study was carried out in Porsha upazila under Naogaon district taking two unions- Tentulia and Ganguria and Nachole upazila under Chapainawabganj district taking three unions- Nachole, Kasba and Nijampur. The study areas were selected purposively since the farmers of those areas cultivated BARI aam3 intensively (DAE, 2020a; DAE, 2020b; Rahman & Khatun, 2018). The population of the study was the farmers of the selected eleven villages of two unions under Porsha upazila and selected three unions of Nachole upazila who cultivated BARI aam3 for at least five years. The sampling population under study was 589 (472 and 117 in Porsha and Nachole upazila, respectively). Among them 111 farmers (19.0% of population) were selected as respondent following the formula used by (Kothari, 1990) using proportionate random sampling technique. Quantitative data were collected by the researchers through face-to-face interview using a pretested interview schedule during January to April, 2021. The fifteen selected characteristics of the respondents were the independent variables of the study which were measured as follows: Age was measured in terms of years. Level of education was measured in terms of years of schooling. Family size was measured by counting the total number of family members of the respondent comprising

the head of the household, his wife, children, parents and other dependents who jointly live and eat together. Farm size was measured in terms of hectares. Annual income was measured in terms of thousand BDT. Training experience was measured in terms of number of days. Extension contact was measured in terms of scores. Farming experience was measured in terms of years. Access to credit, off farm activities and availability of irrigation water were measured in ordinal scale where if the respondents had access to credit, it was coded as one (1) and if he/she had no access to credit, it was coded as zero (0). Similarly, if the respondents had off farm activities, it was coded as one (1) and if he/she had no off farm activities, it was coded as zero (0). In case of availability of irrigation water, if the respondents had available irrigation water, it was coded as one (1) and if he/she did not have available irrigation water, it was coded as zero (0). Organizational membership, cosmopolitanness, innovativeness and knowledge on mango cultivation technique were measured in terms of scores. Problems confrontation in BARI aam3 cultivation was the focus variable of the study which was measured by using a scale consisting of 16 selected problem statements. The 16 selected problem statements were identified after consultation with BARI aam3 growers and related experts and review of relevant literature. The problem confrontation score was measured using a five-point rating scale such as 'not at all', 'low', 'medium', 'high' and 'very high', and the corresponding scores assigned were '0', '1', '2', '3' and '4', respectively. Problem score for each respondent could range from '0' to '64', where, '0' indicated no problem and '64' indicated the highest problem confrontation in BARI aam3 cultivation. In order to investigate the intensity of each problem, Problem Confrontation Index (PCI) of each of the 16 problems was measured using the following formula:

$$PCI = 4 \times f_{vh} + 3 \times f_h + 2 \times f_m + 1 \times f_l + 0 \times f_n$$

Where,

$f_{vh}$  = Very high problem confrontation

$f_h$  = High problem confrontation

$f_m$  = Moderate problem confrontation

$f_l$  = Low problem confrontation

$f_n$  = No problem confrontation

PCI of each problem could range from 0 to 444, where, 0 indicated no problem at all and 444 indicated very high problem confrontation in BARI aam3 cultivation. Fifteen selected characteristics of the respondents viz. age, level of education, family size, farm size, annual income, training experience, extension contact, farming experience, access to credit, off farm activities, availability of irrigation water, organizational membership, cosmopolitanness, innovativeness and knowledge on mango cultivation technique were the independent variables of the study. These variables were measured employing existing standard measuring methods. Data were coded, compiled, tabulated and analyzed according to the objectives of the study using SPSS v20. Descriptive statistical measures like number and percentage distribution, range, rank order, mean, standard deviation etc. were used. Multiple regression analysis was employed to examine the contribution of the respondents' selected

characteristics to their problem confrontation in BARI aam3 cultivation. Stepwise multiple regression analysis was carried out to identify the best contributing factors that influenced the problems confrontation by the respondents in BARI aam3 cultivation.

## Results & Discussion

Results shown in Table 1 indicate that about half (49.5%) of the respondents were middle aged. Ninety-one percent of them were literate and the highest percentage (43.2%) of them belonged to higher secondary education level. Majority of the respondents (45.0%) belonged to small sized family. More than ninety percent (91.9%) respondents belonged to medium to large farm size category. The average annual income of the respondents was BDT766.6 thousand which was much higher than the national average (BDT137.8 thousand) (Bangladesh Bureau of Statistics [BBS], 2021) and most of the farmers (80.2%) belonged to medium to low annual income category. About half (46.0%) of the respondents had high training experience. Majority of the respondents (77.5%) received agricultural training. The highest portion of the respondents (70.3%) had medium extension contact. Most of them (65.8%) had medium farming experience. Most of the respondents (97.3%) had access to credit. More than half (55.0%) of them had some kind of off farm activities. Most of the respondents (89.2%) had availability of irrigation water. Majority of them (42.3%) had medium organizational membership. More than three fourth (75.7%) of the respondents had medium cosmopolitaness. Most of the respondents (78.4%) had low to medium innovativeness. Majority of them (68.5%) had medium knowledge on mango cultivation technique.

**Table 1** Characteristic profile of the respondents

Characteristics (Measurement unit)	Possible and observed range	Respondents (n=111)			Mean	SD
		Categories	No.	%		
Age (Year)	Unknown (24-73)	Young (up to 35)	38	34.2	40.7	10.1
		Middle aged (36-50)	55	49.5		
		Old (above 50)	18	16.3		
Level of education (Years of schooling)	Unknown (0-18)	Illiterate (0)	1	1.0	10.2	5.3
		Can sign only (0.5)	9	8.1		
		Primary (1-5)	12	10.8		
		Secondary (6-10)	41	36.9		
		Higher secondary (>10)	48	43.2		
Family size (Number)	Unknown (2-12)	Small family (up to 4)	50	45.0	5.2	2.0
		Medium family (5-6)	41	37.0		
		Large family (above 6)	20	18.0		
Farm size (Hectare)	Unknown (0.25-32.8)	Small (0.21-1.00)	9	8.1	4.7	4.9
		Medium (1.01-3.00)	43	38.7		
		Large (above 3.00)	59	53.2		
Annual income (‘000’BDT)	Unknown (79-4500)	Low (up to 353)	41	37.0	766.6	826.4
		Medium (354-1180)	48	43.2		
		High (above 1180)	22	19.8		

Training experience (Number of days)	Unknown (0-276)	No training	25	22.5	18.0	34.2
		Low (1-3)	25	22.5		
		Medium (4-6)	10	9.0		
		High (above 6)	51	46.0		
Extension contact (Score)	0 to 72 (10-55)	Low (up to 28)	20	18.0	38.9	10.6
		Medium (29-50)	78	70.3		
		High (above 50)	13	11.7		
Farming experience (Years)	Unknown (5-60)	Low (up to 9)	18	16.2	20.8	11.4
		Medium (10-32)	73	65.8		
		High (above 33)	20	18.0		
Access to credit	-	No	3	2.7	1.0	0.2
		Yes	108	97.3		
Off farm activities	-	No	50	45.0	0.6	0.5
		Yes	61	55.0		
Availability of irrigation water	-	No	12	10.8	0.9	0.3
		Yes	99	89.2		
Organizational membership (Score)	Unknown (0-213)	Low (up to 7)	42	37.8	22.4	31.1
		Medium (8-38)	47	42.3		
		High (above 38)	22	19.9		
Cosmopolitanism (Score)	0 to 15 (1-15)	Low (up to 8)	21	18.9	10.6	3.1
		Medium (9-14)	84	75.7		
		High (above 14)	6	5.4		
Innovativeness (Score)	0 to 21 (0-15)	Low (up to 3)	56	50.5	4.6	3.6
		Medium (4-6)	31	27.9		
		High (above 6)	24	21.6		
Knowledge on mango cultivation technique (Score)	0 to 30 (16-30)	Low (up to 22)	20	18.0	25.2	3.1
		Medium (23-28)	76	68.5		
		High (above 28)	15	13.5		

Data furnished in the Table 2 show that about three fourth (69.4%) of the respondents faced medium problems while about one fifth (18.9%) of the respondents faced low problems and only 11.7 percent respondents faced high problems in BARI aam3 cultivation. It might be due to that BARI aam3 cultivation is not much complex and hence the farmers did not face much problem regarding this. However, there are some major problems in BARI aam3 cultivation like crack of fruit in the heavy rain, disease and insect infestation and some other common problems of mango cultivation. Similar findings have also been reflected in the study of Alam *et al.* (2017) and Sultana *et al.* (2018).

**Table 2** Distribution of the respondents according to their problems faced in cultivation of BARI aam3 (Amrapali)

Categories (mean ± SD)	Respondents		Mean	SD
	Number	Percent		
Low problem (up to 12 )	21	18.9	20.2	8.2
Medium problem (13-28)	77	69.4		
High problem (>28)	13	11.7		

Total	111	100.0
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The observed problem confrontation index in BARI aam3 cultivation ranged from 2-320 against the possible range of 0 to 444. The selected sixteen problems confronted by the respondents were arranged in rank order according to their descending order of PCI in Table 3. 'Crack of fruit in the heavy rain' was the highest ranked problem followed by 'natural disaster', 'disease and insect infestation', and 'irrigation problem'. Most of the respondents reported that BARI aam3 fruit crack in heavy rain which causes damage of fruit and consequently they cannot sell the cracked fruit. It leads to a great loss of farmers. Similar finding was observed by Rahman and Khatun (2018). Natural disaster was the second ranked problem because majority of the respondents experienced damage of mango caused by natural disaster like cyclones, hailstorm, fog, heavy rain, drought etc. which results huge loss in mango cultivation. The finding is in line with the study of Rahman and Khatun (2018) and Sarkar *et al.* (2018). Disease and insect infestation was the third ranked problem since it is a common problem in mango cultivation which cause yield loss, fruit damage and therefore farmers cannot sell the damaged mango leading to a great loss in mango business. This finding is in line with the study of Sampa *et al.* (2019), Alam *et al.* (2017), Rahman and Khatun (2018), Sarkar *et al.* (2018), Galib (2019), Afrad *et al.* (2021), Hossain *et al.* (2003) and Rahman *et al.* (2017). Irrigation problem was the fourth ranked problem since there is water scarcity in the study area. Similar problem was observed by Rahman *et al.* (2017) and Rahman and Khatun (2018). Ali *et al.* (2018) reported that irrigation facilities exist in southern High Barind Tract (HBT), mostly from deep tube wells while the major areas of mainly northern (HBT) are rain fed.

**Table 3** Rank order of 16 selected problems confronted by the respondents in cultivation of BARI aam3 (Amrapali)

Problems	Extent of Problem confronted					PCI	Rank Order
	*NAA (0)	L (1)	M (2)	H (3)	VH (4)		
Crack of fruit in the heavy rain	5	9	28	21	48	320	1
Natural disaster	10	7	42	14	38	285	2
Disease and insect infestation	8	9	42	26	26	275	3
Irrigation problem	30	4	25	18	34	244	4
Farmers do not get reasonable market price in local market	35	3	19	20	34	237	5
Absence of local market	43	2	17	13	36	219	6
Marketing problem (Dhalti system**)	42	8	23	10	28	196	7
Lack of technical knowledge	46	12	36	7	10	145	8
Expert labour crisis	56	10	26	4	15	134	9

Lack of standard packaging material for BARI aam3	77	2	13	7	12	97	10
Brick field pollution	93	5	5	2	6	45	11
Poor road/communication	103	0	1	0	7	30	12
High input price	110	0	0	0	1	4	13
Lack of cold storage	110	0	0	0	1	4	13
High establishment cost of orchard	110	0	0	1	0	3	14
Lack of credit	110	0	1	0	0	2	15

\*NAA= Not at all, L= Low, M= Moderate, H= High, VH= Very high, PCI = Problem Confrontation Index

\*\*Dhalti system: Substandard local system of measurement used by the purchaser where growers become looser.

Suggestions provided by the respondents to solve the problems of BARI aam3 cultivation were presented in Table 4. The highest portion (59.5%) of the respondents suggested that irrigation facilities may be provided/improved with government initiative followed by ‘government/concerned authorities may establish local market place for mango trading for easy and accessible marketing of mango’ (43.2%), and ‘arrangement of training for agricultural entrepreneurs, farmers and agricultural labors’ (41.4%). It is noteworthy that since there is water scarcity in the Barind tract the farmers of the study area faced irrigation problems to a great extent and hence suggested to improve irrigation facilities. There is no standard local market for mango trading in the study areas and therefore the farmers need to go to other upazilas for mango trading which requires higher carrying cost. Therefore, they suggested establishing standard local market in the study area. Proper training facilities can increase their overall agricultural knowledge and thus reduce their problems. These findings are in line with the study of Galib (2019), Sarker *et al.* (2018), Rahman *et al.* (2017), Afrad and Akter (2020), Afrad *et al.* (2021) and Afrad *et al.* (2020a).

**Table 4** Rank order of suggestions provided by the respondents to solve the problems of BARI aam3 (Amrapali) cultivation

Sl. No.	Suggestions	Percent	Rank
1.	Irrigation facilities may be provided/improved with government initiative	59.5	1
2.	Government/concerned authorities may establish local market place for mango trading for easy and accessible marketing of mango	43.2	2
3.	Arrangement of training for agricultural entrepreneurs, farmers and agricultural labors	41.4	3
4.	Reasonable market price in local market can be set by the government and ensured	40.5	4

5.	Timely agricultural advices/assistance from concerned authorities	35.1	5
6.	Timely management of diseases and insects	34.2	6
7.	Government/concerned authorities may solve the weight related problems during selling upon consultation with stakeholders	31.5	7
8.	Suitable measures like well drainage system, bagging practice, application of recommended doses of Boron fertilizer, timely harvest are required to prevent crack of fruit in heavy rain	28.8	8
9.	Adequate quality input can be provided with government initiative timely	17.1	9
10.	Supply of standard packaging material for Amrapali is required	15.3	10
11.	Export of mango to foreign countries with government initiative can be increased and import of mango should be stopped	14.4	11
12.	Modern Multipurpose Cold storage facilities are required for mango storage and processing of mango	14.4	11
13.	Incentive/ subsidy can be arranged	12.6	12
14.	Road/communication facilities can be developed socially and by government initiative for mango carrying/transportation and good transportation facilities are essential	10.8	13
15.	Disaster management by rehabilitation measures from damage, minimizing damage by taking advance measures and weather forecasting	9.9	14
16.	Input price can be kept within reach of farmers/ input should be available at reasonable price	9.0	15
17.	Agricultural credit facilities and government financial grants are required for mango gardening	9.0	15
18.	Brick field may be removed away from agricultural field	8.1	16
19.	Regular electricity supply and modern agricultural machineries are essential	6.3	17
20.	Sub-center of Mango Research Centre can be established in Naogaon	0.9	18

### **Contribution of selected characteristics of the respondents to their problems confrontation in cultivation of BARI aam3**

Multiple regression analysis was conducted to test the hypothesis that there is no significant contribution of the selected characteristics of the respondents to their problems confrontation in BARI aam3 cultivation. Results presented in Table 5 indicate that there is significant contribution of respondents' age, training experience, extension contact, organizational membership, cosmopolitaness, innovativeness and knowledge on mango cultivation

technique to their problem confrontation in BARI aam3 cultivation. Of these, knowledge on mango cultivation technique, cosmopolitaness and training experience were the most important contributing factors (Significant at the 1% level of significance) which profoundly influenced problems faced by respondents in BARI aam3 cultivation and innovativeness, extension contact, age and organizational membership were the second most important contributing factors (Significant at the 5% level of significance). The predictor variables such as age, training experience, extension contact, organizational membership, cosmopolitaness, innovativeness and knowledge on mango cultivation technique might have influenced the respondents' awareness regarding their problems. Few predictor variables such as organizational membership, cosmopolitaness and knowledge on mango cultivation technique are related to increasing agricultural knowledge and thereby increasing awareness regarding their problems in BARI aam3 cultivation. Respondents' organizational membership, cosmopolitaness and knowledge on mango cultivation technique had positive significant contribution to their problem confrontation in BARI aam3 cultivation. It might be due to that the respondents who had more organizational membership and cosmopolitaness had more agricultural knowledge and other practical knowledge due to greater participation in different organizations and more frequent travel to different places which influenced them to be aware of their problems and hence they confronted higher problems. The respondents who had more knowledge on mango cultivation technique were highly conscious about the problems in BARI aam3 cultivation, therefore could identify the appropriate problems. Perhaps therefore the farmers with higher knowledge on mango cultivation technique faced higher problems. Alam *et al.* (2017) found similar result with respect to organizational participation and knowledge on mango production respectively. But, the relationship between problem confrontation in mango production and cosmopolitaness was found insignificant and negative. Respondents' age had negative significant contribution to their problem confrontation. Perhaps the older farmers are more experienced in solving problems due to their life long experience and practical indigenous knowledge. Alam *et al.* (2017) observed reverse findings. Respondents' training experience had negative significant contribution to their problem confrontation which indicates that the farmers who received more training acquired the knowledge of solving agricultural problems and could take necessary prior measures so that problems do not arise in their BARI aam3 cultivation. Similar findings were observed by Sultana *et al.* (2018) and Islam *et al.* (2013). Respondents' extension contact had negative significant contribution to their problem confrontation. It might be due to that the farmers who had more extension contact could communicate frequently with the extension workers and other agricultural information sources in case of any problem and solve their problems. They also could identify the preventive measures to avoid the problems due to their higher extension contact and also take necessary advance measures so that major problems do not arise. Perhaps, therefore they faced lower level of problems. Alam *et al.* (2017) and Barau *et al.* (2020) observed similar findings. Respondents' innovativeness had negative significant contribution to their problem confrontation. It might be due to that the farmers who adopted different agricultural technologies were more experienced in agricultural activities and had more knowledge about different agricultural problems and solutions and therefore they could identify the ways through which problems can be avoided in BARI aam3 cultivation and prior measures can be taken so that any kind of major problem does not arise. Afrad *et al.* (2020b) found similar result.

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**Table 5** Multiple regression coefficients of contributing factors related to problems confrontation by the respondents in cultivation of BARI aam3

Dependent variable	Independent variables	Standardized $\beta$ coefficients	P value
Problems faced in cultivation of BARI aam3	Age	-0.291	0.039*
	Level of education	-0.043	0.654
	Family size	-0.035	0.693
	Farm size	0.062	0.633
	Annual income	-0.057	0.654
	Training experience	-0.264	0.004**
	Extension contact	-0.222	0.037*
	Farming experience	0.097	0.475
	Organizational membership	0.216	0.040*
	Cosmopolitaness	0.330	0.001**
	Innovativeness	-0.205	0.027*
	Knowledge on mango cultivation technique	0.433	0.000**
	Constant		0.270
	R <sup>2</sup>		0.327
	Adjusted R <sup>2</sup>		0.245
F value		3.971	
P value		0.000**	

\* Significant at 0.05 level \*\* Significant at 0.01 level

It was observed that 32.7 percent ( $R^2=0.327$ ) of the variation in the problem confrontation by the respondents in BARI aam3 cultivation can be attributed to their age, level of education, family size, farm size, annual income, training experience, extension contact, farming experience, organizational membership, cosmopolitaness, innovativeness and knowledge on mango cultivation technique. The F value 3.971 indicates that the model is significant ( $p=0.000$ ). Each predictor variable may contribute some of the variations in the problem confrontation by the respondents in BARI aam3 cultivation simply by chance. Adjusted R-square value penalizes the addition of extraneous predictors in the model, and the value of 0.245 still indicates that the variance in the problem confrontation by the respondents in BARI aam3 cultivation can be attributed to the predictor variables rather than by chance, and the model is suitable model.

### Stepwise multiple regression analysis to identify best contributing factors related to problems confrontation by the respondents in cultivation of BARI aam3

In order to identify the best contributing factors that played the major role in problems confrontation by the respondents in BARI aam3 cultivation, stepwise multiple regression analysis was carried out by forward selection. The multiple R and  $R^2$  values were found 0.529 and 0.280 respectively. Knowledge on mango cultivation technique was the best predictor of problems confrontation by the respondents in BARI aam3 cultivation (Adjusted  $R^2 = 0.064$ ) and was entered first (Table 6). The next best predictors were cosmopolitaness (Adjusted  $R^2 = 0.105$ ), innovativeness (Adjusted  $R^2 = 0.164$ ), training experience (Adjusted

$R^2 = 0.213$ ) and extension contact (Adjusted  $R^2 = 0.246$ ), respectively. It was found from the final model that these five variables effectively contributed to the problems confrontation by the respondents in BARI aam3 cultivation. It was also revealed that 24.6 percent of the variation in the problem confrontation by the respondents in BARI aam3 cultivation can be attributed to their knowledge on mango cultivation technique, cosmopolitaness, innovativeness, training experience and extension contact jointly. The F-value 8.172 indicates that the model is highly significant ( $p = 0.000$ ). Therefore, it can be concluded that these five independent variables jointly predicted the problems confrontation by the respondents in BARI aam3 cultivation. For finding out the unique contribution of each variable to problems confrontation in BARI aam3 cultivation the increase in Adjusted  $R^2$  value was calculated. Respondents' knowledge on mango cultivation technique alone contributed 6.4 percent of the variation in the problems confrontation by the respondents in BARI aam3 cultivation. The t-statistics were significant at both the 1 percent and 5 percent levels. The t-statistics indicate that the knowledge on mango cultivation technique and cosmopolitaness were the most important contributing factors (significant at the 1% level) for predicting the problems confrontation by respondents in BARI aam3 cultivation, while the coefficients of the other factors were significant at the 5 percent level. The respondents' innovativeness, training experience and extension contact had negative contribution to their problem confrontation in BARI aam3 cultivation. It might be due to that the adoption of different new technologies, more training and higher extension contact increases farmers' experience and knowledge and thus they could identify the preventive measures to avoid the problems and also take necessary advance measures so that major problems do not arise. Alam *et al.* (2017) found that the relationship between problem confrontation in mango production and knowledge on mango production was positively significant. But, the relationship between problem confrontation in mango production and cosmopolitaness was found insignificant and negative. Afrad *et al.* (2020b) also found that higher innovativeness inspired farmers to adopt new technology and thereby enabled them to overcome different problems. Islam *et al.* (2013) observed that BARI mung farmers suggested arranging training for them to tackle pest problems more efficiently. Alam *et al.* (2017) also observed that the relationship between problem confrontation in mango production and extension media contact was negatively significant.

**Table 6** Variables identified by stepwise multiple regression analysis as contributing factors related to problems confrontation by the respondents in cultivation of BARI aam3

Independent variables	Standardized $\beta$ coefficients	Value of t (with probability level)	$R^2$	Adjusted $R^2$	Increase in Adjusted $R^2$	Variation explained in percent	F value	P value of model
Knowledge on mango cultivation technique	0.269	2.921 (0.004**)	0.073	0.064	0.064	6.4	8.530	0.004**
Knowledge on mango cultivation technique	0.283	3.126 (0.002**)	0.121	0.105	0.041	4.1	7.425	0.001**

Cosmopolitaness	0.220	2.436 (0.016*)							
Knowledge on mango cultivation technique	0.316	3.585 (0.001**)	0.187	0.164	0.059	5.9	8.216	0.000**	
Cosmopolitaness	0.305	3.321 (0.001**)							
Innovativeness	-0.273	-2.956 (0.004**)							
Knowledge on mango cultivation technique	0.330	3.850 (0.000**)							
Cosmopolitaness	0.335	3.727 (0.000**)	0.242	0.213	0.049	4.9	8.438	0.000**	
Innovativeness	-0.249	-2.771 (0.007**)							
Training experience	-0.237	-2.754 (0.007**)							
Knowledge on mango cultivation technique	0.462	4.590 (0.000**)							
Cosmopolitaness	0.354	4.003 (0.000**)	0.280	0.246	0.033	3.3	8.172	0.000**	
Innovativeness	-0.230	-2.599 (0.011*)							
Training experience	-0.209	-2.446 (0.016*)							
Extension contact	-0.243	-2.373 (0.019*)							

\* Significant at 0.05 level, \*\* Significant at 0.01 level

## Conclusion

The highest percentage (69.4%) of the growers confronted moderate problems in BARI aam3 cultivation. The ‘crack of fruit in the heavy rain’ was the top ranked problem followed by ‘natural disaster’, ‘disease and insect infestation’ and ‘irrigation problem’. There was significant contribution of the farmers’ age, training experience, extension contact, organizational membership, cosmopolitaness, innovativeness and knowledge on mango cultivation technique to their problem confrontation in BARI aam3 cultivation. Farmers’ knowledge on mango cultivation technique, cosmopolitaness, innovativeness, training experience and extension contact were the best predictors of problems confrontation by the farmers in BARI aam3 cultivation among which knowledge on mango cultivation technique alone contributed 6.4 percent of the variation in the farmers’ problems confrontation. Government may arrange more training facilities and make arrangement for more frequent

agricultural advices and assistance from concerned authorities. The concerned authorities may also promote more new agricultural technologies and involve the older farmers in mango cultivation.

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