FACTORS AFFECTING THE YIELD GAP OF BRINJAL GROWN IN JHIKARGACHA UPAZILA UNDER JASHORE DISTRICT

ABSTRACT

The purpose of the study was to determine the yield gap of brinjal with the causing factors and explore the relationship between the yield gap and the socioeconomic characteristics of the farmers. The study was conducted with a sample of 50 farmers randomly selected from five villages in Raghunathnagar union under Jhikargacha upazila of Jashore district using a structured interview schedule from February to March 2020. The yield gap was measured based on the differences between the achievable yield recorded at the particular study location and the average actual yield harvested by the farmers. The results revealed that the majority (76.0%) of farmers had a moderate yield gap (26-65.0% gap), while 14.0% had a low yield gap (up to 25.0% gap) and about 10% high yield gap (more than 65% gap). Inadequate amounts of different inputs used in brinjal production along with some socio-psychological-economic characteristics of farmers were the causes of the yield gap. For instance, 80% of farmers had a high gap in the application of Supreme- a locally popular insecticide for controlling fruit and shoot borer, in the case of pesticide application (74% and 76% of farmers had high gap in the application of Amister and Amagold) followed by 74% had high gap in TSP and Mop application, 76% had high gap in Urea application, 60% had high gap in Boron application, 72% had high gap in Gypsum application, almost 58% had medium to high gap in Cowdung application and 44% had high gap in irrigation application. The results of the correlation co-efficient 'r' also revealed that family size, farm size, extension contact, farming experience, knowledge, and level of inputs use were negatively significant with yield gap, while the problems they experienced in brinjal production had a positive significant relationship. The top five problems were: price hike of different inputs required for brinjal production, and poor selling price of products as it is maintained by business syndicates along with lack of proper knowledge about fertilizer management, heavy attack of insects and pests in the brinjal fields, insufficient extension services and lack of training of the farmers about the modern production method of brinjal.

Keywords: Yield gap, Brinjal Farmers, Potential yield, Average yield;

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INTRODUCTION

The economy of the farmers of Jashore district largely depends on agriculture (Dewan *et al.* 2017). Out of the district's total 591 thousand holdings, farms that grow a variety of crops, including native and HYV paddy, wheat, jute, vegetables, spices, pulses, oilseeds, sugarcane, and others, make up 63.38% of the total holdings. It is one of the best districts for supplying a variety of vegetables, such as brinjal, cauliflower, tomato, etc. (The Business Standard, 2020). Brinjal is the 3rd most significant vegetable by amount of production in Bangladesh and is cultivated on around 50,000 hectares nationwide (Choudhary *et al.*, 2014). According to The Business Standard (2020), Jashore farmers produce 25 tons of vegetables per hectare each year. This indicates that 32,000 hectares of land are used to grow 8 lakh tons of vegetables annually. Even though the majority of farmers use contemporary vegetable kinds in their fields, they are still a long way from the yields that their growing vegetable types could produce. Nonetheless, the yield variation between Kharif and Rabi seasons is evident in the fact that there is a sizeable yield gap (Figure 1).

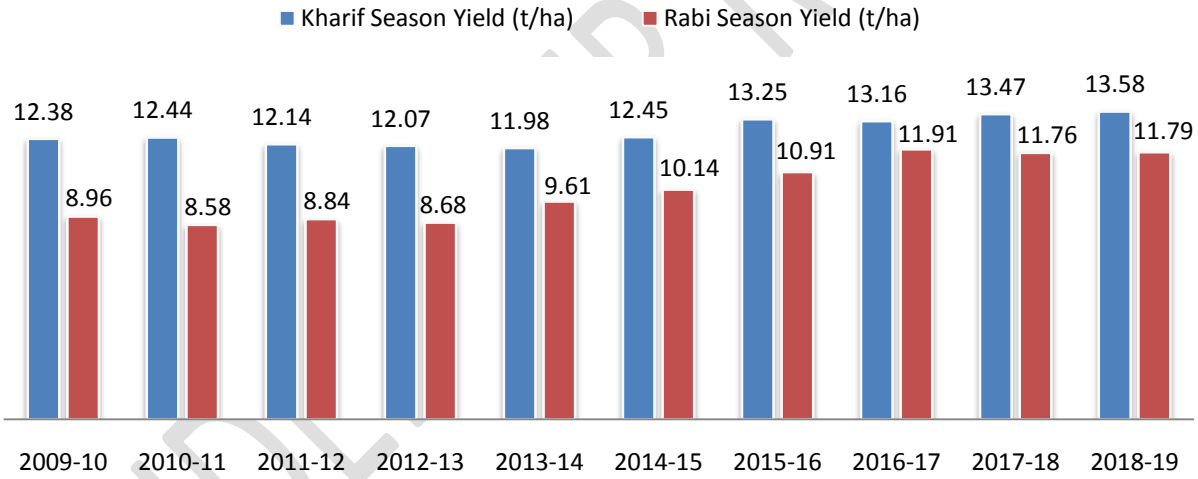

Figure 1: Yield Rate of Brinjal from 2009-10 to 2018-19 in Jashore District (BBS, 2019; BBS, 2018; BBS, 2017; BBS, 2016; BBS, 2015; BBS, 2014; BBS, 2013; BBS, 2012; BBS, 2011)

The Business Standard (2020) reported that 33.98 t/ha Brinjal can be harvested in Jashore district. The reasons behind this yield gap can be simplified by the financial inability of farmers for buying fertilizers, heavy pest infestation, rough weather, higher input price, lack of irrigation, proactive business syndicate, poor extension communication, transportation issues, etc. The yield attained under optimal growing conditions is referred to as potential yield (Fischer, 2015; Stuart et al., 2016; Van Ittersum et al., 2013). And at least 80% of the potential yield in farmers' filed is called economically achievable yield or farmer's field achievable yield (Lobell *et al.*, 2009; Van Ittersum *et al.*, 2013; Laborte *et al.*, 2012) which can be measured by the mean of the farmer's field yields (Stuart *et al.*, 2016; Laborte *et al.*, 2012;

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Senthilkumar *et al.*, 2020; Tanaka *et al.*, 2015; Tanaka *et al.*, 2017) And difference between farmers achievable yield and farmer's actual yield is called yield gap (Stuart *et al.*, 2016). Since sustainability and profitability of any crop farming depend primarily on yield; and most of the brinjal farmers are far away to harvest the potential yield of their cultivating varieties. So, According to Lobell *et al.* (2009), there has a yield gap in brinjal cultivation. The reasons behind the yield gap need to identify as there is no immediate alternate way to raise the yield present ceiling of Brinjal. According to Van and Rabbinge (2013) and Mueller *et al.* (2012), knowing the yield gap is essential for improving productivity and yield. The study aims to i) investigate the reasons behind the yield gap of the brinjal at the farming level; ii) assess the amount of yield gap that exists in the various categories of the farmers; iii) identify problems associated with yield gaps and iv) the relationships between yield gap and selected characteristics of brinjal farmers.

METHODOLOGY

The study was conducted in five villages of Raghunathnagar union under Jhikargacha upazila of Jashore district. A Map of the study area is shown in Figure 2. An updated list of Brinjal farmers of the selected unions was collected from the local office of the DAE. From the total 250 farmers, 50 were selected using the simple random sampling approach as 20 percent of the total respondents (Kerlinger, 1993). Data were collected from these selected farmers from February to March 2020 using a pretested well-structured interview schedule. The interview schedule was prepared with consultation of extension specialists, relevant subject specialists, and available pertinent literature according to the objectives of this study. The schedule contained both open and close-ended questions. The schedule was pre-tested among five farmers in the sample block before preparing the final version for collecting the data.

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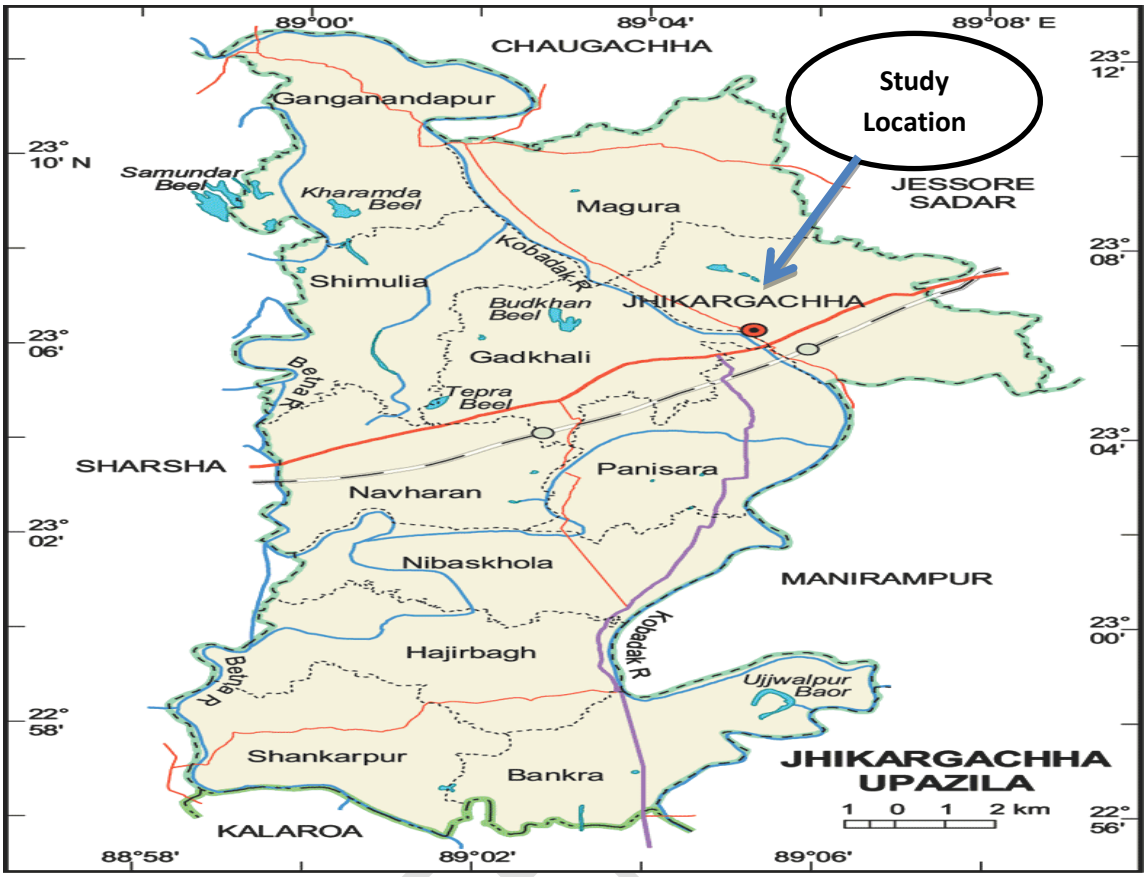

Figure 2: Map showing study location in Jhikargacha upazila under Jashore district (Bdmaps, 2011)

Measurement of Factors Affecting Yield Gap

A total of ten socio-psychological-economic characteristics namely age, level of education, family size, farm size, annual income, extension contact, farming experience, knowledge of brinjal cultivation, level of inputs use, and problems in brinjal production were taken as independent variables to ascertain yield gap of brinjal.

Measurement of Level of Inputs Use in Brinjal Production

The level of input use was measured by the proportion of the actual amount of input used to the recommended dose expressed in percentage. The formula used by Islam (2007) was employed to find out the gap in inputs use:

$$\text{Level of input use} = \frac{(\textit{Recommended dose} - \textit{Actual applied level of inputs})}{\textit{Recommended level of inputs}} \text{ x100}$$

Chart 1 : Recommended level of all inputs used in brinjal production were as follows:

Name of Inputs	Recommended dose
1. TSP	313kg/ha
2. MoP	80kg/ha
3. Urea	110kg/ha

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4. Boron	1.5kg/ha
5. Gypsum	100kg/ha
6. Cowdung	20 tons/ha
7. Irrigation	4-6 times per month
Pesticides	
8. Amister	20L/ha
9. Amagold	10L/ha
10. Supreme Oil	12L/ha
11. Care Oil	15L/ha

(Source: Agri-Farming, 2022; Siddiky et al., 2007; Abegunrin, 2016; Ikishan, 2022)

Measurement of Yield Gap of Brinjal grown in Jashore District

The yield gap was measured based on the difference between the achievable yield (kg/ha) of brinjal and the average actual yield (kg/ha) obtained by the farmers of Raghunathpur Union. The achievable yield was the average of the top five yields of the brinjal of the farmers of the same union. The yield gap of vegetables could vary from 0% to 100%. According to Pushpa and Srivastava (2014); Rokonuzzaman and Islam (2017) the formula was:

Yield Gap = $\frac{\mathbf{1}}{\boldsymbol{Pi}}\sum_{\boldsymbol{i=1}}^{\mathbf{2}}(\boldsymbol{Pi}-\boldsymbol{Yi})\times\mathbf{100}$

Where,

Pi= Achievable yield, average of top five yields obtained at Raghunathpur union.

Yi= Actual yield of the brinjal harvested by the farmers

Measurement of Problems Involved in Brinjal Production

Farmers face different types of problems during brinjal production. These problems hinder the production procedure thus causing yield reduction. Problems were measured by using a closed-formed of 15 questions which were identified as the obstacles to brinjal production through FGD with the farmers during pre-testing of the questionnaire for the study. Each respondent was asked to indicate the degree of severity of each problem he faced. A four-point rating scale such as ‘very severe’, ‘moderately severe’, ‘low severe’, and ‘not at all problem’ was used to determine the response to each question. The weights assigned to these responses were 3, 2, 1, and 0, respectively. The total score of respondents was determined by summing up the weights for responses against all 15 questions. The problem score of the respondents could range from 0 to 45.

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RESULTS

A summary of the socio-psychological-economic characteristics of brinjal farmers is shown in Table 1.

Table 1: Salient features of the selected socio-psychological-economic characteristics of the brinjal farmers

Characteristics (units)	Range		Growers		Mean	Standard Deviation
	Possible	Observed	Categories	Percent		
Age (Year)	Unknown	32-61	Young (up to 35)	6.0	46.18	7.64
			Middle age (36 – 55)	82.0		
			Old (Above 55)	12.0		
Level of education (Year of schooling)	Unknown	0-5	Illiterate	16.0	1.82	1.35
			Primary	58.0		
			Secondary	26.0		
Family size (Number)	Unknown	4-8	Small family (up to 4)	38.0	5.04	1.33
			Medium family (5-6)	46.0		
			Large family (above 6)	16.0		
Farm size (ha)	Unknown	0.01-2.50	Marginal (0.21-0.50)	80.0	0.10	0.10
			Small (0.51-1.00)	16.0		
			Medium (1.01-3.00)	4.0		
Annual income (Taka '000')	Unknown	30000-110000	Low income (up to 300)	18.0	60.60	18.61
			Medium income(301 to 750)	60.0		
			High income (751 to 1100)	22.0		
Extension contact (Scores)	0-30	7-13	Low contact(up to 8 scores)	24.0	9.68	1.42
			Medium contact (8 to 11)	68.0		
			High use (above 11)	8.0		
Farming experience (Year)	Unknown	5-20	Low experience (up to 10)	16.0	10.70	3.30
			Medium experience (11 to 15)	68.0		
			High experience (above 15)	16.0		
Knowledge of brinjal cultivation (Scores)	0-70	34-57	Low knowledge (up to 41)	18.0	47.54	5.09
			Medium knowledge (42 to 49)	66.0		
			High knowledge (above 49)	16.0		
Gap in the level of inputs used (Percent)	0-100	24.73-81.39	Low gap (up to 47.13)	14.0	60.67	13.54
			Medium gap (47.14-74.21)	78.0		
			High gap (above 74.21)	8.0		

Results contained in Table 1 indicate that an overwhelming majority (82.0%) of the farmers in the study area were middle to old-aged. It might be due to middle to old-aged people having more land ownership than young-aged people. Rahman (2018) found similar findings in his study area. He also stated that middle-aged farmers can convince others in the decision-making process regarding farming activities. Findings express that 58.0% of the farmers had only primary education, while 16.0% were illiterate and 26.0% had secondary-level education. Most of the respondents of the locale had a primary level of

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education and the illiteracy rate was moderate. It might be due to a lack of education facilities near the residence of farmers along with their poor economic conditions. Rahman (2018) reported that most of the brinjal farmers are illiterate in his study area. Up to 46.0% of farmers had medium family members whereas up to 38.0% of farmers had a small number of family members. Rahman (2018) also found similar results. It can be speculated that the government incentives for family planning have an impact on family members as the farmers were more conscious about having more than 2 children. Information reveals that 80.0% of the farmers had marginal farm sizes, 16.0% of them had small farm sizes and 4.0% of the farmers had medium farm size. It's speculated that due to the poor economic conditions of farmers; most of them weren't able to occupy huge chunks of land as we saw in the table. Due to the considerable losses brought on by the fruit and shoot borer (FSB), the area used for producing brinjal has decreased over time-related to other vegetables, both during the summer and winter seasons (Choudhary *et al.*, 2014). Results indicate that 60.0% of the farmers had medium income, 18.0% of them had low income and 22.0% had high family income. The predominance of medium-income farmers may be due to moderate socio-economic conditions, and the small and medium farm size of the majority farmers. As well as the mean annual income of the locale was lower than the national average of $2064 (DhakaTribune, 2020), which may be due to more involvement of the farmer's family members in business, services, and getting foreign remittance and causing a lack of engagement in agricultural practices. Around 68.0% of the respondent farmers had moderate extension media contact, while up to 24.0% had low contact. Extension contact of the respondents varied, which may be due to the socioeconomic conditions of the farmers. It is found that low-income farmers had low extension media contact in the locale. The occurrence can be explained as the lack of professionalism of extension workers along with the poor administrative skill of extension administration. The result shown in Table-1 indicates that the moderately experienced farmers (68%) were predominant in the study area as opposed to high (16%) and low experienced (16%). Rahman (2018) found that more than half of the brinjal farmers had medium experience in brinjal cultivation in his study area. It can be explained as most of the farmers were engaged in brinjal cultivation for about 6-12 years, whereas the most experienced were engaged for about 15-20 years, the experienced farmers earned good profit by cultivating brinjal which was why they were invested much time in brinjal cultivation (Rahman *et al.*, 2016). It is also evinced from Table-1 that 18.0% of the farmers had poor knowledge, 66.0% had moderate knowledge and 16.0% had high knowledge of brinjal cultivation and minimizing strategies for yield gap. Results also revealed that the majority (78%) of farmers had a medium gap in the level of inputs used while 8% had a high gap and only 14% had a low gap. It might be because most of the farmers had a lack of knowledge about using the recommended level of inputs in brinjal production.

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The Gap in Level of Inputs Use in Brinjal Production

This section includes the gap in inputs use which is the main fact for the gap in brinjal production. The result contained in Table 2 shows the distribution of the respondents according to the gap in the use of inputs in brinjal production.

Table 2: Distribution of respondents according to the gap in the use of inputs in brinjal production

Inputs		Respondents		Mean	SD
	Gap in use	Frequency	Percent		
Fertilizer					
1. TSP	Low gap (up to 36.03)	2	4	75.21	19.63
	Medium gap (36.04-65.36)	11	22		
	High gap (above 65.37)	37	74		
2. MoP	Low gap (up to 52)	10	20	79.81	20.13
	Medium gap (52.10-76)	3	6		
	High gap (above 76.1)	37	74		
3. Urea	Low gap (up to 42.33)	10	20	75.66	26.01
	Medium gap (42.34-71.1)	2	4		
	High gap (above 71.2)	38	76		
4. Boron	Low gap (up to 33.3)	9	18	64.20	30.58
	Medium gap (33.4-66.6)	11	22		
	High gap (above 66.7)	30	60		
5. Gypsum	Low gap (up to 33.3)	6	12	77.60	28.32
	Medium gap (33.4-66.6)	8	16		
	High gap (above 66.7)	36	72		
6. Cowdung	Low gap (up to 31.3)	21	42	35.86	12.06
	Medium gap (31.4-66.6)	17	34		
	High gap (above 66.7)	12	24		
Irrigation					
7. Irrigation	Low gap (up to 33.3)	28	56	36.99	43.02
	High gap (above 66.7)	22	44		
Pesticide					
8. Amister	Low gap (up to 33.3)	10	20	78.60	37.79
	Medium gap (33.4-66.6)	3	6		
	High gap (above 66.7)	37	74		
9. Amagold	Low gap (up to 16.66)	12	24	38.40	20.93
	High gap (above 33.34)	38	76		
10. Supreme	Low gap (up to 33.3)	10	20	84.00	32.64
	High gap (above 66.7)	40	80		
11. Care	Low gap (up to 26.67)	42	84	25.87	16.31
	Medium gap (26.68-53.33)	5	10		
	High gap (above 53.34)	3	6		

From Table 2 it is seen that the gap in the use of inputs in brinjal production. For fertilizers like TSP application, the majority (74%) of farmers had high gap while 22% had medium gap and only 4% had

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low gap. About 80% of farmers had medium to high gap in the case of MoP application in brinjal field. The overwhelming majority (76%) of farmers had high gap in the case of Urea use in brinjal fields and 60% of farmers had high gap in Boron application in recommended dose. It is also revealed that almost 88% of farmers had medium to high gap in using recommended dose of Gypsum in brinjal field. It is also found that maximum farmers (about 76%) had low to medium gap in cowdung use in brinjal field. More than half (about 56%) of the farmers had proper knowledge about irrigation application in brinjal field. As a result, they had low gap in irrigation application.

Most of the respondents felt the high gap in Amister (74%), Amagold (76%), and Supreme (80%) pesticide application in brinjal field while only 94% had low to medium gap in Care pesticide application in brinjal field. Singla and Kaur (2016) also reported that improper management of these inputs is the key factor for the significant yield gap in crop cultivation.

Problems in Brinjal Production

The problem score of the respondents ranged from 30 to 35 with a mean and standard deviation of 32.52 and 1.31, respectively. Based on their encountered problems, the farmers were classified into three categories, viz low problem, medium problem, and high problem towards vegetable production, also the problems that farmers faced in the field were calculated by PI (Problem Index), and where the problems were categorized based on the severity of the problems.

Table 3: Distribution of the respondent's farmers according to their problems in brinjal cultivation

Categories	Respondents		Mean	SD
	Frequency	Percent		
Low (up to 15 scores)	12	24.0	32.52	1.31
Medium (16 to 23 scores)	26	52.0		
High (24 and above scores)	12	24.0		
Total	50	100.0		

Problems Faced by the farmers causing yield gap in Brinjal Cultivation

To ascertain the extent of severity of problems faced by the farmers in brinjal cultivation, the constraints facing index (PI) was computed. The PI of any problem could range from 0 to 250, where 0 indicates no constraint and 250 indicates high constraint. However, the PI of the 17 constraints ranged from 10 to 138 and has been arranged in rank order according to their constraint indices which appear in Table 4. For calculating the PI, the “highly intense” problem was enumerated by 3, “moderately intense”, “low intense problem” and “no problem” was enumerated by 2, 1, and 0 respectively. The problems faced by the farmers of each category were multiplied by their given number and summed up for ranking. After the

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calculation of the problem index based on the problems faced by farmers in the brinjal cultivation, the top five most severe problems were selected which the researcher recognized as prime factors causing yield gap along with the moderately severe problems which cause obstacles in brinjal cultivation and less severe problems were found through this calculation.

Table 4: Rank order of the problems faced by the farmers that cause yield gap in brinjal cultivation

Sl.	Problems	The extent of problems faced (n=50)				PI	Rank Order
		H*	M	L	N		
1.	Longer duration of a variety	0	0	10	40	10	17th
2.	Scarcity of quality seeds	3	3	14	30	29	14th
3.	Insufficient extension services	35	12	3	0	132	4th
4.	The high price of insecticides and pesticides	25	10	10	5	105	8th
5.	The low market price of brinjal	35	8	6	1	127	6th
6.	Lack of irrigation facilities	7	25	15	3	86	9th
7.	Lack of knowledge about fertilizer management	38	10	2	0	136	2nd
8.	High fertilizer price	30	12	8	0	122	7th
9.	Labor scarcity	12	10	25	3	81	10th
10.	Adverse weather	10	5	20	15	60	11th
11.	Poor transportation	5	10	15	20	40	12th
12.	Heavy attack of insects and pests	38	10	1	1	135	3rd
13.	Excessive rainfall	3	5	12	30	31	13th
14.	Flood	4	5	4	37	26	16th
15.	Uneven field	4	5	5	36	27	15th
16.	Businessman syndicates cause the low prices of products and the high price of seeds & inputs	40	8	2	0	138	1st
17.	Lack of training	36	8	5	1	129	5th

*H=High, M=Medium, L=Low, N=Not at all, PI= Problem Index

The problem score of the respondents ranged from 30 to 35 with a mean and standard deviation of 32.52 and 1.31. More than half (52.0%) of the respondents perceived these problems as medium barriers while 24% were low barriers and the rest 24% were high barriers. Results contained in Table 5 show the top five problems were businessman syndicate (PI=138), lack of knowledge about fertilizer management (PI=136), insect and pest infestation (PI=135), insufficient extension service (PI=132), and lack of training (PI=129). Like other business sectors in the country, the "businessman syndicate" can manipulate the market price of the product, hoard the produce, and create an artificial crisis of brinjal, which cause price hike in the market. All these demoralized farmers from their enthusiasm for using adequate amounts of inputs. Rahman (2018) reported that most of the farmers are bound to sell their brinjal to the "paikar"

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at a very low price. The second one was “lack of knowledge about fertilizer management” as the farmers lack the knowledge of proper fertilizer application, the random application of fertilizer caused a reduction in the brinjal field, as the recommended dose wasn't followed properly, and farmers didn’t get the desired yield. Rahman (2018) stated that brinjal production is significantly hampered due to a lack of proper scientific knowledge of brinjal cultivation. The third problem was “insect and pest infestation”, in brinjal cultivation, severe attack of pest like brinjal foot rot and insects like fruit and shoot borer was observed most as they create most anomalies in the field by damaging the seedling, and farmers couldn’t use recommended dose of insecticides and pesticides as they lack knowledge about the application thus harming their production. Rahman (2018) reported that a huge amount of brinjal yield was lost due to insect and pest attacks. Lack of extension service was also a problem for farmers, as they didn’t get proper information and plot demonstrations about certain practices from extension officers. Lack of training was another major obstacle, for which the farmers lack information about input application and practiced improper application of inputs.

The moderately severe problem, their PI (Problem Index) was; lower price of brinjal (PI=127), high fertilizer price (PI=122), high price of insecticides and pesticides (PI=105), lack of irrigation facilities (PI=86), and labor scarcity (PI=81).

The problem that created medium problems for farmers were- the “lower price of brinjal”, as the farmers didn’t get enough money for the produced, they lost the motivation for cultivating again. “High fertilizer prices” often forced farmers to apply less fertilizer in the field as they couldn’t afford the fertilizers needed for the field. “High price of insecticides and pesticides” created the same issue as the high price of fertilizer as most farmers couldn’t afford to buy it. “Lack of irrigation facilities” causes fewer water supplies on the field in the dry season causing yield reduction. “Labor scarcity” is another one that impact often, as farmers didn’t get adequate manpower for harvesting or cultivating, which hindered the cultivation procedure and caused huge yield reduction in the field.

The less severe problems along with their problem index are as followed- Adverse weather (PI=60), the poor transportation system (PI=40), excessive rainfall (PI=31), scarcity of quality seeds (PI=29), uneven field (PI=27), flood (PI=26), and larger duration of variety (PI=10) were less severe problems in Brinjal cultivation faced by the farmers in the study area.

Yield gap in Brinjal Cultivation

The yield gap of the farmers ranges from 0 to 68% with the mean and standard deviation of 45.12% and 19.43, respectively. Based on the yield gap the farmers were classified into three categories which is shown in Table 5. Results revealed that the overwhelming majority (76.0%) of farmers had a moderate yield gap in brinjal cultivation while 10% had high and only 14.0% had low yield gap.

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Table 5: Distribution of respondents depending upon their yield gap of cultivated brinjal

Categories of yield gap	Respondents		Mean	Standard deviation
	Frequency	Percent		
Low yield gap (up to 25.69%)	7	14.0	45.12	19.43
Moderate yield gap (25.70% to 64.55%)	38	76.0		
High yield gap (64.56% and above)	5	10.0		
Total	50	100.0		

Table 6: Potential yield and yield gap of the brinjal varieties grown by the respondents

Name of the variety	The highest yield (t/ha), obtained at farmers' plot (Pi)	Actual Yield (t/ha), harvested by the farmers (Yi)	Yield gap (%)
Kushtia (V1)	34.33	18.20	47
Marka (V2)	31.49	17.32	45
China (V3)	30.07	16.54	45
Nayantara (V4)	28.24	15.25	46
Katabegun (V5)	19.66	11.40	42

It is evinced from Table 6 that the variety that was cultivated in the study area, where the Kushtia variety showed a significant yield gap (47%) and the Katabegun variety of brinjal had less deviation from potential yield and the gap was 42%. It can be explained as the cultivation procedure and management of the Katabegun variety isn't as complicated as the other varieties presented here as it's easy to grow. Whereas the other varieties needed extreme incentives and nurturing to grow, in this regard the level of inputs usage by farmers was lagging behind the recommended input application.

Relationship between Selected Characteristics of the Brinjal Farmers and Yield Gap

Pearson's product-moment correlation coefficient was computed to find out the extent of the relationship between the yield gap of brinjal and the selected characteristics of farmers. To reject or accept the null hypothesis, 1% and 5% levels of probability were used.

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Table 7: Relationship between selected characteristics of the brinjal farmers and yield gap

Dependent Variable	Independent Variables	Correlation of Co-efficient with the yield gap	Tabulated 'r' value	
			0.05 level	0.01 level
Yield gap of Brinjal Farmers	Age	-0.162 NS	0.281	0.364
	Level of education	-0.001 NS		
	Family size	-0.288 *		
	Farm size	-0.284 *		
	Annual income	0.103 NS		
	Extension contact	-0.393 **		
	Farming experience	-0.364 **		
	Knowledge of brinjal cultivation	-0.392 **		
	Level of inputs use	-0.536 **		
	Problems in Brinjal production	0.378 **		

****Significant at P>0.01; *Significant at P> 0.05, NS- Not significant**

From Table 7, it is observed that age, level of education, and annual income didn't show a significant relationship with the yield gap as farmers of different ages participated in cultivation, and also farmers from illiterate to literate did participate in cultivation. On the other hand, a farmer with having large family got more individuals to engage them in the field for cultivation procedure thus reducing the yield gap, as he got more people for proper management as opposed to small family size farmers. A larger farm size means the farmer is affluent enough to minimize the yield gap by applying proper inputs level on the field and managing the cultivation procedure in a good manner. Extension contact indicated a negative impact because as the farmer couldn't get proper information or knowledge from extension services he was not able to cultivate brinjal on the field by knowing the applications of certain inputs along with its management and the outcome. It's also noted that the farmers who had less experience, faced the problems most in the field because they didn't know about cultivation procedures as opposed to the experienced farmers, who had higher experience than them, by utilizing that, they were able to minimize the yield gap in the field. For knowledge, the higher the educated or well learned the farmer was more efficient and benefitted they are because the farmers who lack knowledge became affected by a higher yield gap on the field. In two areas of Bangladesh, Kashem et al. (2012) discovered a substantial correlation between the farmers' agricultural knowledge and the gap in wheat yield. The level of inputs had great significance in the field, as the farmers who applied the inputs like fertilizers, pesticides, and insecticides and managed irrigation in a good manner (means applying the recommended dose or proximate to recommended dose) were able to mitigate the yield gap on the field by attaining the good amount of yield, but the farmers who didn't, observed higher yield gap. Suffice it to say, problems have a positive relationship with the yield gap, as problems like-natural disasters, businessman syndicates, soil

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topography, communication system, labor scarcity, etc. created impediments to achieving potential yield on the field. These findings are also supported by Mithun (2022). Lack of education, agricultural extension media contact and training exposure to brinjal cultivation may be the reason behind the yield gap.

CONCLUSION

In a developing country like Bangladesh where cultivable land is decreasing by 1% every year, food security and sustainability are mostly dependent on the adoption of high-yield potential crop varieties. As a result, high-yielding varieties are cultivated in all sorts of crops including brinjal. Although there is no scope to increase the yield of brinjal genetically, farmers are still far behind (45% gap) to harvest the achievable yield of this crop. Findings revealed that the yield gap was due to inadequate use of insecticide (80% of farmers had a high gap in the application of Supreme- a locally popular insecticide for controlling fruit and shoot borer) and pesticide (74% and 76% of farmers had high gap in the application of Amister and Amagold) followed by 74% had high gap in TSP and Mop application, 76% had high gap in Urea application, 60% had high gap in Boron application, 72% had high gap in Gypsum application, almost 58% had medium to high gap in Cowdung application and 44% had high gap in irrigation application which the marginal and small farmers (96%) could not afford. To this, interruption of the price of inputs and products by the vested business syndicates, lack of proper knowledge and skill about fertilizer management, mechanical and biological control of insect pests, and insufficient advisory services hindered the farmers further to get a potential yield of this crop. As there is no immediate solution to increase brinjal production, bridging the yield gap could be an effective avenue to increase brinjal production at least by 25% which meets up to 30% of vegetable consumption.

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