

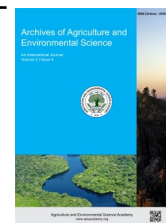


e-ISSN: 2456-6632

This content is available online at AESA

Archives of Agriculture and Environmental Science

Journal homepage: journals.aesacademy.org/index.php/aaes



ORIGINAL RESEARCH ARTICLE



Profitability of green leaf cultivation in some selected areas of Panchagarh district in Bangladesh

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ARTICLE HISTORY

Received: 07 July 2020

Revised received: 26 August 2020

Accepted: 15 September 2020

Keywords

Cultural practices

Green leaf cultivation

Profitability

Socioeconomic characteristics

ABSTRACT

The tea industry has the potentiality of the transform of socioeconomic conditions of rural Bangladesh which provides ample for self-employment of unemployed youth. The present study examines the socioeconomic characteristics, cultural practices and profitability of green leaf cultivation of the randomly selected 45 sample farmers from Panchagarh district in Bangladesh. Primary data were collected through field survey using an interview schedule. Some statistical measures like average percentage and ratios were calculated. The study showed that the average family size of the green leaf growers was 4.77. About 72 % of the respondents' education levels were primary to higher secondary. On an average 100 % of the tea estates owners' occupation was business while majority of smaller growers and small holder occupation was agriculture. The average size of land holding per family was 12.16 hectares. But on the other hand area under tea cultivation was found to be 8.50 hectares. The number of bushes planted per hectare was 15218. The study showed that on average 71% farmers maintained the plant spacing (3 ft. x 2.5 ft.). It was found that 58% farmers plucked more than 3 leaves and bud. On an average, per kilogram cost of green leaf was Tk.11.60 (\$ 0.137) and Tk. 13.15(\$ 0.155) on the basis variable and fixed cost, respectively. The cost was the highest in small holder while it was the lowest in the small farmer. The average per kilogram gross margin of green leaf was Tk.8.90 (\$ 0.105). But on the other hand per kilogram net benefit was Tk.7.35 (\$ 0.087). The net benefit was the highest among the small farmer due to lower cost; while net benefit was the lowest in small holder due to higher cost of cultivation. The benefit cost ratio was 1.57.

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Citation of this article: Saha, J.K. and Rahman, M.A. (2020). Profitability of green leaf cultivation in some selected areas of Panchagarh district in Bangladesh. *Archives of Agriculture and Environmental Science*, 5(3): 306-312, <https://dx.doi.org/10.26832/24566632.2020.0503011>

INTRODUCTION

Tea is that the most ancient beverage has been enjoying, continues to be hottest non-alcoholic drink the globe. The tea industry is one in all the primogenital and may be the capably organized agricultural enterprises within the country (Borborah and Gogoi, 2007). Tea is that the dried leaf of a bush, which contains the Theine and when added to hot water together with sugar and milk, it gives a budget and stimulating drink. Thus, it's the foremost imperative beverage crop in Bangladesh. Tea is largely

an export-oriented evergreen crop in Bangladesh and a perennial crop grown as a monoculture on large contiguous areas. Tea cultivation in Bangladesh was started in Malnicherra of greater Sylhet in 1854. Since inception, tea cultivation has extended to greater Sylhet and Chattogram. Presently, Bangladesh has 166 tea estates covering a complete area of 1, 15,440 hectares of land out of which 61,643 hectares of land are cultivated with tea in greater Sylhet and Chattogram (BTB, 2019). Only 12% new land has been added within 14 years which is very much poor indication of development of tea sector (Raza, 2019).

The annual tea production is 96.07 million Kg with average yield 1769 kg/ha which is low as compared to other leading tea producing countries. The industry accounts for 3% of worldwide tea production, and employs quite 4 million people (Ahammed, 2012). More people are indirectly employed in other sectors associated with tea processing and business. Tea is one in every of the foremost important plantation crops, with a financially viable era of not but 60 years. Tea is additionally a significant source of foreign currency earning of Bangladesh which supplies the tea industry a stimulating place within the country's economy (Mukhopadhyay and Mondal, 2017). Beginning of the year 2000; small, marginal and huge farmers and investors are showing interest in tea farming on the plain land within the Sub-Himalayan district as a crop. During a recent feasibility study undertaken by the Bangladesh Tea Board it appears that about 6,000 hectares of land are available in three upazilas of Panchagarh district. Currently, 3076 hectares are under tea cultivation in Panchagarh district (The Financial Express, 2018).

The cost of production of a commodity plays a crucial role within the economy of farmers. It regulates and also indicates the expansion of an industry. It furnishes the base for creating a policy decision. It's also a crucial parameter to see the economic profitability of the farmer. The aim of analyzing costs and returns is to work out the number of profit of a farmer is to creating from a selected commodity production within the given technology and investment. The profitability of a commodity production depends on its prices, cost of production and available technology. However, there are only a few studies were found in tea in Panchagarh district. But few relevant studies had been dispensed like; Saha *et al.* (2007) applied a study on "Cost of production of tea in selected areas of Bangladesh". The typical per kilogram cost of constructing tea was Tk. 54.40(\$ 0.642). The typical per kilogram cost of creating tea was the best (Tk. 62.69Kg⁻¹) (\$0.740) at U class while it had been rock bottom (Tk. 53.07 Kg⁻¹) (\$ 0.626) at A category. Cost of production decreased with a rise in production. An outsized tea area is under seedlings were in absolute term clonal yield levels are much above the seedling types. Of the overall tea area, only 41% were clonal variety (Boonerjee, 2016). High production cost, ancient tea garden, legal problems, unskilled labor, poor infrastructure etc. are the reasons for the poor performance of tea industry in Bangladesh (Raza, 2019). The very rare research was founded on concentrating on the economic profitability of small tea farmers. Additionally, this study just focused only on small farmers, which weren't found in the other study. Hence, the proposed study is anticipated to come up with variety of important information useful for the planters yet as policy planners to guide the tea industry in Panchagarh district, which is nowadays indispensable for the general development of the tea industry also as earning of foreign currency for the country.

For giving emphasis on the practicing green leaf cultivation, relevant and adequate information on different aspects of the green leaf growing practices at farm level are required. Such knowledge of cultural practices is additionally necessary to create an appropriate decision by the tea growers, especially

when several alternatives are receptive them. However, little systematic economic investigations on the green leaf cultivation are undertaken either by the government or private organization so on satisfies the demand of extension workers, policy makers, research personnel, and NGO officials and thus the farmers.

Bangladesh was a major world exporter of tea but now a net importer of tea. The rise of the Bangladeshi middle class has increasingly driven the industry to focus on a money-spinning domestic market. A comparatively fresh area has come under tea cultivation in the northern district of Panchagarh in Bangladesh. The soil and climate is decidedly encouraging for cultivating tea here. In fact this area is touching with Assam and Bengal in India where tea has been grown for decades. The tea produced in Panchagarh is supposedly much better in quality than that of other areas of Bangladesh. A lot of nurseries have been set up in the study area to provide high quality plantlets to the tea gardens. This will be a good area of employment for the local people which will contribute to export more tea. As of now Bangladesh exports tea to few countries of the world. This may shortly spread up wider markets.

Any research should be conducted to seek out answers to some questions. The research questions can provide the direction to maneuver on the way of finding answers. By answering research question a researcher/researchers reach to the goal. The research questions of this study were: What are the socioeconomic characteristics of the green leaf growers? What are the plant varieties cultivate in their tea land and what are the proportions? What's the relative profitability of green leaf cultivation? On the premise of the research questions, this research was focused on to research the socioeconomic characteristics of sample households, assess the cultivation practices, and determine the profitability of green leaf cultivation.

MATERIALS AND METHODS

Samples of 45 green leaf growers were selected randomly from Sadar, Tetulia and Atwariupazilas of the Panchagarh district of Bangladesh. The farmers were categorized into small grower (less than 5 acres), small holder (5 to 15.00 acres) and tea estate (15.01 and above). Required data were collected through field survey using interview schedule. Focus group discussion and observation techniques also were used for collecting relevant information. A stratified random sampling technique was followed in this study. Simple statistical techniques such as percentage and arithmetic mean or average were employed to analyze the data. The data were collected in the period of October 2016 to December 2016.

Analytical techniques

Data were presented mostly in the tabular form in simple in calculation, widely used and easy to understand. Some statistical measures like average percentage and ratios were calculated as these were simple to understand and easy to calculate. These analyses also included socioeconomic characteristics of the sample farmers, production practices and input use, costs and

return of tea cultivation. Per kilogram profitability of green leaf cultivation from the viewpoint of individual farmers was measured in terms of gross return, gross margin, net return and benefit-cost ratio (undiscounted).

Gross return

$$GR_i = \sum_{i=1}^n Q_i P_i$$

Where, GR_i= Gross Return from ith product (Tk. ha⁻¹)

Q_i= Quantity of the ith product (kg)

P_i= Average price of the ith product (Tk.)

i= 1, 2, 3....., n.

Gross margin

Gross margin was calculated among the difference between gross return and total variable costs. That is, GM= GR-TVC
Where, GM= Gross margin, GR= Gross Return, TVC= Total variable cost.

Net return (NR)

The net return analysis considered fixed costs; cost of land rent, interest on operating capital, etc. Net return was calculated by deducting all cost (variable and fixed) from gross return. A profitability measure of the tea cultivation was prepared using the following algebraic equation.

$$\pi = P_y Y - \sum_{i=1}^n (P_{xi} X_i) - TFC$$

π = Net return (Tk./ha);

P_y= per unit price of the product (Tk./kg);

Y = Quantity of the production per hectare (Kg);

P_{xi}= Per unit price of i-th inputs (Tk.);

X_i=Quantity of the i-th inputs per hectare (kg);

TFC= Total fixed cost (Tk.);

i= 1,2,3.....,n (number of inputs).

RESULTS AND DISCUSSION

Socioeconomic characteristics of the green leaf growers

Socioeconomic condition of sample farmers is very essential for cultivation because there are copious interconnected and integral features that characterizes an individual and influences the development of decision making behavior. The growing tea sector in the Panchagarh district has enhanced in a new hope for improving the standard of socioeconomic life and woman empowerment (Sultana *et al.*, 2014). This section provides information on the socioeconomic characteristics of selected green leaf growers such as family size, education level, occupational structure and farm size. The study shows that the average size of green leaf grower's farm families was found to be 4.77 out of which 43% were adult male, 36% were adult female while 21% were children (Table 1) The study revealed that average family size of the respondents was comparatively higher than that of agricultural laborer in Bangladesh (BBS, 2019). The average number of family member decreased with the increase in farm size.

The study generates data on educational status among the different farm size of green leaf growers is shown in Table 2. The study showed that on an average only eight percent of the sampled tea growers were illiterate having no formal education. The respondents having primary, secondary, higher secondary, graduate, and post graduate were found to be 21%, 28%, 23%, 14% and 5%, respectively. The literacy was the highest among the tea estates and was the lowest in small growers. The study also revealed that literacy rate of the respondents was also higher as compared with national level. The study depicts that literacy percentages increases with the increases of farm sizes. Table 3 shows the occupational status of the green leaf growers at the study area. The study showed that on an average 60 % of green leaf growers occupation was agriculture followed by business (24%) and only 9 % of the grower's occupation was tea cultivation. The study also revealed that 100 % of the tea estates owner's occupation was business while majority of the small holder and small grower's occupation was agriculture. Table 4 shows the average size of land holdings of the tea growers at Panchagarh. The study revealed that the average size of land holding per family was found to be 12.16 hectare. On an average the total area of different tea growers were 50.61, 9.31 and 3.09 hectares respectively. But on the other hand on an average area under tea cultivation among the selected tea growers were 30.77, 5.02 and 1.17 hectares, respectively.

Cultural practices of the selected green leaf growers

Table 5 shows on an average 87% of the green leaf growers planted TV (Tocklai Variety) varieties while only 13% percent growers planted BT2 (Bangladesh Tea Research Released) variety. The study also revealed that the tea estates planted BT2 variety higher as compared with small grower and small holder. The tea growers planted the number of bush per hectare was 15218. The study showed that on average 71% farmers maintain the plant spacing (3 x 2.5) ft. The study also revealed that 58% farmers plucked the leaf above 3 leaf and bud. The study showed that the major insects in the study area were Looper, Caterpillar, Helopeltis, Thrips and Red Spider Mite. The major diseases were Black Rot, Dieback and Red Rust. The major types of weeds in the sampled area were Maccania, Bagracoat and Sugrass etc.

Utilization of human labor in different intercultural operation of green leaf growers at farm level

Utilization of human labor for different intercultural operations of tea workers in different farm sizes was shown in Table 6. The study showed that on an average 582 man-days per hectare was required for different intercultural operations. The utilization of labor varies from growers to growers. The highest amount of labor was incurred in tea estates followed by small holder and small grower respectively. The study also revealed that the efficiency of laborer per hectare per year was 2.01. The highest efficiency of labor highest tea estate (2.27) and lowest small farm.

Table 1. Composition and size of families according to different size of tea estates.

Tea Growers	Average number of Family Member per estate			
	Adult Male	Adult Female	Children	Total
Tea estates	1.80	1.00	1.20	4.00
Small Holder	2.40	2.40	1.00	5.80
Small Grower	1.66	1.34	0.86	3.86
All Average	2.03(43)	1.71(36)	1.03(21)	4.77(100)

Figure in parentheses indicate percentages; Source: Computed.

Table 2. Educational level of sample green leaf growers.

Tea Growers	Level of education in Percent							Grand Total
	Illiterate	Literate					Total	
		Primary	Secondary	Secondary	Graduate	Post-Graduate		
Tea estates	0	20	5	20	30	25	100	100
Small Holder	0	14	38	31	17	0	100	100
Small Grower	9	22	28	22	13	5	91	100
All Average	8	21	28	23	14	5	92	100

Source: Computed.

Table 3. Occupational status of different size of tea estates.

Tea Growers	Occupational level in Percent					Total
	Agriculture	Business	Tea	Service		
Tea estates	--	100	--	--	100	
Small Holder	60	40	--	--	100	
Small Grower	69	11	11	9	100	
All Average	60	24	9	7	100	

Source: Computed.

Table 4. Average size of land holdings of the green leaf growers.

Tea Growers	Total area (ha)	Tea area (ha)
Tea estates	50.61	30.77
Small Holder	9.31	5.02
Small Grower	3.09	1.17
All Average	12.16	8.50

Source: Computed.

Table 5. General technical Information of different green leaf growers.

Tea Growers	Total area (ha)	Tea area (ha)	Variety planted (%)					Bush /ha	No. of plucking
			BT ₂	TV ₂₃	TV ₂₅	TV ₂₆	Total		
Tea estates	50.61	30.77	22	--	39	39	100	15660	23
Small Holder	9.31	5.02	10	20	50	20	100	14820	23
Small Grower	3.09	1.17	12	12	39	37	100	15230	16
All Average	12.16	8.50	13	12	40	35	100	15218	17

Table 5. Contd.....

Plant spacing (%)				Selectivity of Plucking (%)		
3 x 2	3 x 2.5	3.5 x 2.5	Total	3 leaf & a bud	above 3 leaf	Total
40	40	20	100	80	20	100
--	80	20	100	40	60	100
14	74	12	100	37	63	100
16	71	13	100	42	58	100

Table 5. Contd.....

Major weeds		Major insects		Major diseases	
i.	Maccania	i.	Looper Caterpillar	i.	Black Rot
ii.	Bagracoat	ii.	Jassid and Aphid	ii.	Dieback
iii.	Sugrass etc.	iii.	Helopeltis	iii.	Red Rust
		iv.	Thrips	iv.	Coller Rot etc.
		v.	Red Spider Mite etc.		

Source: author's estimation, 2016; (Source: computed).

Utilization of manures and fertilizers for green leaf tea cultivation according to size of tea estates

Table 7 shows the utilization of manures and fertilizer. The study showed that on average manure application of tea cultivation was @ 7921 kilogram per hectare. The manure application was the highest (15018 kg/ha) among the small holder and it was the lowest among the small grower. There is a good source of sugar mill bagasse in the region as few sugar mills are running in Panchagarh district (Sultana *et al.*, 2014). A green manure crop may add 10 -15 ton of biomass (fresh weight) and 60-90 kg of N per hectare to the soil (RTRS, 2012). On an average, the application of urea was 618 kg/ha and also the application of TSP and MP was 262 and 442 kilogram per hectare. The study also showed that the application of chemical fertilizer was the highest among the small holders. The study also showed that on an average the growers of selected areas applied more chemical fertilizer than that of the recommended doses of BTRI.

Profitability of green leaf cultivation of tea growers at farm level in the study area

The cost incurred for the use of different inputs in green leaf production among the sampled tea estates was calculated on the basis of per unit area and output return obtained. The study shows that on average, per kilogram cost of green leaf of tea growers was observed to be Tk. 11.60 (\$ 0.137) and Tk. 13.15 (\$ 0.155) on the basis variable and fixed cost respectively (Table 8). The study also shows that on an average the highest cost (Tk.15.60/kg) (\$ 0.184) was obtained by the smallholder (Tk 12.60/kg) (\$ 0.149) and it was the lowest for small farmer (Tk 11.60/kg) (\$ 0.137). Saha *et al.* (2011) found that on an average per kilogram cost of green of small farmer was found to be Tk.

10.16 (\$ 0.120) and Tk. 12.65 (\$ 0. 149) on the basis of variable and fixed cost basis respectively. Kiruthiga and Damodaran (2016) obtained the cost was higher at large farm followed by small and medium, respectively. Percentage of different items of cost to total cost of production of green leaf cultivation is shown in Table 9. On an average the cost of production was found to be the highest in labor wage constituting 52.84% followed by fertilizers 17.16%, overhead 16.98%, chemicals and pesticides 6.90%, and establishment 6.12%, respectively. But on the other hand among the labor cost, the highest was incurred in plucking (41.92 %) followed by weeding (14.02%). The study revealed that on an average per kilogram gross margin of green leaf cultivation was Tk. 8.90(\$ 0.105). The highest gross margin (Tk. 9.70/kg) (\$ 0.114) was received by the small farmer and it was the lowest (Tk. 7.90/kg) (\$ 0.093) for the small holder. On an average the net benefit per kilogram green leaf of tea growers was found to be Tk. 7.35 (\$ 0.087). The study also showed that per kilogram net benefit of green leaf was the highest for small farmer (Tk. 8.40/kg) (\$ 0.099) due lower cost of cultivation but on the other hand it was the lowest in small holder (Tk. 5.42/kg) (\$ 0.064) due to higher cost of production. Kiruthiga and Damodaran, 2016) revealed that the revenue was the highest for small farm as compared with medium and large farms. The study also indicates that the benefit cost ratio of green leaf cultivation was 1.57 which indicates that tea growers in the study area could earn Tk. 1.57 (\$ 0.019) with the investment of one taka. The highest benefit cost ratio was obtained by the small farmer while it was the lowest for small holder. The rate of return (BCR) over total cost was higher and the estimated net profit was positive implied that tea cultivation of tea farmers was profitable in the study area.

Table 6. Utilization of human labor in different intercultural operation for green leaf cultivation according to size of tea estates.

Tea Growers	Punning	Weeding	Maintenance	Manuring & Fertilizing	Pesticides application	Irrigation	Plucking	Carrying	Total
Tea estates	84	80	17	24	45	27	338	34	689 (2.27)*
Small holder	64	86	19	31	57	35	274	40	605 (2.08)*
Small farmer	55	81	14	26	65	37	236	54	568 (1.95)*
All farms	50 (10)	83 (15)	14 (2)	26 (5)	62 (11)	35 (6)	252 (43)	51 (9)	582 (2.01)*

Source: Computed; The figures in parentheses indicate percentages; *Efficiency of labor per hectare per year.

Table 7. Utilization of Manures and Fertilizers for green leaf cultivation according to size of tea estates (kg/ha).

Tea Growers	Cowdung	Urea	TSP	MOP	Dolomite
Tea estates	12795	411	216	297	--
Small Holder	15018	815	494	523	416
Small Grower	6210	620	235	452	168
All Average	7921	618	262	442	177

Source: Computed.

Table 8. Profitability of green leaf cultivation in the study area.

Cost parameter		Farm size (Taka)			All average
		Tea estate	Small holder	Small farmer	
Variable cost basis					
1.	Labour wage (Tk/kg)	3.68 (\$0.043)	5.46 (\$0.064)	6.55 (\$0.077)	6.13 (\$0.072)
	i. Pruning	0.48	0.58	0.65	0.62
	ii. Weeding	0.49	0.77	0.92	0.86
	iii. Maintenance of roads and bridges	0.09	0.17	0.16	0.15
	iv. Manuring and fertilizing	0.14	0.28	0.31	0.28
	v. Insecticides and pesticides	0.25	0.52	0.76	0.68
	vi. Irrigation	0.15	0.31	0.44	0.40
	vii. Plucking	1.88	2.46	2.68	2.57
	viii. Carrying	0.20	0.37	0.63	0.57
2.	Manures and Fertilizer (Tk/kg)	4.04 (\$0.048)	3.09 (\$0.036)	1.49 (\$0.018)	1.99 (\$0.023)
	i. Cowdung	2.27	1.69	0.87	1.04
	ii. Chemical Fertilizer	1.77	1.40	0.62	0.94
3.	Chemicals & Pesticides	1.00	1.01	0.72	0.80
4.	Establishment	1.07	1.30	0.58	0.71
5.	Overheads	2.01	1.74	1.96	1.97
	i. Interest on Loan	1.36	1.06	1.48	1.45
	ii. Fuel for irrigation	0.63	0.66	0.46	0.50
	iii. Land Revenue	0.02	0.02	0.02	0.02
Sub-Total		11.80 (\$0.139)	12.60 (\$0.149)	11.30 (\$0.133)	11.60 (\$0.137)
B. Fixed Cost Basis :		2.51	2.48	1.30	1.55
	i. Plucking Materials	0.10	0.04	0.05	0.05
	ii. Spraying	0.31	0.06	0.02	0.06
	iii. Irrigation	1.24	1.31	0.27	0.49
	iv. Opportunity cost of Land	0.86	1.07	0.96	0.95
Grand-Total		14.31 (\$0.169)	15.08 (\$0.178)	12.60 (\$0.149)	13.15 (\$0.155)
Profitability					
	i. Yield (kg)	1.00	1.00	1.00	1.00
	ii. Price (Tk./kg)	20.00 (\$0.236)	20.50 (\$0.242)	21.00 (\$0.248)	20.50 (\$0.242)
	iii. Gross return (Tk./kg)	20.00 (\$0.236)	20.50 (\$0.242)	21.00 (\$0.248)	20.50 (\$0.242)
	iv. Gross margin (Tk./kg)	8.20 (\$0.097)	7.90 (\$0.093)	9.70 (\$0.114)	8.90 (\$0.105)
	v. Net Profit (Tk./kg)	5.69 (\$0.067)	5.42 (\$0.064)	8.40 (\$0.099)	7.35 (\$0.087)
	vi. Benefit cost ratio (undiscounted)	1.39	1.36	1.67	1.57

Source: Computed; Note: (Tk. 84.77 = USD 1).

Table 9. Cost components as proportion to total cost (in Percent).

Cost parameter		All average
Variable cost basis		
1.	Labour wage (Tk./kg)	52.84 (\$0.623)
	i. Pruning	5.34 (\$0.063)
	ii. Weeding	7.41 (\$0.087)
	iii. Maintenance of roads and bridges	1.29 (\$0.015)
	iv. Manuring and fertilizing	2.41 (\$0.028)
	v. Insecticides and pesticides	5.86 (\$0.069)
	vi. Irrigation	3.45 (\$0.041)
	vii. Plucking	22.16 (\$0.261)
	viii. Carrying	4.91 (\$0.058)
2.	Manures and Fertilizer (Tk./kg)	17.16 (\$0.202)
	i. Cowdung	8.97 (\$0.106)
	ii. Chemical Fertilizer	8.19 (\$0.097)
3.	Chemicals & Pesticides	6.90 (\$0.081)
4.	Establishment	6.12 (\$0.072)
5.	Overheads	16.98 (\$0.200)
	i. Interest on loan	12.50 (\$0.147)
	ii. Fuel for irrigation	4.31 (\$0.051)
	iii. Land revenue	0.17 (\$0.002)
		100.00

Source: Computed; Note: (Tk. 84.77 = USD 1).

Conclusion

Green leaf cultivation is a labor intensive agribusiness and the benefit cost ratio (BCR) indicated that tea cultivation was profitable in the study area. The tea growers in the study area used overdoses of chemical fertilizer than the recommended doses of Bangladesh Tea Research Institute (BTRI) and did not follow the proper plucking practices. The essential practices for maintaining fine leaf and the health of the bush and its economics are to be explained so that quality augmentation programs should be implemented in the field. Therefore, the need of intervention is necessary and can be done by arranging training programs for improvement of skill and knowledge of green leaf cultivation. The respected authorities like Bangladesh Tea Board, Bangladesh Tea Research institute or non-government organizations can manage advisory services for green leaf growers to improve the knowledge of farmers in terms of cultivation practices and related operations so that farmers can maintain profitable tea production over time in the study area.

Conflict of interest

The authors declare that there is no conflict of interests regarding the publication of this paper

ACKNOWLEDGEMENTS

The author acknowledge to Agricultural Economics and Rural Sociology division for patronizing this study. The author also expresses to deep sense of gratitude to Bangladesh Agricultural Research Council for financial support.

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