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PROFITABILITY AND ITS DETERMINANTS BETEL (PIPER BETEL L.) LEAF PRODUCTION IN SELECTED AREAS OF RAJSHAHI DISTRICT, BANGLADESH

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Abstract: Popularly known as *Pann*, the fresh leaves of betel vine is a masticatory having socio-cultural importance in Bangladesh. This study investigates input use pattern, profitability and the factors affecting the profitability of betel leaf cultivation. A structured questionnaire is used to collect data from major betel leaves producing area Mohanpur upazila in Rajshahi district, Bangladesh. The study found that cost composition related to betel vine cultivation are bamboo (36%), labour (28%), pesticide & insecticide (19%), straw & yarn (11%) and irrigation (11%). The study also found that investment on betel vine cultivation is commercially profitable. The empirical estimates also revealed that among the socio-economic variables of farmers, experience and education affect profitability significantly. However, the effect of education is much more (around 3 times higher) than experience. Apart from these, among the cost variables bamboo cost and labour cost significantly affect profit. However, there effect is much less than the effect of experience and education.

Keywords: Betel leaf, Betel vine, Profitability, Cost composition, Net Revenue, Determinant of profitability.

I. INTRODUCTION

The betel leaf comes from a shade loving creeper plant belonging to the pepper family. Betel vine (Piper Betel Linn) is probably a native of Malaysia and cultivated in Indian sub-continent from the Vedic period, 1500-500 BC (Modak et al, 1994). This plant thrives well in moist, tropical and sub-tropical regions of Indian-sub continent (Chauhan et al., 2016). Although historical origin of betel vine cultivation in Bangladesh is unknown, about 60-70% of people usually consume betel leaf frequently. Betel leaf, locally known as *Paan*, is integral part of all social, cultural and sometimes religious activities in Bangladesh. It is also regarded as a symbol of hospitality. Cityscapes of Bangladesh are shaped by thousands of small shop, known as *Paan* stalls. Although there are some health issues, it is also used as an important medicinal plant in the traditional treatment systems of Southeast Asian countries (Gundala & Aneja, 2014; Hossain et al., 2017; Guha & Roy, 2021).

Research works on several aspects of Betel leaf are found in the literature. First group of literature are related with the production and marketing aspects of Betel leaf (Acharjee & Sengupta, 1991; Varadarajan & Bose, 2005; Kaleeswari & Sridhar, 2013; Saha et al., 2014; Das et al., 2018; Mahfuza et al., 2020). It is found that the crop is highly labour intensive and the proportion of family labour and hired labour are around 59% and 41% respectively (Kar et al., 2014). Once a Boroj (betel vine yard) is established it becomes a perennial source of employment. One hectare of betel vine can create employment of 5000 working hours (Acharjee & Sengupta, 1991) and 240 days for men in a year (Battana, 2018). Around 20.8 lakh rural people derive their livelihood from production, processing, handling, transportation and marketing of betel leaves in Bihar state India (Das et al, 2018).

During rainy season, growth of vine, production of leaf per vine increased compared to other seasons and in winter season growth of vine as well as production of leaf is the lowest (Saha et al., 2014). Major problems found as traditional management, unskilled labour, pest and disease, inadequacy of credit, non-existence of regulated market, presence of too many middlemen and price fluctuation (Kaleeswari & Sridhar, 2013). Three major marketing channels are also identified in the literature (Varadarajan & Bose, 2005; Patil, 2018). Varadarajan and Bose (2005) found that the channel involving producer-wholesaler-retailer-consumer is the most efficient one with a producer share of 78 percent compare to other channels involving commission agents and village traders. However, in similar types of study Patil (2018) argued that the producers share in consumer's spending was around 50 percent.

The second group of literature is related with the cost-benefit and profitability aspects of betel leaf production. Battana (2018) found it commercially profitable in Andhra Pradesh, India. Reddy et al (1990) even concluded that the returns from this crop were larger than those of other cash crops there. The principle components of cost are the construction cost of Boroj, repair cost, fertilizer, harvesting, and planting costs (Saha, 2019). However, the variable cost is the major cost of total cost among which farm yard manure and labor cost accounted for the larger portion, around 28% and 14% respectively (Patil, 2018). Earlier Reddy et al

(1990) found that the labor costs and the rental value of land constituted nearly 50% of the total costs. Although the resource use efficiency showed that farmers were inefficient in using inputs, net return were found positive in Karnataka, India (Patil, 2018). Rate of return in the first year is reasonable, around 9% but very high in the second year, around 113% (Battana, 2018). The net income even increased between the 1st year and the subsequent 2 years by about 1200 percent, although there was not much variation in the total cost over the 3-year period (Reddy et al, 1990). Even examining the cost-benefit analysis in organic and conventional betel leaf cultivation in Tamil Nadu, India, Tholkappian (2014) found that both farming is profitable, but net return from organic farms compared to the conventional farms is higher.

One interesting thing that is related to the above literatures is that all of them are in the context of India. To the best of our knowledge, very limited literatures are found in the context of Bangladesh. Among them, Mahfuza et al (2020) tried to identify the present and future production pattern of betel leaf in Bangladesh. Using dynamic ARIMA model they forecasted an upward trend of production of betel leaf in Bangladesh. The others are about profitability of betel leaf cultivation (Islam and Matin, 2017; Islam et al, 2015; Zabir et al, 2019). All of them are similar type of study, only differences are they conducted the research considering different district. Islam and Matin (2017) studied the profitability considering three districts, namely Noakhali, Rajbari and Khulna. Similarly, Islam et al (2015) did the same considering Barishal, Chittagong, Rajshahi and Khulna district. Zabir et al (2019) studied profitability and marketing channels considering Bagerhat district.

These studies related to Bangladesh concluded that betel leaf cultivation is profitable. However, benefit cost ratio (BCR) in first two year is below one because of high initial cost (Islam et al., 2015; Islam & Matin, 2017). The highest return was found in the fourth year followed by third and fifth year (Islam et al., 2015). Islam et al. (2015) estimated the average gross return as around Tk. 5260 per decimal and net return as Tk. 2919 per decimal. Similarly, Islam and Matin (2017) estimated those quite close as Tk. 4871 and Tk. 2793 respectively and BCR as 1.50. Whatever the slight differences seen, it may be because of different area covered as well as the different time the study conducted. They also concluded that labour use in betel cultivation was profitable than the opportunity cost (Islam & Matin, 2017). Moreover, these studies concluded that leaf root disease, high price of boroj materials, non-availability of modern variety, low price of betel leaf, high price of different inputs, vine died, lack of capital, dominance of intermediaries in marketing are the constraints faced by farmers. However, no study among these used econometric tools to estimate the determinants of profitability. This study would fill the knowledge gap in this respect. Moreover, this present study would be exclusively on related with Rajshahi district of Bangladesh.

Since the independence, despite the rapid growth of population from 40 million to 160 million, the food security situation in Bangladesh has improved (Mainuddin and Kirby, 2015). However, the problem of inequality and rural employment generation is always a major challenge to her. To tackle these problems Bangladesh need to emphasis on diversifying non-conventional crop along with food grain production. Therefore, a thrust area for Bangladesh agriculture can be on Betel vine which is a high valued commercial perennial crop. About 20 million people are presently involved directly or indirectly in production, processing, handling, transportation and marketing of betel leaves (Saha, 2019). Bangladesh is exporting betel leaves to many countries of Asia and Europe including India, Pakistan, Saudi Arabia, United Arab Emirates, England, Italy and Germany (Habib, 2020). But in competition with India and other betel leaf producing countries, Bangladesh is having a very small share in the world's betel leaf market. This indicates the vast economic potential of the crop.

In spite of such tremendous economic potential, betel leaf cultivation remains neglected by the scientists, technologists, researchers and policy makers in Bangladesh. Farmers are facing production as well as marketing problems with regards to this crop. Moreover, especially for Mohanpur upazila, which is an important area in betel leaf cultivation in Bangladesh, no study on economic aspects of betel vine has been conducted here. Very little effort seems to have been made to study empirically and evaluate the economics of production of betel vine. Considering the above views, the crop Betel leaf has been selected to examine the profitability aspects in this research. Therefore, the specific objectives of this study are:

i. To examine the input use pattern of Betel leaf production.
ii. To determine the profitability level of Betel leaf cultivation.
iii. To investigate the determinants of profitability of Betel leaf cultivation.

The entire paper is divided into five sections. This first section is the introductory section where the background of betel leaf, the objectives of this study along with the review of the related literature are discussed. Section two is about the data and methodology where description of the data and the methodology to achieve the objectives are discussed. Section three shows results of this research. Section five is discussion where findings of this research are discussed in relation to previous findings as well as their implications. Finally, in the conclusion section summary of this research has been drawn with some policy implications as well as future direction of research.

II. DATA AND METHODOLOGY

2.1 Study Area

In Bangladesh, export quality betel leaves are grown in the districts of Natore, Kushtia, Rajshahi, Barisal, Khulna and Chuadanga. Betel leaves grown in these districts have high demand at home and abroad for its quality and flavor. According to the Department of Agricultural Extension (DAE), in Rajshahi, the topographic and climatic condition of some upazilas like Mohanpur, Bagmara, Durgapur, Puthia and Paba are very suitable for the farming of the crop. Betel leaves worth of Tk. 1,103.67 crore are sold annually in Rajshahi, which is much more than mangoes here. The number of farmers cultivating betel leaves is 69,226 in Rajshahi, and Mohanpur upazila has the highest production (Habib, 2020). However, to the best of our knowledge no study is there related to our study on Mohanpur upazila till now. In view of this, Mohanpur upazila of Rajshahi district is purposively selected for this study. Five villages named Amrail, Mohobbotpur, Bakshimoil, Shibbpur and Vaturia were then selected based on the high intensity of Baraj.

2.2 Data and Collection Procedure

A simple random sampling technique was followed for data collection in this study. At first, a list of farmers who were engaged in betel leaf cultivation was collected from the Agricultural Extension Office of Mohanpur upozilla. Then 20 farmers were selected from Amrail village and 5 were selected from each of the remaining four villages, making a total of 40 respondents. As our objectives were related with profitability, 40 respondents are enough to calculate that. Taking more respondent would not vary result much. Moreover, while selecting respondent random sampling procedure is followed with due care to ensure the representativeness of samples. Data were collected through face to face interview using structured questionnaires during June-July 2019. The pre-tested questionnaire included both open ended and closed questions. It included socio-economic characteristics of respondents, for example age, sex, education, occupation, family members, earning members, total firm land, total land employed in the betel leaf cultivation, experience of cultivating betel leaves, number of boroj, and information of different cost and harvest.

2.3 Analytical Technique: Cost and Profitability

Both tabular and statistical techniques is used for the analysis of the data. In tabular method descriptive statistics like maxima, minima, mean, standard deviation, percentage etc. are applied to interpret the data. Being a perennial crop, although previous studies (Islam & Matin, 2017; Islam et al. 2015) categorized according to the age of boroj and then calculate the average which become 5-6 years age. Moreover, around this aged boroj gains the highest return. Therefore, to make it simple, in this study we only considered mature aged boroj (4-8 years old). While collecting cost data boroj establishment cost is considered along with the present year's running cost. For revenue data present year's harvest and price is considered.

For profitability, net revenue is considered which is calculated as:

$$\pi = P.Q - \sum P_i X_i \qquad 01$$

Where

π = Profit from betel leaf production (Tk/decimal);
P = Price of betel leaf produced (Tk/bira[1]);
Q = Quantity of betel leaf produced (bira);
P_i = Price per unit of i-th inputs used;
X_i = Quantty of i-th input used

However, there is another cost as price or rent of the land which may considered as fixed cost. We found that for some farmers Boroj is in their own land so no rent is required, and for some farmers Boroj is in rented land. Moreover, there are differences in rent because of land location and availability of facilities like road, irrigation etc. To avoid these differences, this fixed cost is not considered here. Therefore, total cost here representing only the variables cost, excluding the rent of the land. In other words, the profitability will represent here for land owner farmers perspective. All other cost considered here are the cost of bamboo, straw, labor cost, irrigation cost etc. The revenue from the cultivation also seen from different seasons: rainy season, winter season and rest of the year. Moreover, all calculation on costs and revenue are calculated per decimal of land employed in betel leaf cultivation in individual level. Then total revenue and total cost is calculated by taking the average of those from individual values. The benefit cost ratio (BCR) is calculated by dividing the gross revenue by total cost.

2.4 Analytical Technique: Determinants of Profitability

To estimate the determinants of profitability of betel leaves, most widely used multiple linear regression model was used here (Wooldridge 2015). The net revenue is used here as the profit variable. After several trials 8 variables were ultimately selected to explain the net revenue of betel leaves cultivation. While considering different socio-economic variables in the model, special care was given to avoid multicollinearity problems and correlation coefficients were checked for all the variables. To explore the determinant of net revenue of betel leave cultivation the selected multiple regression model is:

$$Y = \beta_0 + \sum \beta_i X_i + u \qquad 02$$

In this empirical model dependent variable (Y) is the net revenue and the explanatory variables (X) are the experience of cultivating the betel leaf, years of education of the respondents, land area of betel vine, bamboo cost, straw and yarn cost, irrigation cost, labor cost, pesticide and insecticide cost.

2.5 Socio-economic Characteristics of the Sample Farmers

The socio-economic characteristics of the respondents are presented in table 1. Some of these socio-economics characteristics of farmers are important influencing their decisions related to production process (technology choice, input use, selling decision, credit acquiring and overall farm decision making). Thus information related age, education level, total family members, earning members of the family, total farmland, total farmland employed in betel cultivation, no. of betel garden each respondent have, and experience of cultivating betel leaves give us a primary understanding about the farmers' environment and decision making ability.

[1] Bira is a local measure for the quantity of betel leaves. Although the number of betel leaf per bira is different in different region in Bangladesh, in Rajshahi region 1 bira equals to 64 betel leaves.

Table 1: Socio-economic characteristics of the respondents

Variables	Minimum	Maximum	Mean	Standard Deviation
Age	27	60	45	8.54
Education	2	16	8.35	3.99
Family mem.	2	8	3.85	1.17
Earning mem.	1	2	1.18	0.38
Number of Betel vine	1	5	2	1.08
Experience	7	50	30.25	12.08
Total Farmland	18	693	106.95	143.24
Land area of Betel vine	8	99	21.125	17.77

Source: Field Survey, June-July 2019; (Farmland and area betel vine are in decimal)

III. RESULTS AND DISCUSSION

3.1 Cost of Betel Vine Production

Micro-climate plays an important role in the production of good quality betel leaves. The ideal conditions are provided by artificial means under thatched cover, popularly known as Boroj. The Boroj is constructed with local materials such as bamboos, jute sticks, jute rope, straws, etc. The initial expenditure for establishment of pan boroj varies, depending on the availability of raw materials, home labor and management practices. The major share of costs involve in Boroj construction as well as other cost in boroj management are discussed below.

Cost of Bamboo

The major share of cost related to betel leaf cultivation involves on bamboo. Although we considered it in the name of bamboo but it included all other cost (except jute rope, straws and yarn) involve in Boroj construction as well as repairing. The largest share of this cost is the cost of bamboo. For some farmers some portion of required bamboo comes from own sources. However, the average cost on bamboo is Tk. 2004.15 per decimal (Table 2) which is around 36 percent of total cost, the biggest of all cost (Figure 1). In previous studies in Bangladesh (Islam et al., 2015; Islam and Matin, 2017) this cost was included in the fixed cost. However, these materials decay over time and farmers need to incur cost to repair and maintenance purposes. Therefore, alternative to bamboo and other materials which are not prone to decay can be used to reduce a considerable amount of cost.

Cost of Human Labour

Labor is another major cost involved in betel vine cultivation, second largest share we found here, around 28 percent of total cost involve (Figure 1). Labor is employed for doing many works like planting, weeding and cleaning, maintaining and repairing vine, picking up leaves etc. For some enterprises family members are enough, whereas in some cases enterprises need to hire labor from outside. The total average cost of labor employed in betel leaves cultivation is found here as Tk. 1532.39 per decimal (Table 2). Earlier Islam et al. (2015) and Islam & Matin (2017) calculated the average labour employed in mandays and found 1665 and 1365 mandays/ha respectively. If we convert this into money paid (250 per manday) in per decimal then it becomes around Tk. 1685 and Tk. 1382 respectively which is quit close to our estimate here. Although from cost perspective labour incurred a major cost, in other sense it generate employment also. Betel leaves cultivation and harvest is going on throughout the year, not like the other crop where 3-4 months. As a result this provides a continuous employment.

Table 2: Important Costs (Tk./Decimal)

Item	Min	Max	Mean	S.D.
Bamboo	1333.33	3500	2004.15	469.77
Straw & Yarn	373.33	1148.64	624.67	166.36
Irrigation	181.81	666.67	357.50	122.35
labor	0000	5000	1532.39	1470.59
P & I cost	328.5	1625	1075.89	324.09
Total Cost	2680.00	11241.50	5594.60	2003.18

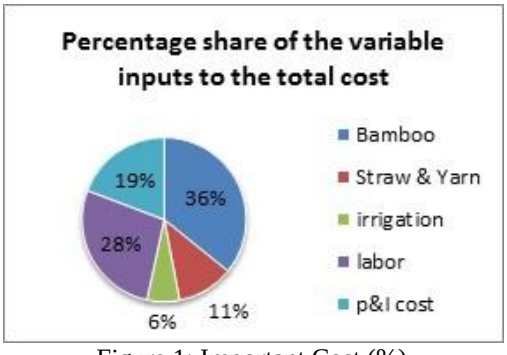

Figure 1: Important Cost (%)

Source: Field Survey, June-July 2019; (all costs are in per decimal)

Cost on Pest Control and Insecticides

Farmers also need to use some fertilizer and to spray different medicine and insecticide to keep their betel leaf fresh and free from diseases. They mainly bought these from local dealers and retail shops. It is seen from figure 1 that a significant, third largest share of cost involves for these, around 19 percent. According to the respondent the reason for this large share of cost is because of frequently insects and disease attack in betel vine. Mahfuza et al. (2020) also found that the disease in betel leave cultivation was the major challenges in this region. On an average total cost on the pesticide and insecticide is Tk. 1075.89 per decimal in the study area. Our findings is also in the same direction that found in previous studies in Bangladesh conducted by Islam et al. (2015) and Islam and Matin (2017). However, in our study farmers' claimed that the advice from agricultural

extension is very limited. Therefore, there is a possibility of improper utilization of fertilizers, pesticides and insecticides which might have implication on human health, soil health, environment as well as the cost of production.

Cost on Straw and Yarn

These are required the tie up the betel vine with bamboo or jute stick to keep it tall. Straw and yarn collectively accounts for 11% of the total cost, which are also important cost here. On an average cost involve here is Tk. 624.67 per decimal.

Irrigation

Last as well as least cost involve with betel leave production is irrigation cost. It accounts for about only 6 percent of the total cost which is on an average Tk.357.5 per decimal. Islam and Matin (2017) in their study in Noakhali, Khulna and Rajbari found very few times (once or twice) irrigation required there. On the contrary, Islam et al. (2015) found that around 19 times irrigation required in Rajshahi which is quite similar to our study. Rajshahi region is bit dry than Noakhali-Khulna region.

3.2 Gross Revenue

The betel leave are cultivated through-out the years. However, fluctuation in the growth and production as well as the prices of betel leaf was evident here. Therefore, while calculating revenue three periods are considered for better understanding: the rainy season (June-September), the winter season (November-January) and rest of the time (Shown in table 3). The gross returns of betel leaf production were estimated on the basis of average yield and prices of those months that considered on the season. However, previous studies in Bangladesh did not consider the seasonal aspect in their analysis.

We found here in this study that in the winter season the production is very high and because of this more supply, price is relatively low compared to other periods. On average, gross revenue in the winter season is Tk. 4868.76 per decimal. The second highest harvesting season is rainy, when by average Tk. 4232.59 revenue earned per decimal. The harvest in the rest of the year other than rainy and winter season is a bit low; the average revenue is Tk. 3561.74 per decimal. The gross return of betel farmers were estimated as Tk. 12663.09. Previous studies did not estimated from the seasonal perspective. However, Islam et al. (2015) estimated the gross return as around Tk. 6229 per decimal for a 5 year age Boroj which is around half of our estimate here. Again this differences may due to the price differences as prices of betel leaves has increased now.

Table 3: Gross Revenue

Season	Min	Max	Mean (%)	S.D.
Winter	2527.27	9000	4868.76 (38.5%)	1422.40
Rainy	1527.27	7632	4232.59 (33.5%)	1326.73
Other	1818.18	5500	3561.74 (28%)	1013.47
Gross Yearly Return	5872.72	21780	12663.09 (100%)	3591.5

Source: Field Survey, June-July 2019

3.3 Profitability of Betel Leaf Production

By deducting the total cost and total revenue, the profitability is calculated here as net-revenue (Table 4). The total cost to maintain per decimal betel vine garden was estimated as Tk. 5594.60. On the other hand, gross return from the same is calculated as Tk. 12663.09. Therefore, per decimal net revenue were calculated as Tk. 7068.48. The benefit-cost ratio (BCR) for the sample farmers is found here as 2.26. However, Islam and Matin (2017) estimated it bit less than the present study which was 1.5. The differences may be because of differences in study area as well as year of study. However, the conclusion regarding the profitability of betel leave cultivation is same here as them which is 'betel leaf cultivation in the study areas is profitable'.

Table 4: Net Revenue (Tk. /Decimal)

	Minimum	Maximum	Mean	Standard Deviation
Total Revenue	5872.72	21780	12663.09	3591.5
Total Cost	2680	11241.5	5594.6	2003.18
Net Revenue	798.79	17005	7068.48	4021.08
BCR			2.26	

Source: Field Survey, June-July 2019

3.4 Determinants of Profitability

The determinants of profitability of betel leaf cultivation is seen through the regression results shown in Table 5. According to the findings of this study, factors like experience and education of farmers as well as cost on bamboo, tying material (straw and yarn), labor, and pesticide & insecticide are statistically significant factors to influence profitability of the Betel leaf cultivation. Other variables like land size and irrigation cost are found not significant here. However, to the best of our knowledge, there is no such studies similar to this where the determinant of profitability of betel leave cultivation is analysed. Therefore, discussion on the comparison with previous knowledge is missing here.

Table 5: Determinant of Net Revenue

Variable	Coefficient	Standard Error	t-values
Experience	1431.76*	708.22	2.02
Education	4767.05*	2242.22	2.13
Betel Land	-697.06	1696.84	-0.41
Bamboo Cost	-4.22**	0.96	-4.41
Straw & Yarn Cost	4.55*	1.84	2.48
Irrigation	4.43	3.51	1.26
Labor Cost	-0.47*	0.22	-2.11
Pesticide & Insecticide Cost	4.66**	0.89	5.21
Constant	30314.82	34966.88	0.87
Number of observations	40		
F – Statistics	9.43		
Probability Value (*Prob > F)*	0.000		
R-Squared	0.71		
Adj R-Squard	0.63		

Note: * shows significant at 5 percent level and ** shows at 1 percent level

It is found here that both experience and education for betel leaf grower are positively significant at 5 percent level. The result is as expected and not contradictory to any theory. It indicates that an increase in one year of experience and education level (year of schooling), keeping all other things constant, would result an increase in the net return by around Tk. 1432 and Tk. 4767 respectively. Another conclusion we may derive from here also that education is much more influential factor than experience. Although it is not proper to interpret but just to show the importance of education, we can say, one year of schooling is more than 3 times important than one year of experience to influence profit.

Among the cost related factors, bamboo and labor cost are negatively related with net revenue at 5 percent and 1 percent level of significant. These two are the top two highest cost bearer headings related to betel leaf production, 36 percent and 28 percent respectively (Figure 1). Our result here indicates that 1 unit increase in bamboo cost and labor cost result a decrease in net revenue by 4.22 and 0.47 unit, respectively. This is logical, as they involve major shares of cost so increase of them would definitely reduce the profit. On the contrary, cost on tying material (straw and yarn), pesticide and insecticide are positively related with profit at 5 percent and 1 percent significant level respectively. Therefore, the regression results indicate here that 1 unit increase in those costs result an increase in net revenue by 4.55 and 4.66 unit, respectively. This is interesting because increase in cost affect increase in profit. The possible explanation would be that use of tying material, pesticides and insecticides are not at its optimum level. There is still possibility to increase use of those properly (so increase cost) which may result in increase in yield and so increase in profit.

The coefficients of determination R-square and adjusted R-squared values are 0.71 and 0.63 respectively. Considering adjusted R-squared, we conclude that 63 percent variations in net revenue (profit) of betel leaf cultivation is explained by the independent variables included in the model. The probability of the F-value of the model (0.000) implying a good fit of the model considered here.

IV. CONCLUSION

Betel leave is an important commercial and heritage crop of Bangladesh. It is also a masticatory having socio-cultural importance and significant medicinal properties and nutritional values (Islam et al., 2015). The present study has investigated input use pattern, profitability and the factors affecting the profitability of betel leaf cultivation. Primary data were collected from 40 growers from Mohanpur upazila of Rajshashi district for this study. Important cost involve in betel leaf cultivation are related to bamboo (36%), labour (28%), pesticide & insecticide (19%), straw & yarn (11%) and irrigation (11%). Per decimal average net revenue is found here as around 7068 taka. The BCR is more than 2 indicating more than double return in betel leaf cultivation. Conducting a regression analysis it is found that experience of betel cultivation, years of schooling of farmer, bamboo cost, straw and yarn cost, labor cost, pesticide and insecticide costs are important determinants of net revenue.

Several policy recommendations can be suggested based on the findings of this research. These are:

1. Cost on bamboo is the major cost involve in the betel leaf production which decay over time. Therefore, to reduce cost in the long term, more strong material like concreate pillar or something else can be used. Research and technical support is needed in this respect.
2. Another major cost involved with pesticide and insecticide. Right thing in the right time with right quantity can reduce the pest, insects and disease attack on betel leaf that may reduce the cost. Adequate agricultural extension advice is required in this respect.
3. Education variable has found to affect the profitability of betel production significantly. So, farmers need to educate in this respect. Government should provide training related to different aspect of betel leaf production.
4. More attention should be placed on availability of inputs in general as well.

The economic aspects of the crop observed here indicate that betel leaf is one of the most promising commercial crops in Bangladesh. This adequately justifies its nomenclature as the 'Green Gold' (Guha, 2006). However, this research is a limited effort with less data as well as less area coverage. Further study covering more areas of Bangladesh can be done. More specifically problems related to production and marketing aspect could be future area of research.

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