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Original Article

Economic Safety Margin of *Bombax ceiba* Production in Selected Areas of Bangladesh

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ABSTRACT

Bombax ceiba (L.) is a medicinal plant that is grown commercially by the farmers in Bangladesh for its' roots, where farm revenues are inherently volatile, subject to debilitating diseases, lack of quality varieties, and the vagaries of harsh weather. This study was carried out to determine the profitability of *Bombax ceiba* root production by assessing costs and returns, their relations, and also the risk-bearing abilities through breakeven and margin of safety analyses. A total of 31 sample *Bombax ceiba* root producers were purposively interviewed. The overall cost of Bombax ceiba root production was determined to be Tk. 409855.16 per hectare, where labor cost accounting for the major portion of the total cost. The gross and net margins were about Tk. 436431.30 and Tk. 264209.01, respectively. Regression analysis showed that gypsum, TSP, and irrigation have contributed significantly and positively to yield increase (increase revenue), and seed, human labor, and urea cost have caused negative relations on yield. The breakeven analysis indicated that Bombax ceiba root production has a high level of risk-bearing ability in terms of price, yield, and costs. The risk levels were also cleared by the margin of safety percentage, which showed that a 39.11 percent fall in yield or price would result in a profit of just breaking even. It also provides farmers with a comfortable margin of safety on the variable, fixed, and total costs at 111.18, 153.41, and 64.46 percent, respectively. The findings indicated that complete absorption and sale of *Bombax ceiba* roots should be ensured. The policy should be focused on reducing excess labor use if any in *Bombax ceiba* roots production activities and a contract marketing system might be a good option to increase revenue and reducing risk and price instability.

Introduction

The pharmaceutical sub-sector of Bangladesh has been listed as the highest priority in export policy 2015 where medicinal plants are played in contributing role in export earning (BFTI, 2016). By 2050, the world herbal medicine industry can be reached a market share of 5.0 trillion US dollars (BFTI, 2016). There are 21,0000 medicinal plants species around the world (WHO, 2003). In Bangladesh, only about 700 medicinal plants (Yusuf et al., 2009) are listed and used. Bangladesh is endowed with a rich diversity of medicinal plant species (Barua et al., 2001; Chowdhury, 2001; Hossain, 2001; Nishat et al., 2002). *Bombax ceiba* root is a common medicinal plant produced by farmers in Bangladesh. Its' local name is *shimulmul* (Hossain et al., 2013), and this tree is also commonly known as a cotton tree, which is sometimes known as red silk-cotton; red cotton tree; or ambiguously as silk-cotton (Samsai and Praveena, 2016). Its different parts including flowers, roots, stem bark, and leaves, etc. have been used for the treatment of diarrhea, dysentery, hepatitis, lymph adenoma, and menorrhagia.

In Bangladesh, farmers have grown *Bombax ceiba* in their land only for roots. Like other medicinal plant producers, *Bombax ceiba* root-producing farmers in Bangladesh encounter two major risks. First, they

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encounter yield risk (variability of yield) because of weather variability and higher pests and diseases attraction. The second source of risk stems from market absorption and relies on quantities that are distributed through each available marketing channel. As roots are selling in the traditional marketing system, all the harvested roots don't sell at a good price. These risks also make the farm revenue unstable (Vassalos, 2013). As a result, *Bombax ceiba* root production farmers take switching decisions to the next alternative crops. Thus, the planned or commercial production of *Bombax ceiba* root is virtually non-existent or in some cases at a very preliminary stage in Bangladesh, though commercial production started in the early 1990s in the Natore district (Dixie et al., 2003).

In general, farmers are predicting and calculating production cost and return prior to the production cycle and then allocate land to new crops only if the economic returns from these crops are at least equal to the return from the most profitable conventional alternatives (Jain et al., 2010; James et al., 2010; Kells and Swinton, 2014). Sharmin (2006) found that the farmers are motivated to cultivate medicinal plants because of their profitability. Profitability is a critical factor to adopt a new crop like a medicinal plant, which is also affected by different risks (Ghadim et al., 2005; Marra et al., 2003; Chavas, et al., 2009, Saiyem et al. 2020). Sharmin (2006) further reported that sugarcane cultivation was more profitable than *Bombax ceiba* root. Bari and Rahim (2012) showed that despite the lower yield of *Bombax ceiba* root, the highest gross return was observed under coconut-based multistoried agroforestry systems compared to sole cropping. Rashid *et al*. (2010) observed that the *Bombax ceiba* root was a viable way of earning of livelihood of the farmers in the Natore district. They also identified one key challenge in managing the production of *Bombax ceiba* root and other medicinal plants as it is integrated into the needs of farmers with available knowledge and technological supports. Therefore, on the choice of *Bombax ceiba* root production, farmers need a clear picture about cost, return their relationship, and also the profit structure with risk-bearing ability in the current production practices.

There are many scientific studies conducted on the issues of medicinal plants. Dixie *et al*. (2003) studied the importance of medicinal plants (Dixie et al., 2003). Hasan et al. (2014), Hasan et al. (2013), and Rashid and Eakram (2009) conducted their studies on the use of medicinal plants (Hasan et al., 2014, Hasan et al., 2013, Rashid and Eakram, 2009). Bari and Rahim (2012) and Sharmin (2006) carried out studies on cultivation practices of medicinal plants (Bari and Rahim 2012, Sharmin 2006). But, to the best of the authors no closely related studies were found related to examine the cost, return, risk-bearing ability, and also the relationship of return with input costs in the *Bombax ceiba* root production practices in Bangladesh and abroad as well. Some attempted were taken by Samsai and Praveena (2016) and Guleria et al. (2014) to estimate the cost and return of medicinal plant cultivators (Samsai and Praveena 2016, Guleria et al., 2014). Samsai and Praveena (2016) conducted a study on the production and processing of aloevera among the districts of Tamil Nadu, India (Samsai and Praveena 2016). The authors primarily focused on aloevera production cost and return. Except for Samsai and Praveena (2016) study, based on a rigorous literature search, no other study was observed on the profitability as well as on the risk-bearing ability of Bombax ceiba root growers (Samsai and Praveena 2016). Saiyem *et al*. (2020) investigated the profitability analysis of aloe vera production and showed that aloe vera production was profitable (Saiyem et al. 2020).

By addressing the research gap, considering the present hindrance settings, the study was undertaken to find out the cost, return, relationship, and risk-bearing abilityof *Bombax ceiba* root production in the study location. Key research questions that addressed the present study were: (i) how much it costs to produce *Bombax ceiba* root and makes a return? (ii) what is the relation of revenue with costs in the *Bombax ceiba* root production practices? (iii) are *Bombax ceiba* root production farmers have the risk-bearing ability at different risks of price, yield, and cost. Based on these research questions the present study is dealt with the profitability of *Bombax ceiba* root production, their relationship with revenue, and examines the farmers' risk-bearing ability to *Bombax ceiba* root production at different risks of price, yield, and cost.

Materials and Methods

Study area

The research was carried out in the Natore district of Bangladesh which was selected purposively based on the area allocation and production of *Bombax ceiba* root. Natore District has four upazilas. Among these, Natore Sadar is well known for medicinal plant cultivation. In this Upazila, *Bombax ceiba* root is grown commercially (Hossain et al., 2013; Rashid et al., 2010; Sharmin, 2006). The population was the household who produce *Bombax ceiba* root in their cropland. Figure 1 depicts the study location of *Bombax ceiba* root production.

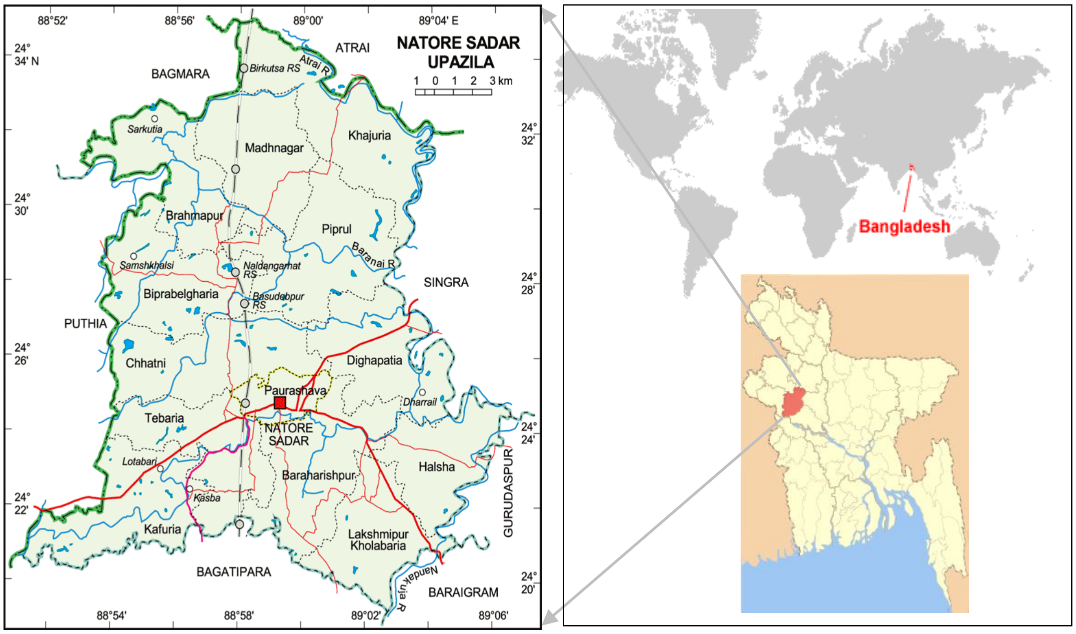

Figure 1. Location map of the study area

Sampling design

About 5000 farmers in the study Upazila are producing around 109 medicinal plant crops in their farmland. Among them, only 135 farmers are cultivating *Bombax ceiba* root commercially. Therefore, the study is considered the population size (N) at 135. The study also assumes 20% of precision (e), 95% of confidence level (Z=1.96), and 65% of the variance in the population (σ). The formula for the required sample size is,

$$n = \frac{Z^2 * \sigma^2 * N}{(N-1)e^2 + Z^2 * \sigma^2}$$

Result found the total sample to be 31.378 for this study. Therefore, for better representation of the population, the total sample size was taken as 31 farmers.

Methods of data collection

Both primary and secondary data were used for this study. For collecting primary data, a pretested structure interview schedule was used. Primary data were collected from the farmers who producing *Bombax ceiba* root. The farmers were identified by consulting with Department of Agricultural Extension (DAE) personnel. Data were collected through personal interviews by the researchers themselves. The survey was conducted from 10th February to 15th April of 2018. The respondents provide information from their memory as they normally do not keep records. Secondary data were also used in this study, which was gathered from different journals, reports, websites, books, and handouts.

Data analysis

The data were analyzed using descriptive, mathematical, and statistical techniques.

The profitability of *Bombax ceiba* root production was measured in terms of gross return, gross margin, the net return, and profitability ratio.

The gross return (GR) of *Bombax ceiba* root was calculated by multiplying the total output at the farm gate price. The formula is:

$$GR_i = \sum_{i=1}^{n} p_i * y_i$$

where, y_i = Quantity of the main product; and P_i = Per unit price.

Gross margin (GM) was estimated where the variable cost (TVC_i) is deducted from the total return, and net margin (NM) was estimated by deducting fixed costs ($\mathrm{TFC_i}$) from GM. For this purpose, the following equations proposed by Dillon and Hardaker (1993) was used:

$$\mathrm{GM}_i = GR_i - TVC_i$$

$$\mathrm{NM}_i = GM_i - \mathrm{TFC_i}$$

where total cost (TC) includes all types of variable and fixed cost items involved in the production process. The total cost was estimated as:

$$TC_i = \sum_{j=1}^{n} P_{x_{ij}} x_{ij} + \mathrm{TFC_i}$$

where, $\sum_{i=1}^{n} P_{x_{ij}} x_{ij} = \mathrm{TVC_i}$ = Total variable cost; x_{ij} = Quantity (kg/ha) of the jth variable; $P_{x_{ij}}$ = Per unit price

(Tk/kg) of the j[th] variable input; and TFC_i = Total fixed cost.

The profitability ratio was measured as the gross profit ratio.The formula of gross profit ratio (GPR_i) is:

$$GPR_i = \frac{GM_i}{GR_i} \times 100$$

The decision rule is that; a high ratio may be indicated high net sales with a constant cost of sold or it may be indicated a reduced direct cost with constant net sales. Similarly, a low ratio may be indicated low net sales with a constant cost of sold or it may be also indicated an increased direct cost with constant net sales.

The Cobb-Douglas type revenue model was used in this study to see the input and output relationship. It is generally considered superior on theoretical and econometric grounds for determining the effects of variable inputs (Beattie and Taylor, 1985). The logarithmic form of Cobb-Douglas type revenue function is:

$$ln\ y_{ij} = ln\beta_{0ij} + \beta_{kij} \sum_{\substack{i=1 \\ j=1}}^{n} \ln x_{ij} + u_{ij}$$

Where, y= output; x=input; ln= natural logarithm.

In the use of Cobb-Douglas type revenue function, ten variables were selected and coefficients were estimated by transferring the original unit into value terms. The selected Cobb-Douglas type revenue function model, in its deterministic form, is:

$$\ln y_{ij} = ln\beta_{0_{ij}} + \beta_{1_{ij}}\ln x_{1_{ij}} + \beta_{2_{ij}}\ln x_{2_{ij}} + \beta_{3_{ij}}\ln x_{3_{ij}} + \beta_{4_{ij}}\ln x_{4_{ij}} + \beta_{5_{ij}}\ln x_{5_{ij}} + \beta_{6_{ij}}\ln x_{6_{ij}} + \beta_{7_{ij}}\ln x_{7_{ij}} + \beta_{8_{ij}}\ln x_{8_{ij}} + \beta_{9_{ij}}\ln x_{9_{ij}} + \beta_{10_{ij}}\ln x_{10_{ij}} + u_{ij}$$

Where,

y_{ij} = is the value of yield of *Bombax ceiba* root production, measured by gross returns per hectare (Tk/ha);

$\ln x_{1_{ij}}$ = Logarithm of human labor cost (Tk./ha);

$\ln x_{2_{ij}}$ = Logarithm of mechanical power cost (Tk./ha);

$\ln x_{3_{ij}}$ = Logarithm of seed/seedling cost (Tk./ha);

$\ln x_{4_{ij}}$ = Logarithm of compost/manure used cost (Tk./ha);

$\ln x_{5_{ij}}$ = Logarithm of urea used cost (Tk./ha);

$\ln x_{6_{ij}}$ = Logarithm of TSP used cost (Tk./ha),

$\ln x_{7_{ij}}$ = Logarithm of MP used cost (Tk./ha),

$\ln x_{8_{ij}}$ = Logarithm of gypsum used cost (Tk/ha),

$\ln x_{9_{ij}}$ = Logarithm of irrigation cost (Tk/ha),

$\ln x_{10_{ij}}$ = Logarithm of pesticide cost (Tk/ha),

$\beta_{0_{ij}}$ = constant,

$\beta_{1_{ij}}, \ldots \ldots \beta_{8_{ij}}$ = estimated coefficients of the 10 explanatory variables, and

u_{ij} = disturbance term.

Prior to interpreting the coefficients by applying the Cobb-Douglas type revenue function, the multicollinearity and heteroscedasticity by Variance Inflation Factor (VIF) and Breusch-Pagan tests were checked.

The study furthermore used breakeven and margin of safety percentage methods to evaluate the farmers' risk-bearing ability to *Bombax ceiba* root production at different risks of price, yield, and cost. In breakeven point $NM_i = 0$, thus $p_i y_i - VC_i - FC_i = 0$. Therefore, the breakeven points can be written:

the breakeven point of output: $y_{be} = \frac{VC_i + FC_i}{p_i}$;

the breakeven point of output price: $p_{be} = \frac{VC_i + FC_i}{y_i}$;

the breakeven point of variable cost: $VC_{be} = p_i y_i - FC_i$;

the breakeven point of fixed cost: $FC_{be} = p_i y_i - VC_i$;

the breakeven point of total cost: $TC_{be} = p_i y_i$.

Finally, the study resulted in the economic safety margin by estimating the margin of safety percentage (MSP) using the formula:

$$MSP_i = \frac{Y_i - y_{bei}}{Y_i} \times 100$$

where, Y_i = actual value; and y_{bei} = breakeven value.

The study has derived the margin of safety percentage for yield, price, variable cost, fixed cost, and total cost for *Bombax ceiba* root. No doubt, a greater margin of safety indicates the soundness of the farming. The unsatisfactory margin of safety can be rectified by lowering variable or fixed costs, by increasing selling price or by substituting unprofitable products with profitable products.

Results and Discussion

Profitability of Bombax ceiba root farming

The inputs that were used in *Bombax ceiba* root production and their cost estimation were carried on a single production cycle of one year because the roots can be harvested within this time. The cost of hiring human labor, machine power, bullock charge was estimated by prevailing the rate at that particular period of time in the study area. Hired labor charges at the actual wage paid in cash and other kinds of payments were also converted into monetary terms at the prevailing price. The imputed value of the family labor cost was also calculated using the opportunity cost theory which is transferred in monetary multiplying by prevailing wage rate in the study area. In the case of a bullock, tractor, and other machinery, hiring charges were applied to these as the cost for those who don't own them. In case of material costs; the cost of seeds, manure, chemicals, fertilizers, and irrigation were calculated at the prevailing price at the time of application per hectare basis for *Bombax ceiba* root producing farmers. The owned seed was priced at the prevailing seed price in the study area. Other costs include interests on operating capital (IOC) which was calculated on the working capital at a flat rate of 9% per annum as it prevailed at the time of the investigation. Since the cultivation of *Bombax ceiba* root is suitable in the high land, most of the time farmers rented high land for one year to produce *Bombax ceiba* root commercially. Therefore, the rental value of the land that prevailed in the study area during the study period is taken under the production cost. In the survey of *Bombax ceiba* root farmers, the surveyed farms were found with an area ranging from 0.004 to 0.5 hectares.

The average cost of production of *Bombax ceiba* root is presented in Table1. The cost of labor accounted for the largest proportion (37.88% of the total cost) among the variable cost items. This is followed by the cost of seed, fertilizers, and irrigation accounting for 6.38%, 4.89%, and 3.65% of total cost respectively. The cost of labor was estimated at Tk. 155267.22 per hectare. It also showed that the cost of hired labor is more than the family labor. It is because, though the *Bombax ceiba* root grower tended to avoid hired labor to reduce the cost of production, most of the time they were compelled to use hire labor at different stages, such as pre-sowing land clearing, land preparation, weeding, pest control, and harvesting. This finding is consistent with Shahidullah (2007) and Saiyem et al. (2020) who conducted a study where he reported that medicinal plants cultivation was mostly labor-intensive (Shahidullah 2007, Saiyem et al., 2020). The average cost of urea, TSP, MP, and gypsum fertilizers per hectare was found at Tk. 5375.39, Tk. 10711.34, Tk. 2968.55, and Tk. 979.13 per ha, respectively. Manure cost per hectare was Tk. 10381.37 (2.53% of the total costs). The average cost of irrigation was Tk. 14970.78 accounting for 3.65% of the total cost. The average cost of tillage was Tk. 8279.96 per hectare which is 2.02% of the total cost. Almost all sample farmers were observed to use different kinds of insecticides in their fields. The average cost of insecticides per hectare was stood at Tk. 432.19 (0.11%). Land use cost and interest on operating capital (IOC) were Tk. 161528.81 and Tk. 10693.48 per hectare which accounted for 39.41% and 2.61% of the total cost, respectively. The total cost per hectare of *Bombax ceiba* root production in the study area was found at Tk. 409855.16.

Table 1. Annual average production cost of *Bombax ceiba*root (Tk./ha)

Cost Items	Unit price	Cost (Tk.)	Share (%)
Variable cost	-	237632.87	57.98
Labor	Tk. 431.88 per man-day	155267.22	37.88
Family Labor	Tk. 431.88 per man-day	76330.16	18.62
Haired Labor	Tk. 431.88 per man-day	78937.06	19.26
Machinery	Tk.	8279.96	2.02
Seedling	Tk. 175.48 per seedling	26129.91	6.38
Compost/manure	Tk. 1.23 per kg	10381.37	2.53
Fertilizer	Tk. 16.66 per kg	20034.41	4.89
Urea	Tk. 24.46 per kg	5375.39	1.31
TSP	Tk. 16.07 per kg	10711.34	2.61
MP	Tk. 30.57 per kg	2968.55	0.72
Gypsum	Tk. 16.66 per kg	979.13	0.24
Irrigation	Tk.	14970.78	3.65
Pest and disease control	Tk.	432.19	0.11
Harvesting	Tk. 39.13 per bundle	2137.03	0.52
Fixed cost	-	172222.29	42.02
Land use cost	Tk.	161528.81	39.41
Interest on operating capital	at 9% rate	10693.48	2.61
Total cost	-	**409855.16**	-

Source: Authors' own calculation, based on the field survey (2018)

Table 2 showed the yield, price, and returns of *Bombax ceiba* root production at the farm level. The average yield of *Bombax ceiba* root was found to be 10363.87 kg per hectare. Yield means per ha production of roots which is also called *Bombax ceiba* produces. The gross return was calculated at Tk. 674064.17. The return from each market is calculated by multiplying the total yield of *Bombax ceiba* root by the proportion of absorption by the market and farmers' price in that market during the time of harvesting. The farmers sell their *Bombax ceiba* roots at different markets and different prices. The markets are of two types: contract market and local market. The estimated prices of *Bombax ceiba* roots were Tk. 67.94 per kg in the contract market and Tk. 57.63 per kg in the local market. The mean price was stood at Tk. 64.95 in the present study. Therefore, the gross margin and net margin were stood at Tk. 436431.30 and Tk. 264209.01 per hectare respectively. The profitability ratio result implies that for every Tk.1 generated in sales of *Bombax ceiba* roots, the farmer has Tk.0.65 leftover to cover basic operating costs and profit. The study therefore indicating that the production of *Bombax ceiba* root in the study area was profitable. It is similar to Sharmin (2006) who explored the possibility of medicinal plant cultivation as a sustainable livelihood option and founds medicinal plant farming as a profitable option (Sharmin 2006).

Table 2. Returns from *Bombax ceiba* root production (Tk./ha)

Indicators	Unit	Value
Yield (production of roots)	kg/ha	10363.87
Absorption of yield (total)	%	100
by the local market	%	71.88
by the contract market	%	28.13
Producer's price (average)	Tk./kg	64.95
in the local market	Tk./kg	57.63
in the contract market	Tk./kg	67.94
Gross return	Tk./ha	674064.17
Gross margin	Tk./ha	436431.30
Net margin	Tk./ha	264209.01
Profitability Ratio	Ratio	0.65

Source: Authors' own calculation, based on the field survey (2018)

Multicollinearity was tested by using the variance inflation factor (VIF). The results showed no multicollinearity in the data. As the rule of thumb, Gujarati (2003) stated that if the VIF value of a variable exceeds 10, then, that variable is said to be highly collinear. In this study, none of the variables was found that exceed the thumb rule. Also, the p-value of the Breusch-Pagan test statistics was found more than the significance level ($\alpha = 0.05$) which also indicated that there was no heteroscedasticity in the regression model.

Technical relationship of cost and revenue

In determining the technical relationship of cost and revenue using the Cobb-Douglas type revenue function, ten variables were included in the model. The results are shown in Table 3. The value of the coefficient of seed cost was -0.152 which is significant at a 1% confidence level. The negative sign indicates that revenue from *Bombax ceiba* root production can be decreased by using more amount of seed which is increased the seed cost. This also indicates that seed is excessively used in the study area which is common practice in Bangladesh. Furthermore, if farmers increase seed cost by 1%, taking other factors remaining constant, would decrease the revenues from *Bombax ceiba* root by 0.15%. The regression coefficient of gypsum was 0.099 and significant at 1% confidence level. The coefficient of irrigation was about 0.236 and significant at 1% confidence level. At the 5% level, TSP and human labor were found significant with the coefficient value of 0.089 and -0.551, respectively. The positive coefficient of TSP indicates that using more TSP can increase the revenue from *Bombax ceiba* root production. The regression coefficient of human labor was negative and implies that further use of labor in Bombax ceiba root production may reduce the revenues. The urea coefficient was found significant at 10% confidence level with a negative sign (-0.115). Farmers of *bombay ceiba* root production in the study area allocated their input use in the rational stage of production. Still, there is scope to increase revenue by applying scientifically recommended doses and improved management of inputs. The R^2 value is about 0.712 and means that the explanatory variables included in the model can be explained 71% by the model. The F-test showed high significance at a 1% level of confidence, implying that the included variables collectively are important for explaining the variations of revenue.

Table 3. Results of Cobb-Douglas type revenue function for *Bombax ceiba* root

Variables		*coeffi.*	*std. Err*	*p > t*
Dependent variable: Revenue of *Bombax ceiba* rootproduction				
Input variables				
Cost of human labour		-0.551**	0.291	0.036
Mechanical power cost		-0.008	0.100	0.468
Cost of seedling		-0.152***	0.055	0.006
Cost of compost & manure		-0.006	0.009	0.253
Cost of urea		-0.115*	0.074	0.068
Cost of TSP		0.089**	0.044	0.027
Cost of MP		-0.015	0.025	0.272
Cost of gypsum		0.099***	0.032	0.003
Cost of irrigation		0.236***	0.067	0.001
Cost of pesticide		0.010	0.014	0.239
_constant		4.148	1.416	0.004
R-squared		0.7124		
Adjusted R-squared		0.5686		
Prob > F		0.0012***		
Number of obs.		31		
Breusch-Pagan test	BP	7.52		
	DF	10		
	P-value	0.642		
	alpha	0.05		

Significant at the 10% level; **Significant at the 5% level; * Significant at the 1% level.*

Level of the risk-bearing ability of Bombax ceiba root producers

Risk-bearing ability is explained by breakeven analysis which showed in Table 4. Breakeven analysis of *Bombax ceiba* root was calculated for yield, output price, variable cost, fixed cost, and total cost basis. The breakeven point of the yield of *Bombax ceiba* root is about 6310.68 kg/hectare. This means that the production of *Bombax ceiba* root production is profitable only if the yield turns out more than 6310.68kg/hectare. Similarly, *Bombax ceiba* root cultivation is profitable if farmers are able to sell roots above Tk. 39.55/kg. Table4 also showed that in the case of yield and price, the margin of safety percentages of *Bombax ceiba* root is 39.11%. This implies that at the current level of yield or price and cost structure, a reduction of yield or price of *Bombax ceiba* roots at 39.11%will result in just breaking even, vice-versa. As indicated in Table 3, the breakeven levels of variable cost, fixed cost, and total cost for the *Bombax ceiba* root production farms were found at Tk. 501,841.89, Tk. 436,431.30 and Tk. 674064.17 per hectare, where the margin of safety percentages was found at 111%, 153%, and 64% respectively. The implication is that breakeven analysis of *Bombax ceiba* root production resists a large drop of yield and price before incurring a loss, which gives the farmers a comfortable margin of safety and a risk-bearing ability. It is similar to Liontakis and Tzouramani (2016) who found economic sustainability in the case of organic aloe vera farming under risk and uncertainty.

Table 4. Breakeven point and margin of safety for *Bombax ceiba* rootproduction

Breakeven points			*Margin of safety percentage (%)*	Direction
Break-even points for-	Unit	Breakeven value		
Yield	kg/ha	6310.68	39.11	-
Price	Tk./kg	39.55	39.11	-
Variable cost	Tk./ha	501841.88	111.18	+
Fixed cost	Tk./ha	436431.30	153.41	+
Total cost	Tk./ha	674064.17	64.46	+

Source: Authors' own calculation

Conclusion and Policy Recommendations

Bombax ceiba root farming is gaining popularity and contributing to generating income for the farmers. The study examined the cost, return, profitability, factors contributing, and risk-bearing ability of the farmers of *bombax ceiba* root production. It is largely attributed that the cost of human labor accounts for the largest proportion among all cost items, indicating that the *Bombax ceiba* root production is labor-intensive, mostly comes from hired labor sources. Since profitability analysis showed that the *Bombax ceiba* root production is profitable in the study area. The farmers have an opportunity to allocate more land to *Bombax ceiba* root production in the existing marketing system. The cost of seedling had a strong and significant positive relationship with revenue followed by gypsum, irrigation, urea, and TSP. There was a significantly negative relationship with the cost of human labor. The breakeven point showed that *Bombax ceiba* root had a high level of risk-bearing ability at different risks of price, yield, and cost. The margin of safety percentage cleared the risk levels. About forty percent reduction in yield or price may result in the profit just breaking even. It also gives the farmers a comfortable margin of safety on different costs. Since profit depends on a large number of factors including cost of production and the volume of sales, absorption of the whole volume of *Bombax ceiba* roots should be ensured. Therefore, farmers should rely not only on direct marketing but also participate in contract marketing that the firm can afford to lose due to any contingency, without falling below its breakeven. Government can take some initiatives with line departments to ensure a fair price.

Conflict of interests

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

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