Production and profitability of banana in Bangladesh-an economic analysis

Abu Zafar Ahmed Mukul [1], Md. Arafat Rahman[2, *]

[1]Lecturer, Sher-e-Bangla Agricultural University, Dhaka-1207, Bangladesh
[2]Research Associate, Implementation of Monitoring and Evaluation for IFC (World Bank Group) at A. D. S. L., Bangladesh

Email address:

mukul_mgt@yahoo.com(A. Z. A. Mukul), arahman4@isrt.ac.bd(M. A. Rahman)

Abstract: Banana production provides suitable options for subsistence and income generation in Bangladesh. It is a commercial fruit, but in context of Bangladesh, it is grown in limited area commercially. Inadequate marketing system in this sector affect the income of the producers and its trading which also limit the expansion of banana production in our country. We are trying to determine relative profitability of banana in Narsingdhi during the period January to March, 2013. In this study we investigate total cost, profit and benefit cost ratio for different marketing channel like banana producers, wholesalers and retailers. Profit for producer, wholesaler and retailer in banana production were Tk. 55002.8 per Hectare, Tk. 59.08 per Chari, and Tk. 122.67 per Chari respectively and benefit cost ratio for producers, wholesalers and retailers were 1.40, 1.30 and 1.41 respectively. We have also followed Cobb-Douglas production model was used to determine the contribution of some important inputs like land preparation, fertilizer, irrigation, insecticides, sucker and labor cost to production of banana. We also investigate to explore the problems of producing banana and offer suggestion for possible improvement in the existing marketing system.

Keywords: Banana Production, Benefit Cost Ratio (BCR), Cobb-Douglas Function, Economic Profit, Narsingdhi District

1. Introduction

Bangladesh is an agricultural country. More than 80% people directly or indirectly depends on agriculture. About 19.29% of GDP is derived from agriculture in fiscal year 2011-12 (BBS-2012). About 35,000 children become blind each year due to Vitamin-A deficiency. The common deficient nutrients of Bangladesh are Vitamin-A and Vitamin-C, riboflavin, folic acid etc. banana, tomato and cauliflower are the most in expensive and rich sources of those nutrients. In Bangladesh banana is the only fruit crop, which is available throughout the year and consumption rate is also higher than any other fruits. It has been associated with man for centuries and many people consider the banana as on off man's finest fruit. Banana is delicious fruit crop gross widely all over Bangladesh and most important fruit in the country from the stand point of food value and availability, throughout the year (USAID, 1969).

Major Districts of cultivated Banana are Narsingdi, Gazipur, Rangpur, Bogra, Nator, Pabna, Noakhali, Faridpur, Khulna in our country. Districts of wild grown Banana are Sylhet, Moulvibazar, Netrokona, Rangamati, Khagrachhari, Bandarban; Generally banana plants are found throughout the country in most of the rural homesteads. There are a number of banana cultivars in Bangladesh. Among them, BARI Kola-1, Amritsagar, Sabri, Champa and Kabri are the commercial cultivars. The other cultivars are Mehersagar, Dudsagar, Agniswar, Genasundari, Kanaibanshi, Basrai, Binisuta, etc. In Bangladesh, total estimated production of banana was 801000 metritons and cultivated area is 131 acres in 2010-11. The annual production of banana in our country for different year has been shown below:

Table 1. Annual production of banana for fiscal year 2001-02 to 2010-11

Year	Area(000)acres	Production (000) M. tones	Per Acre Yield M. tones
2001-02	111	654	5.89
2002-03	112	650	5.80
2003-04	122	707	5.80
2004-05	133	899	6.75
2005-06	138	909	6.57
2006-07	145	1005	6.93
2007-08	132	877	6.66
2008-09	132	836	6.32
2009-10	133	818	6.15
2010-11	131	801	6.13

Source: Bangladesh Bureau of Statistics (BBS)-2012

Hanumantharaya et al. (2009) conducted a study based on data collected from 80 farmers in 12 villages of two taluks in Tungabhadra and Malaprabha command areas of Karnataka. Results of the study revealed that, in crop-I, per ha production cost of sucker banana was Rs. 82,298 and tissue culture banana was Rs. 1,17,563. The gross returns obtained were 1,60,113.81 and Rs. 1,97,295.94, respectively. The net returns obtained were Rs. 77,815.81 and Rs. 79,732.94, respectively. In crop-II, production cost of sucker banana was Rs. 55,073 and tissue culture banana was Rs. 57,561.30. The gross returns realised were Rs. 1,70,596.56 and Rs. 1,85,953.07, respectively and the net returns were Rs. 1,15,523.56 and Rs.1,28,391.77, respectively. In sucker banana cultivation, regression coefficient of plant nutrients (0.35) was significant at five per cent and that of plant protection chemicals and bullock labour were non-significant. Octavio Damiani (2001) investigated that organic production of cacao and banana had great positive impacts on the incomes and quality of life of small farmers in Talamanca. These producers had lost their main source of cash income in the late 1970s due to the attack of Moniliophtora roreri sp to their cacao plantations. As a result, by the early 1990s they were living on subsistence products—mainly corn, beans, rice, and poultry.

Subaiah et. al (1980) found in their study that a high yield of banana could be achieved from intercropping with green and black gram. Intercrop like okra, cowpea and onion with banana did not affect the bunch weight, the findings of the economics of intercropping with banana revealed that net return was relatively higher with green gram followed by black gram. S. C. Sarode (2009) investigated that Banana is a popular and important commercial fruit crop grown in tropical and sub tropical part of world. Jalgaon district in the state of Maharashtra, India is one of the largest producers of banana which contributes about 44% of banana production in the state. Hence, Jalgon district was selected for this study. The cultivation of banana is mainly concentrated in Raver and Chopda sub regions (tahasils) in Jalgaon district. Therefore these tahasils having highest acreage under banana plantations were selected purposively for the present

investigation. The banana fruits fetches price depending on size in the market. The size of fruit is measured in terms of weight of bunches and number of hands per bunch at the farm level. Hoque (1983) conducted a research on some technological aspects for the commercial production of banana during the period from 1981 to 1983 at Bangladesh Agricultural University (BAU), Mymensingh, he reported that the best period of banana plantation was September to November. In another study by him reported that intercropping of banana were practiced during of period September to april, as the weather of this period remain favorable for large number of vegetables, oilseed and pulse crops. Hoque (1998) conducted a research Bangladesh Agricultural University (BAU), Mymensingh during October 1987 to November, 1988. He examined the economic performance of banana production. He found that per hector cost and net return of banana production were taka 103, 614.88 and 1, 61, 386.12 respectively. Rahman and Akbar (1989) conducted a study on Banana marketing in Narsingdhi District. They reported that the farmers share of the consumers taka spent on bananas varied between 42 to 62%. The intermediaries appropriated a marketing margin of 38 to 56% from marketing cost and profit. Bairagi (1980) conducted a study to determine the profitability of banana production in Jhenaidah District of Bangladesh. He found that per hector costs and returns on banana production were taka 53714.50 and 116674.84 respectively. Kamal (1996) conducted a survey in some selected areas of Jaypurhat and found that banana production was more profitable that sugarcane. Per hectare net returns of banana and sugarcane were taka 67650.10 taka and 10980.66 respectively. Barmon et al. (2012) was conducted to estimate profit, benefit cost ratio (BCR) and household income of mushroom production and also to explore the problems of producing mushroom and its marketing channels in Bangladesh. Mushroom was found to be a profitable agricultural enterprise (22,888 taka per farm). The benefit cost ratio (BCR) was 1.55. The average family household income was about Tk. 43,731. Usually, three intermediaries (mushroom office, wholesalers and retailers) are involved in the marketing channels of mushroom. The marketing margin of mushroom for farm-

gate to wholesalers and wholesalers to retailers were taka 50 and 70 per kg, respectively. Roy (1996) conducted a study that comparative economic analysis of banana and their crops production in Mymensigh district to determine the cost and return as well as the relative profitability of banana growers. He observed per hectare gross expense of banana production with intercrops was taka 65583.13, while per hectare gross return, net return above gross expenses is stood at taka 111191297.24 and 12514.11 respectively. Nargis (1997) conducted a study on comparative economic analysis of growing banana and banana with other vegetables in some selected area of Muktagacha Thana. The major findings of the study were that per hectare costs of production of sole banana were taka 121438 and taka 92011, respectively considering full cost and cash cost.

Figure1. *Distribution channel of banana production*

2. Methodology

In this study, survey for data collection was conducted during January to March, 2013. Both primary and secondary data were collected from Narsingdhi district purposively because a large number of people are engaged in banana production and easy accessibility and good communication facilities were prevailing in this area. The interviews are divided into three major groups: the farmers, wholesalers and retailers. In this study, the farmers, wholesalers and retailers of banana were considered as the population of the study. To construct a sampling frame for this study, simple random sampling was used to determine the sample size which is 40 and it was allocated to 20 farmers, 10 wholesalers and 10 retailers. We have also collected qualitative information about different problems which are facing to continue their business activities for producers side.

Economic analysis of banana production:

The cost of banana was calculated by fixed and variable cost. On the return side, we have considered the revenue from banana and its product.

Profitability analysis:

Enterprise costing was followed in calculating cost & return. Economic performances as well as relative profitability of banana were calculated on the basis of gross margin and net return analysis.

Gross margin analysis:

Gross margin is difference between total revenue and total variable cost. Reason to choose this analysis was that the farmers of Bangladesh are very eager to know their return over total variable cost.

Net return analysis:

Per hectare net return was defined by subtracting the total cost (variable cost + fixed cost) from the total return obtained from banana production.

Benefit cost ratio (BCR):

Benefit Cost Ratio (BCR) of banana was estimated as a ratio of gross return to total cost:

BCR =Gross Return /Total Cost.

Functional analysis:

Cobb Douglas Production Function was chosen to estimate the effects of key variables on production process of banana. The double log form of the Cobb-Douglas proved to be superior alternative theoretical and econometric grounds. The specification of Cobb-Douglas production functions as follows:

Table 2. *List of Variable Corresponding to Banana Production*

Y= Gross return per hectare	X_5 = Cost of irrigation per hectare
X_1 = Cost of land preparation per hectare	X_6 = Cost of labor(man days) per hectare
X_2 = Cost of Sucker per hectare	U_i = Error term
X_3= Cost of fertilizer per hectare	a =Intercept
X_4 = Cost of insecticides / pesticides per hectare	$b_1 b_2 ... ... b_6$ = Coefficients of respective variables

$$Y = a x_1{}^{b_1} x_2{}^{b2} x_3{}^{b3} x_4{}^{b4} x_5{}^{b5} x_6{}^{b6} e^{u_i} \quad (1)$$

By taking log on both sides Cobb-Douglas production functions written as

$$lny = lna + b_1 lnx_1 + b_2 lnx_2 + b_3 lnx_3 + b_4 lnx_4 + b_5 lnx_5 + b_6 lnx_6 + u_i \quad (2)$$

Table 3. *Analysis of cost and returns of banana production by farmers:*

	Particulars	Price (Tk./Hectare)
Fixed Cost	Land value	56000
	Interest on working capital @12%	15600
	a. Total fixed cost	71600
Variable cost	Land preparation	13067
	Sucker	3632
	Irrigation	7301

	Fertilizer		9500
	Pesticide		2246
		Planting	6901
		Weeding	9500
Labor cost	Desuckering		3245
		Deflowering	3245
		Stalking	7270
Total labor cost			30161
b. Total variable cost			65907
c. Total cost [a + b]			137507
d. Revenue			192509
e. By product			0.000
f. Total revenue [d + e]			192509
g. Net profit [f - c]			55002
h. Gross margin (GM)[f - b]			126602
i. Benefit cost ratio (BCR) [f / c]			1.40

Source: Calculated from primary data

3. Results and Discussion

3.1. Total Variable Cost

Labor cost includes the cost of planting, desuckering, deflowering, weeding and stalking etc. It's a combination of family labor and hired labor. On an average per hectare human labor was Tk. 30161. Number of labor man day depends on the financial condition of the farmer. Farmer used power tiller from land preparation. Land preparation cost also includes driver labor cost and foil of power tiller. The land preparation cost was average 13067 taka per hectare. Per hectare cost of sucker for banana production was Tk. 3632 on an average, per sucker cost Tk. 5 approximately. There are different types of fertilizer such as Urea, Triple Super Phosphate (TSP), Muriate of potash (MP). In this study, total cost of fertilizer was average Tk. 9500. Irrigation is a leading input in producing banana. From this study it is observed that, cost of irrigation was average Tk. 7301. Irrigation was given average on an two times in their field. Irrigation cost consisted of fuel and payment for use of machine. Most of the banana producers used insecticide, such as diazinon, Sobicrne, Tilt, Oczin and Liquid insecticide. The cost of insecticide computed on the basis of bottle / packet used by the farmers. Total cost of insecticide was average Tk. 2246 per hectare. Total variable cost was estimated adding all the variable cost such as labor cost, land preparation, cost of sucker, cost of irrigation, cost of insecticide etc. From this study it was observed that total variable cost was Tk. 65905 per hectare.

3.2. Total Fixed Cost

The cost of land depends on location topography and fertility of the plots. In this study, valuation of land as its rental price considered the method of estimate the land value. Land cost of banana cultivation was estimated considering land used over a production period for 1 year. From this study per hectare land value for banana cultivation was average Tk. 56000 per hectare. Total fixed cost was the summation of all fixed cost which was family labor cost, land value cost and interest on operating capital. Total fixed cost for banana production was Tk. 71600 per hectare. The amount of money needed to meet the express on hired or purchase inputs was treated as operating cost. The average interest rate per annual was varying from bank to bank but in this study we already consider 12% interest rate. It is observed that interest rate on operating capital was Tk. 15600 per hectare.

3.3. Total Cost

Total cost was the summation of all fixed cost and variable cost. In this study, total cost was Tk. 137507 per hectare.

Gross margin, return and profit

Per hectare gross margin of banana production was average Tk. 126602.8, per hectare gross return of banana production was average Tk. 192509.8, per hectare benefit cost ratio of banana production was 1.4.

Table 4. *Analysis of cost, returns and benefit cost ratio (BCR) of banana production by wholesalers*

Items	Wholesaler (Tk. /Chari.)
a) Buy	182.50
b) Transport	12.12
c) Others	5
d) Total cost[a + b + c]	195.62
e) Return	254.70
f) By product	0.00
g) Total return [e + f]	254.70
h) Profit[g - d]	59.08
i) Benefit cost ratio (BCR) [g / d]	1.30

Source: Calculated from primary data

From this table 4 we observed that, on an average wholesalers buy banana from producers Tk. 182.50 per Chari. Total cost from wholesaler side was Tk. 195.62 where the share of transport cost was Tk. 12.12 per Chari and others that means personal expenses, security, electricity bill, mobile bill etc was average Tk. 5 per Chari. Total revenue from this sector was Tk. 254.70 per Chari, surprisingly in banana production there is no

income from by product. So, total profit was on an average Tk. 59.08 per Chari and Benefit Cost Ratio (BCR) was 1.30.

Table 5. Analysis of cost, returns and benefit cost ratio (BCR) of banana production by retailers

Items		Retailer(Tk./Chari)
a)	Buy	262.68
b)	Transport	18.00
c)	Others	12
d)	Total cost [a + b + c]	292.68
e)	Return	415.35
f)	By product	0.00
g)	Total return [e + f]	415.35
h)	Profit [g - d]	122.67
i)	Benefit cost ratio (BCR) [g / d]	1.41

Source: Calculated from primary data

From this table 5 we observed that, on an average retailer buy banana from wholesalers Tk. 262.68 Per Chari. Total cost from retailer side was Tk. 292.68 where the share of transport cost was Tk. 18.00 per Chari and others that mean personal expenses, security, electricity bill, mobile bill etc was average Tk. 12 per Chari. Total revenue from this sector was Tk. 415.35 per Chari, surprisingly in banana production there is no income from by product. So, total profit was on an average Tk. 122.67 per Chari and Benefit Cost Ratio (BCR) was 1.41.

Table 6. Parametric estimation of Cobb-Douglas production function.

Explanatory Variable	Coefficient	SE
Intercept	-1.834	5.441
Cost of Land preparation(Mechanical power) (X_1)	0.98**	0.327
Cost of Sucker (X_2)	1.21**	0.231
Cost of Fertilizer(X_3)	0.75	0.354
Cost of Insecticides / pesticides(X_4)	0.63**	0.265
Cost of Irrigation(X_5)	-0.18	0.232
Cost of Labor (X_6)	-0.65**	0.174
R Square	0.82	
F-Value	9.56	

Source: Calculated from primary data
** indicates 5 % level of significance

The Cobb-Douglas model fitted the data quite well as indicated by F-Values and R-Square. The co-efficient of multiple determinations R2 was 0.82 for banana producers. The value of R2 means that means that the explanatory variables explained 82% of the variation in banana production. The contribution of specified factors affecting productivity of banana can be observed from the estimates of regression equation. In case of banana producers, the result show that the co-efficient of human labor, sucker, Insecticides and Land preparation (Mechanical power) was significant at 5% level. This implies that the variation in banana production mostly depends upon the explanatory variables included in the model.

The value of the production co-efficient for human labor was -0.65 for banana. The production co-efficient was negative. The negative sign indicates that return from banana can be increased by reducing human labor. The producers used higher amount of labor so if the cost of labor can be reduced then the production will be increased. The estimated co-efficient -0.65 revealed that 1% increase in human labor in the pre-harvesting period with other factors remaining constant, would decrease the gross return by 0.65% up to certain level. The value of production co-efficient for sucker was 1.21 for banana. The production co-efficient was positive. The positive sign indicates that return from banana can be increased by using sucker. The estimated co-efficient 1.21 revealed that 1% increase in sucker in the pre-harvesting period with other factors remaining constant, would increase the gross return by 1.21% up to certain level. The value of production co-efficient for Fertilizer was 0.75 for banana. The production co-efficient was positive. The positive sign indicates that return from banana can be increased by using Fertilizer. The estimated co-efficient revealed that 1% increase in fertilizer in the pre-harvesting period with other factors remaining constant, would increase the gross return by 0.75% up to certain level. The value of production co-efficient for TSP was 0.63 for banana. The production co-efficient was positive. The positive sign indicates that return from banana can be increased by using Insecticides / pesticides. The estimated co-efficient revealed that 1% increase in Insecticides / pesticides in the pre-harvesting period with other factors remaining constant, would increase the gross return by 0.63% up to certain level. The value of production co-efficient for irrigation was -0.18 for banana. The production co-efficient was negative. The producers used higher amount of irrigation and we know that the sucker cannot tolerate amount of water. So if the use of irrigation can be reduced then the production will be increased. The negative sign indicates that return from banana can be increase by reducing irrigation. The estimated co-efficient 0.18 revealed that 1% increased in irrigation the pre-harvesting period with other factors remaining constant, would decrease the gross return by 0.18% up to certain level. The value of production co-efficient for mechanical power was 0.98 for banana. The production co-efficient was positive. The positive sign indicates that return from banana can be increased by using mechanical power. The estimated co-efficient 1.07 revealed that 1% increase in mechanical power in the pre-harvesting period with other factors remaining constant, would increase the gross return by 0.98% up to certain level.
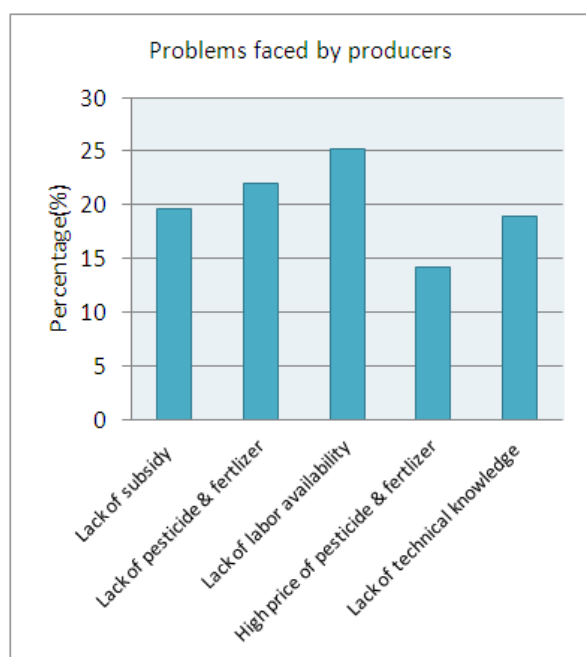
Figure 2. Problems faced by farmer in banana production

In this study area, 19.68% banana producer claimed that they did not get any subsidy from government side. They have to pay high interest rate on working capital. The necessary instruments which were required for banana production very high that is why it's really burden to bear expense of production. Fertilizer and pesticide were the most important inputs for banana production. Farmer s had used this several times in the field of production. Some traders made artificial crisis for high price so producers had to pay high price that were mentioned by 14.7% producers as a problem. Moreover, 25.19% banana producers reported that they had faced lack of labor availability in local area, so it is really tough to carry various inputs and outputs from market to field and field to market. In addition, 18.89% banana producers seemed that they were not aware of scientific knowledge and modern technology. They were mentioned that absence of improved weeding and fertilizer application practices as they had to employ large number of labors in these operations.

4. Conclusion

Despite of some limitations, the findings of the study confirm that the farmers can obtain positive net return from cultivation of banana. In the context of income generation and poverty alleviation, production of crop like banana may play a crucial   role in meeting the cash needs of the farmers. The findings of the study also revealed that the trading of banana is a profitable venture to different intermediaries. The profit of retailers was higher than that of other intermediaries and the profit was found reasonable. But the marketing efficiency was not good in the study area. The gap between the producer's price and consumer's price was huge and the producers do not get their reasonable price for their product, on the other hand the intermediaries especially the retailer's net marketing margin is high enough and ultimately the consumers are the main sufferer of this marketing system. For this reason, the Government should take an effective step to control the price system and price spread of the market and make sure that the producers can get their reasonable price and also the consumer can also get the product in a reasonable price. Measure should be taken to improve the knowledge of a farmer to the modern cultivation technique and encouraged them to adopt the new technology to increase the production. Banana is not only important source of nutrition but also an important source of cash income to producers and traders. Moreover, a large number of people were involved in the production and marketing of banana. So the farmers and intermediaries could be more benefited financially if production and marketing of banana are to be well expanded.

References

[1]   Anonymous, 2012. Statistics Year Book of Bangladesh, Bangladesh Bureau of Statistics, Ministry of Planning, Government of the people's Republic of Bangladesh, Dhaka.

[2]   Anonymous, 1969, United States Agency for International Development (USAID)

[3]   Basanta K. Barmon, Imrana Sharmin, Parvez K. Abbasi and Al Mamun(2012), Economics of Mushroom (Agaricus bisporus) Production in a Selected Upazila of Bangladesh, The Agriculturists 10 (2): 77-89

[4]   GOB 2008. Bangladesh Economic Review, Ministry of Planning, Government of the people's Republic of Bangladesh, Dhaka, Bangladesh, June, 2000

[5]   Haque, M.A. 1983. Some Technological Aspects for the commercial Production of Banana, National Symposium on Agricultural Research, 22-23 December, BARC, Dhaka.

[6]   Haque, M.A. 1984. Intercropping in Banana and its Economic Return, Bangladesh Journal of Agriculture, 9(3): 53-55.

[7]   Kamal, M.K. 1996. An economic Study on Banana Production in Some selected Areas of Joypurhat district.

[8]   Kohlas, R.L. 1972. Marketing of Agricultural Products. 4th edition, Macmillon Co., Newyork.

[9]   M. R., Kerutagi M. G., Patil B. L., Kanamadi V. C. and Bankar B. (2009) Comparative economic analysis of tissue culture banana and sucker propagated banana production in Karnataka, Karnataka J. Agric. Sci., 22(4): (810-815)

[10] Nargis, K. 1997. A Comparative Economic Study of Banana and Sugarcane Production in a Selected Area of Meherpur District.

[11] Octavio Damiani (2001), Organic agriculture in Costa Rica: The case of cacao and banana production in Talamanca, Office of Evaluation and Studies of the International Fund for Agricultural Development

[12] Roy, B. 1996. A Comparative Economic Analysis of Banana and Other Crops Production in an Area of Mymensingh District. An MS Thesis, Department of Agricultural Economics, BAU, Mymensingh.

[13] Subaiah, R.L Kohls, R.L., J.N. Uhl 1980. Intercropping of Banana with vegetables and Pulse Crops, Bangladesh Journal of Extension Education.

[14] S. C. Sarode (2009), Economics of banana marketing in Jalgaon district: An analysis across alternative channels, African Journal of Marketing Management Vol. 1(5) pp.128-132.