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PROFITABILITY OF GARLIC (*Allium sativum* L.) CULTIVATION IN SOME SELECTED AREAS OF BANGLADESH

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Abstract

The current production of garlic can't meet up the increasing demand of Bangladesh. Due to unknown reasons, the area and production of garlic have not been increased at desired level. Therefore, the study was conducted in Magura and Faridpur districts during 2008-2009 to analyze the relative profitability, input-output relationship, and constraints to garlic production. Primary data were collected from 100 randomly selected garlic farmers for the study. Per hectare costs of garlic cultivation were Tk. 65493 and Tk. 51747 on full cost and variable cost basis. The major share of total cost was human labour (30%) and seed (25%). The yield of garlic was 6.15 metric tons per hectare. The gross margin and net return were Tk. 70660 and Tk 56914 per hectare, respectively. The benefit cost ratio was 1.87. The net returns from garlic cultivation were 68%, 59%, and 0.64% higher than mustard, groundnut and cabbage cultivation. Cobb-Douglas production function revealed that human labour, land preparation cost, manure, TSP, irrigation and insecticide had positive effect on the yield of garlic. Non-availability of HYV garlic seed, lack of technical knowledge about improved cultivation practices of garlic, infestation of insects and diseases and low market price were the major problems for garlic cultivation.

Keywords: Garlic, input use, profitability, gross margin, net return, BCR.

Introduction

Garlic (*Allium sativum* L.) is an important spices crop in Bangladesh. Among the bulb spices, garlic ranks third in terms of area (37072 ha) and production (164392 m. ton) covered 7 percent of the total area under spices. The average yield of garlic was 4.43 metric tons per hectare (BBS, 2010). Garlic is generally cultivated with traditional method. Production of garlic is increasing day by day in Bangladesh. Table 1 reveals that the highest growth in area, production, and yield were registered in Rajshahi division followed by that of Khulna division. But due to increase in population, garlic production of the country does not meet up the domestic demand. There is an acute shortage of garlic in relation to its requirement. Every year, Bangladesh imports big amounts of garlic from neighbouring country and others to meet up the demand of its population. Due to

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limitation of land, it is not possible to increase the area and production of this crop horizontally. The high demand of garlic can only be met by increasing yield. The farm level yield of garlic is very low compared to their recommended yield.

Table 1. Area, production and yield of garlic in Bangladesh, 1990-2009.

Regions	Area (ac)	Production (mt)	Yield (t/ac)
Barisal	1.9***	0.6 ^{ns}	-1.4***
Chittagong	0.7***	1.1**	0.4 ^{ns}
Dhaka	3.0***	3.4***	0.4 ^{ns}
Khulna	4.5***	6.9***	2.4***
Rajshahi	12.2***	14.7***	2.5***
Sylhet	-3.3**	-2.8**	0.5 ^{ns}
Rangpur	3.5***	5.0***	1.3**
Bangladesh	5.1***	7.4***	2.3***

Note: '***'; '**' and '*' represent 1%, 5% and 10% level of significant

Usually farmers followed different levels of production inputs and management depending upon their infrastructural facility and socio- economic conditions which ultimately results variability in yields. Therefore, the present study was undertaken with the following objectives:

i. To identify the existing agronomic practices of garlic cultivation;

ii. To estimate the profitability level of garlic cultivation;

iii. To measure the relative profitability of garlic cultivation with major competing crops;

iv. To determine the input-output relationship of garlic cultivation, and

v. To find out the socio-economic constraints to its higher production.

Materials and Method

Sampling technique: A multi-stage sampling technique was followed in this study to select study areas and sample farmers. In first stage of sampling, two garlic growing districts, namely Mugara and Faridpur were selected purposively. In the second stage, one Upazila was selected from each district for sample survey. Shalikha Upazila under Mugara district and Shadorpur Upazila under Faridpur district were purposively selected for the study based on the extensive garlic cultivation area. In the third stage, a complete list of garlic growers were collected from each Upazila and finally a total of 100 garlic farmers taking 50 farmers from each Upazila were selected by random sampling technique.

In order to compare the benefit of garlic cultivation with other existing competing crops like mustard, groundnut, and cabbage for garlic were selected. The competitive crops were selected on the basis of same soil and land type of garlic cultivation in the study areas.

Method of data collection: Data for the present study were collected from sample garlic farmers through face to face interview method using a pre-tested interview schedule. Field level data were colleted by the researcher with the help of trained enumerators during the month of April and May 2009.

Analytical techniques

Both descriptive and functional analyses were done in this study. These analytical techniques are discussed below:

Descriptive analysis: Both fixed cost and variable cost were taken into account in calculating the cost of garlic cultivation. Land use cost was calculated on the basis of per year existing lease value of land. The profitability of garlic cultivation was examined on the basis of gross margin, net return, and benefit cost analysis. The collected data were edited, summarized, tabulated, and analyzed to fulfill the objectives of the study. Tabular method using descriptive statistics was mostly used in the study.

Functional analyses: Cobb-Douglas production function model was used to estimate the contribution of factors to garlic cultivation. The functional form of the Cobb-Douglas production function model is given below:

$$Y = AX_1^{b1}X_2^{b2} \text{ ---------- } X_n^{bn}e^{ui}$$

The production function was linearized by transforming it into the following logarithmic form:

$$\log Y = \log a + b_1 \log X_1 + \ldots\ldots\ldots\ldots + b_n \log X_n + U_i$$

The empirical production function was the following:

$$\log Y = \log a + b_1 \log X_1 + b_2 \text{Log} X_2 + b_3 \log X_3 + b_4 \log X_4 + b_5 \log X_5 + b_6 \log X_6 + b_7 \log X_7 + b_8 \log X_8 + b_9 \log X_{9+} U_i.$$

Where, Y = Yield of garlic (kg/ha)
X_1 = Human labour (Man-day/ha)
X_2 = Land preparation cost (Tk/ha)
X_3 = Seed (kg/ha)
X_4 = Manure (Kg/ha)
X_5 = Urea (kg/ha)
X_6 = TSP (kg/ha)
X_7 = MoP (kg/ha)

X_8 = Irrigation cost (Tk/ha)
X_9 = Insecticide cost (Tk/ha)
a = Intercept
b_1, b_2 ---------- b_9 = Coefficients of the respective variables
U_i = Error term.

Results and Discussion

Agronomic practices

It was revealed from Table 2 that the average number of ploughings and ladderings per farm were 4.6 and 4.2, respectively. In the study areas, 100% farmers planted garlic seed in line. The planting time of garlic ranged from 4th week of October to 3rd week of November. The average number of weedings, spraying insecticides, and irrigation per farm was 2.5, 0.64, and 2.7, respectively. The harvesting time was started from 2nd week of March and continued up to Ist week of April. The farmers in the study areas used different local varieties of garlic seed such as Rovpuri, Gonggajoli, Vinnapothi, respectively.

Table 2. Agronomic practices of garlic cultivation in two districts.

Items	Magura	Faridpur	All areas
Ploughing (no./farm)	4.7	4.6	4.6
Laddering (no. /farm)	4.5	4.0	4.2
Sowing method (% of farmer):			
Line	100	100	100
Sowing time :	4th week of Oct. to 4th week of Nov.	3rd week of Oct. to 3rd week of Nov.	4th week of Oct. to 3rd week of Nov.
Weeding (no./farm)	3.0	2.0	2.5
Urea top dressing (no./farm)	2.0	2.0	2.0
Spraying Insecticides (no./farm)	0.80	0.50	0.65
Irrigation (no./farm)	2.5	3.0	2.7
Harvesting time:	2nd week of March to Ist week of April	4th week of Feb. to Ist week of April	2nd week of March to Ist week of April
Variety used (% of farmer)			
Local	100	100	100

Input use pattern

The human labour required for producing garlic was 158 man-days per hectare (Table 3). It was found that 100% garlic growers planted their seeds in line. The

average quantities of seed used by the farmers were 382 kg per hectare. The average quantity of cowdung was 4379 kg per hectare. The average quantity of urea, TSP, and MoP were 156, 128, and 74 kg per hectare, respectively. The use of urea and MP at farm level were lower than the recommended doses of urea and MP (201-265 kg/ha and 202-267 kg/ha). The quantity of TSP was equal to the recommended doses (102-132 kg/ha) (BARC, 2005). The application of urea was found higher in Faridpur (160 kg/ha) than that of Magura (152 kg/ha), while same trend was observed in the application of TSP and MP.

Table 3. Input use pattern of garlic cultivation in two districts.

Items	Magura	Faridpur	All areas
Human labour (man-days/ha):	165	152	158
Family	75	53	64
Hired	90	99	94
Land preparation cost (Tk./ha) :	6490	4820	5655
Seed (kg/ha)	369	396	382
Owned	134	-	67
Purchased	235	396	315
Manures (kg/ha)	5441	3317	4379
Fertilizers (kg/ha) :			
Urea	152	160	156
TSP	122	135	128
MP	62	86	74

Cost and return of garlic cultivation

The cost of garlic cultivation included different variables and fixed costs. The cost of human labour, land preparation, seed, manures, fertilizers, insecticides, irrigation, interest on operating capital, and land use, etc. were calculated on per hectare basis. Per hectare costs of garlic cultivation were Tk. 65493 and Tk. 51747 on full cost and variable cost basis, respectively. The major share of total cost was human labour (30%) and seed (25%). The cost of cultivation of garlic was found higher in Magura (Tk 68910/ha) than in Faridpur (Tk 62077/ha) due to higher cost of human labour, land preparation, seed, fertilizers, irrigation, and insecticides cost etc. (Table 4).

The yield of garlic was 6157 kg per hectare. The yield was found higher in Faridpur (6416 kg/ha) than in Magura (5897 kg/ha) due to better land preparation and good soil condition. Gross return from garlic cultivation was Tk. 122407 per hectare. The gross return was found higher in Faridpur (Tk. 128320/ha) than in Magura (Tk. 116494 /ha) due to higher yield and price of product. The net return

of garlic cultivation was Tk. 56914 per hectare. The net return was found higher in Faridpur than in Magura due to higher gross return. The benefit cost ratio of garlic cultivation was 1.87 (Table 5). The cost of garlic cultivation was 48%, 51%, and 4% higher than mustard, groundnut, and cabbage cultivation, respectively (Table 7). The net returns from garlic cultivation were 68%, 59%, and 0.64% higher than mustard, groundnut, and cabbage cultivation.

Table 4. Cost of cultivation of garlic in two districts.

Figures (Tk./ha)

Items	Magura	Faridpur	All areas
A. Variable cost	53298 (77)	50197 (81)	51747 (80)
Hired labour	11250 (16)	12870 (21)	12060 (19)
Land preparation cost	6490 (9)	4820 (8)	5655 (9)
Seed	17017 (25)	15618 (25)	16317 (25)
Own	6329	-	3164
Purchased	10688	15618	13153
Manure	1924 (3)	1970 (3)	1947 (3)
Fertilizers	6159 (9)	6454 (10)	6306 (10)
Urea	991	960	975
TSP	3660	3645	3653
MP	1508	1849	1678
Insecticides	968 (1)	683 (1)	826 (1)
Irrigation	7684 (11)	5851 (10)	6768 (10)
Interest on operating capital	1806 (3)	1931 (3)	1968 (3)
B. Fixed cost	15612 (23)	11880 (19)	13746 (21)
Family labour	9375 (14)	6890 (11)	8132 (11)
Land use cost	6237 (9)	4990 (8)	5614 (9)
C. Total cost (A+B)	68910 (100)	62077 (100)	65493 (100)

Garlic seed price Tk 42.71/kg

Figures within the parentheses indicates percentage of total cost

Table 5. Profitability of garlic cultivation in two districts.

Items	Magura	Faridpur	All areas
Total Variable cost (Tk./ha)	53298	50197	51747
Total cost (Tk./ha)	68910	62077	65493
Yield (kg/ha)	5897	6416	6157
Price (Tk./kg)	19.77	20.00	19.88
Gross return (Tk./ha)	116494	128320	122407
Gross margin (Tk./ha)	63196	78123	70660
Net return (Tk./ha)	47584	66243	56914
Benefit cost ratio over total cost	1.69	2.07	1.87

Table 6. Cost and return of different competing crops of garlic,

(Figures in Tk./ha)

Items	Mustard	Groundnut	Cabbage
A. Variable cost	14582	20775	37449
Hired labour	4969	3000	6444
Land preparation	2915	3151	2567
Seed/seedling	552	3639	12526
Manures	762	199	1465
Fertilizers	3700	6148	8063
Pesticides	88	1095	1250
Irrigation	1291	3385	4490
Int. on operating capital	305	357	644
B. Fixed cost	19530	11500	25563
Family labour	2500	6500	17063
Land use	17030	5000	8500
C. Total cost (A+B)	34112	32474	63012
Yield (kg/ha)	979	1982	-
Price (Tk/kg)	53.44	28.00	-
D. Gross return	52327	55496	119558
Gross margin (D-A)	37745	34721	82109
Net return (D-C)	18215	23022	56546
Benefit cost ratio (D/C)	1.53	1.71	1.90

Table 7. Relative economic performance of garlic with other competitive crops.

Figure inTk./ha

Items	Garlic	Mustard		Ground nut		Cabbage	
	Cost/ Return	Cost/ Return	% higher /lower with garlic	Cost/ return	% higher /lower with garlic	Cost/ Return	% higher /lower with garlic
Gross return	122407	52327	+ 57	55496	+55	119558	+2
Total variable cost	51747	14582	+ 72	20775	+60	37449	+28
Total cost	65493	34112	+ 48	32275	+51	63012	+4
Gross margin	70660	37745	+ 47	34721	+51	82109	+16
Net return	56914	18215	+ 68	23221	+59	56546	0.64
Benefit cost ratio	1.87	1.53	+ 18	1.71	+5	1.90	-2

Factors affecting garlic yield

In order to determine the contribution of some inputs like human labour, land preparation cost, manures, urea, TSP, MP, irrigation, insecticides, etc. for garlic cultivation. The estimated values of co-efficient and their statistics of production function were presented in Table 8. It is clear from the model that most of the co-efficient had positive sign except urea and MP which are significant at 1%, 1%, and 10% level, indicating that the production of garlic decrease with higher use of urea and lower use of MP keeping other factors constant. This may be due to the fact that for the production of garlic, farmers use more urea and lower level of MP than the recommended doses. The coefficient of human labour, land preparation, manure, TSP, irrigation, and insecticides' cost were positive and significant at 1% and 5% level. It implies that human labour, land preparation cost, manure, TSP, irrigation, and insecticide had positive effect on the yield of garlic.

Table 8. Estimated coefficients and their related statistics of production function for garlic.

Explanatory Variables	Co-efficient	t-value
Intercept	0.99***	571.93
Human labour(X_1)	0.01***	6.11
Land preparation cost (X_2)	0.003***	2.33
Seed(X_3)	0.001ns	1.02
Manure (X_4)	0.0001***	2.84
Urea (X_5)	-0.007***	-4.20
TSP (X_6)	0.001***	4.04
MP (X_7)	-0.0007*	-1.84
Irrigation (X_8)	0.001**	1.93
Insecticides (X_9)	0.0007***	12.60
R^2	0.67	
F value	38.23***	

Table 9. Constraints to garlic cultivation in two districts

Constraints	Rank value		
	Magura	Faridpur	All areas
1. Non- availability of HYV seed at proper time	1	1	1
2. Lack of technical knowledge about improved cultivation practices	2	2	2
3. Infestation of insects and diseases	3	3	3
4. Low market price	4	4	4

The value of the coefficient of determination (R^2) was 0.67 which indicates that around 67% of the variation in yield was explained by the independent variables included in the model. F-value was found 38.23 which were significant at 1% level implying that the variation depends mainly on the explanatory variables included in the model.

Problems of garlic cultivation

The respondent farmers were asked about the problems of garlic cultivation. In this regard, more than one answer was given by the respondents. The answer was arranged in rank value. It was observed that non-availability of HYV seed at proper time was the first ranked constraint to garlic production followed by lack of technical knowledge about improved cultivation practices, infestation of insects and diseases, and low market price of garlic (Table 9).

Conclusions and Recommendations

Based on the findings, it can be concluded that garlic is profitable crop on the basis of its return to investment. Among the competitive crops like mustard, groundnut, and cabbage, the highest net return was obtained from garlic cultivation, human labour, land preparation cost, manure, TSP, irrigation, and insecticide had positive effect on the yield of garlic. Non-availability of HYV seed at proper time, lack of technical knowledge, infestation of insects and diseases and low market price were the major problems of garlic cultivation. Based on the findings of the study the following recommendations were undertaken for the improvement of garlic cultivation:

- High yielding varieties of garlic seed should be made available to the farmers' level at proper time. For these reason, Government should encourage BARI scientists to develop HYV seed of garlic.
- Farmers training on garlic cultivation should be organized by government and non-government organizations to develop technical knowledge of the farmers about improved cultivation practices of garlic.
- Local garlic market is controlled by some fraudulent traders. As a result, the farmers did not get fair price of their product. Therefore, Government should take necessary steps against those types of traders and the existing market monitoring mechanism should be strengthened.
- More intensive research should be undertaken by the BARI scientists to develop disease and insect-pest resistant seed in the near future.

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