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Present Status and Potentiality of Onion Production in Bangladesh

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Abstract

Onion is one of the most important spices as well as vegetable crops widely grown and consumed almost all over the country. The study was conducted to generate information of present status, profitability and potentiality of onion production in Bangladesh. The average yield of onion was about 9985 kg/ha. Introducing improved varieties of onion to the farmers' field, yield has started to increase since 2002-03. Estimated total cost of production was Tk.118495/ha of which 88 and 12 percent were variable and fixed cost, respectively. Onion growers received on an average Tk.99670/ha as net return. The benefit cost ratio (1.74) indicates that onion cultivation was profitable. The magnitudes of the co-efficient of onion imply that farm size, seed, inorganic fertilizer, organic fertilizer, age, education and training of farmer are positive and significant in the Cobb-Douglas stochastic frontier for all farm categories indicating that the above variables increased the onion production significantly. The study also shows that there is a huge potentiality to increase yield by 26-33% by using recommended technology. With the mitigation of shortfall of onion, dissemination of improved varieties and extension of on-going credit program to the spices farmers (2% interest), onion production will be increased by 2-3 times and could meet up the demand of the country.

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I. Introduction

Flavoring food and making it tasty by adding different plant parts during cooking or making paste or salad is a very common practice almost everywhere in the world. Spices are the symbol for aristocracy, health, tonic, immunity, vigor and stimuli. The people of Bangladesh cannot think of a meal without the use of spice. It can increase the farmers' income, generate employment, alleviate poverty, ensure food security, empower women, and increase social development of Bangladesh. On the basis of area, yield, demand and availability, spices are divided into three categories viz. major, minor and exotic. Major spices are regularly used in daily diet in large amount such as onion, garlic, chilli, turmeric and ginger. Minor spices are used in small scale in special items of food. These are coriander, fenugreek, black cumin, fenel, black pepper, dil, Joan etc. On the other hand, exotic spices, such as cumin, cardamom, cinnamon, clove, nutmeg, pistachio etc., are imported from outside the country. Among the major spices, people largely consume onion and its requirement per capita per day is 25 g (Spices Experts 2005).

Onion is one of the most important commercial spice crops of Bangladesh grown and consumed almost all over the country. It is widely grown in winter season. Onion is used as spice as well as vegetable in various ways in all curries, fried, boiled, baked and for other purposes. It adds flavour of distinctive pungent and has medicinal values also. It is semi perishable in nature. Onion stands first among the spice crops grown in the country both in area (1.25 lac ha) and production (8.89 lac metric tonnes) (BBS 2009).

The yield (7.11 t/ha) of onion is very low in Bangladesh as compared to other countries like Korea (57 t/ha), USA (55.88 t/ha), Spain (47.55 t/ha), Chile (48.50 t/ha), Japan (47.55t/ha) and India (13.20 t/ha) (Shukla 2009). Such low yield is possibly due to practicing traditional method and cultivating local varieties of onion. Accordingly, acreage production of onion is very low in Bangladesh. However, the trend of productivity has been increasing after 2003-04, which is shown in Figure 1.

Figure 1. Yield trend of onion during 1994-95 to 2007-08

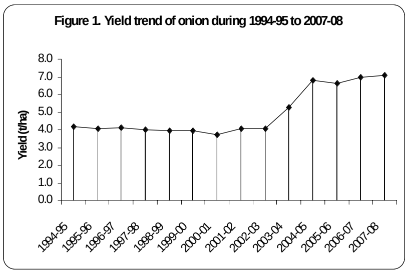
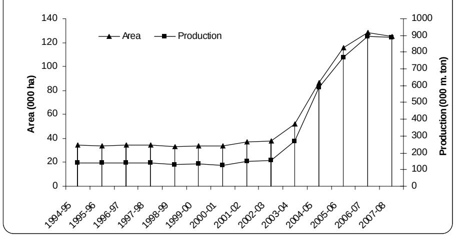


Figure 2. Area and production trend of onion during 1994-95 to 2007-08



The trend of growing area and production of onion is increasing day by day because of introducing new improved varieties, which has brought higher income to the farmer (Figure 2). The area under onion cultivation increased from 34 thousand hectares in 1994-95 to 1.25 lac hectare in 2007-08. On the other hand, production increased from 1.41 lac mt in 1994-95 to 8.89 lac mt in 2007-08 (BBS 2009).

Bangladesh requires about 1.46 million tonnes of onion per year, but it produces only 0.89 million tonnes and the rest of the onion are imported mainly from India, for which about Tk.2122 to 3000 million are spent per year (BBS 2008). This shortage is mainly due to low productivity, seasonality of onion production and higher storage losses (29.34%) (Hassan *et. al.* 2011). Its higher demand, scarcity and higher price sometimes create political unrest in the country. Moreover, it is possible to produce large amount of onion bulb which might assure to fulfill the requirement of the country's demand.

Realizing the importance of onion, Bangladesh government established Spices Research Centre (SRC) in 1994 under Bangladesh Agricultural Research Institute (BARI) for increasing the production of onion throughout the country. SRC has been working on spices research and development from 1995-1996. It has already released five improved onion varieties along with two summer onion varieties namely BARI Piaz 2 and BARI Piaz 3 in April, 2000. Many studies have been done in onion production and varietal improvement aspect. But no study of this nature has been conducted before. Keeping this in view, the present study was undertaken to analyze the present status, profitability and potentiality of onion production in Bangladesh.

II. Methodology and Analytical Techniques Used

A multi stage sampling technique was followed to select sample farmers for the study. In the first stage of sampling, three important onion growing upazilas, namely Durgapur of Rajshahi, Sadarpur of Faridpur and Sujanagar of Pabna district were selected on the basis of concentration of onion production. In the second stage, one union from each upazila, familiar for maximum production of onion, was purposively selected. Before selecting the sample farmers, a complete list of all onion growers in each union was prepared with the help of Sub Asst. Agriculture Officer of Directorate of Agricultural Extension (DAE). Finally, a total of 180 farmers from three districts who commercially produced onion were selected randomly, of which small, medium and large farmers were 100, 60 and 20, respectively. The necessary information was collected with the help of pretested interview schedule using direct interview in 2009-10 production period. Depending on farm size, farmers were categorized as small, medium and large farmers. Land use cost was calculated on the basis of per year rental value of land. The collected data were analyzed to achieve the objectives of the study. Tabular and statistical methods were followed in analyzing the result of the study.

Profitability Analysis

In profitability analysis of onion, gross return as well as net return, and benefit cost ratio were calculated. Gross return was calculated by multiplying the total amount of product by the respective price. Total cost was calculated by the summation of cost of human labour, draft power and power tiller, seed, manure, fertilizer, irrigation, pesticides/fungicide, interest on operating capital and land use cost. Gross margin was calculated by subtracting variable cost from gross return. Net return was calculated by deducting total cost from the gross return.

Resource Use Efficiency by Cobb-Douglas Stochastic Frontier Production Function

Specification of Production Model

The Cobb-Douglas stochastic frontier production function was used to analyze productivity and resource use efficiency of onion production. The functional form of stochastic frontier is as follows

$$Y = \beta_0 X1^{\beta 1} X_2^{\beta_2} \ldots\ldots\ldots X_9^{\beta_9} e^{V_i - U_i}$$

The above function is linearised double-log form:

$$\text{In}Y = \ln\beta 0 + \beta_1 \text{In}X_1 + \beta_2 \text{In}X_2 + \beta_3 \text{In}X_3 + \beta_4 \text{In}X_4 + \beta_5 \text{In}X_5 + \beta_6 \text{In}X_6 + \beta_7 \text{In}X_7 + \beta_8 \text{In}X_8 + \beta_8 \text{In}X_8 + V_i - U_i$$

Where

Y = Output (kg), X_1= Farm size (decimal), X_2 = Seed (kg), X_3 = Inorganic fertilizer (Kg), X_4= Organic fertilizer (Kg), x_5 = Cost of power tiller and draft power(Tk.), X_6 = Farmer’s age (year), X_7 = Farmer’s education (year of schooling), X_8 = Farmer’s experience (year),X_9 = Farmer’s training (Dummy variable which receives 1 if the operator had training and receives 0 if he did not have any training)

Technical Inefficiency Effect Model

$U_i = \delta_0 + \delta_1$ Farm size + δ_2 Age + δ_3 Education + δ_4 Experience + δ_5 Training + W_i

Farm size is the total cultivable land under farm household. V is two sided uniform random variable beyond the control of farmer having N $(0,\sigma^2_V)$ distribution, U is one sided technical inefficiency effect under the control of farmer having a positive half normal distribution ($U \sim |N(0,\sigma^2_u)|$) and W_i is two sided uniform random variable. The model was estimated simultaneously using frontier package 4.1c.

The ?- and ?- coefficients are unknown parameters to be estimated together with the variance parameters which are expressed in terms of

$$\sigma^2 = \sigma^2_u + \sigma^2_v$$

and

$$\gamma = \sigma^2_u / \sigma^2$$

where γ parameter has value between zero and one.

Some null hypotheses are tested in relation to the estimation of stochastic production frontier and technical inefficiency effect model, such as the inefficiency effects are not present, H_0: $\gamma = \delta_0 = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$; the inefficiency effects are not stochastic, H_0: $\gamma = 0$; and the coefficients of the variables in the model for the inefficiency effects are zero, H_0: $\gamma = \delta_1 = \delta_2 = \delta_3 = \delta_4 = \delta_5 = 0$. The above null hypotheses are tested using the generalized likelihood ratio (LR) test and it is calculated as

$$LR = -2\{\ln[L(H_0)/L(H_1)]\}$$

$$= -2\{\ln[L(H_0)] - \ln[L(H_1)]\}$$

where $L(H_0)$ and $L(H_1)$ are the values of the likelihood function under the null and alternative hypotheses, H_0 and H_1, respectively.

The technical efficiency of the ith farmer can be shown to be equal to

$$TE_i = \frac{\text{Observed output}}{\text{Maximum attainable output}}$$

$$= \exp.(-u_i)$$

$$= \exp.[-E\{u_i/(v_i-u_i)\}]$$

$$= 1 - E\{u_i/(v_i-u_i)\}$$

The mean technical efficiency can be defined by

Mean TE. $=E[\exp.[-E\{u_i/(v_i-u_i)\}]\ ]=E[1- E\{\ u_i/(v_i-u_i)\}]$

Elasticity of Production and Returns to Scale

The estimated co-efficient of the regression equation indicates the elasticity of production for the different inputs used. The elasticity co-efficient (Ep) is defined as

$$EPx_i = (dY/Y)/\ (dX_i\ /X_i)$$

$$=(dY/dX_i)\ .\ X_i\ /Y$$

Where Y= output/ gross return, X_i = Different variable inputs (i= 1, 2, 3...8).

The summation of the elasticity co-efficient gives the returns to scale of production function. The returns to scale describe the responsiveness of the output to proportionate increases in all inputs. In this model, it is defined as $\Sigma\beta i = \beta_1+\beta_2+\beta_3+ \beta_4+\beta_5+ \beta_6+\beta_7+\beta_8+ \beta_9$

III. Present Status and Profitability of Onion Production

Cost of Production

The yield of onion is influenced by a number of environmental factors, including the cultural practices (Khan *et al.,* 2003). Different types of cultural management like ploughing, laddering, weeding, top dressing, spraying of insecticides and fungicides and irrigation are generally adopted by farmers for the cultivation of onion.

The cost of production includes both variable costs like human labour, ploughing and laddering, seed, manure, organic and inorganic fertilizer, irrigation and pesticides/fungicides, interest on operating capital and fixed costs like land use cost (Table 1). Total cost of production of onion grower was estimated Tk. 118495/ha, of which variable cost and fixed cost shared 88 and 12 percent, respectively. The total cost was higher for small farmer (Tk. 124639/ha) than those of medium (Tk. 111782/ha) and large farmer (Tk. 96584/ha) due to use of more labour, fertilizer and irrigation to cultivate onion. The variable cost was also higher for small farmer (Tk. 110996/ha) compared to medium (Tk.98114/ha) and large (Tk. 83190/ha). The fixed cost was more or less same for all farm groups. Human labour cost was the highest for onion bulb production in all categories of farmers. It constituted 43, 40 and 40 percent of the total cost for small, medium and large farmers, respectively. Other variable costs like draft power and power tiller, seed/seedling, organic fertilizer, inorganic fertilizer, pesticide/fungicide and irrigation cost were 7, 8, 3, 15, 4, and 10 percent, respectively, for all farmers.

Table 1: Total cost of producing onion Tk/ha)

Cost items	Small farmers n=100	Medium farmers n=60	Large farmers n=20	All farmers n=180
A. Variable cost				
Labour	53720 (43)	45050 (40)	39100 (40)	49640 (42)
Draft power and power tiller	8812 (7)	8184 (7)	4325 (4)	8386 (7)
Seed	7542 (6)	11860 (11)	5878 (6)	8970 (8)
Fertilizer				
Organic	2770 (2)	4025 (4)	6135 (6)	3401 (3)
Inorganic	19466 (16)	15336 (14)	12845 (13)	17693 (15)
Pesticide/fungicide	5260 (4)	4678 (4)	8514 (9)	5219 (4)
Irrigation	13426 (11)	8981 (8)	6393 (7)	11519 (10)
Total variable cost	110996 (89)	98114 (88)	83190 (86)	104828 (88)
B. Fixed cost				
Land use cost	12163 (10)	12360 (11)	12285 (13)	12269 (10)
Interest on operating capital (@ of 8% for 4 months)	1480 (1)	1308 (1)	1109 (1)	1398 (1)
Total fixed cost	13643 (11)	13668 (12)	13394 (14)	13667 (12)
Total cost (A+B)	124639 (100)	111782 (100)	96584 100)	118495 (100)

Note: Figures within parentheses indicate percentages of total cost

Returns from Onion Bulb Production

In general, return comes from sale of onion bulb. After harvesting, farmer usually graded onion bulbs in three categories - multiple bulb, single bulb and seed bulb. The farmer used to sell multiple bulbs after harvesting due to shortage of capacity. Single bulb are stored and sold in peak period. Seed bulb are kept in storage and sold in planting season. The average yield of onion was 9985 kg/ha (Table 2). The small farmers received a higher yield of 10717 kg/ha as compared to medium (9850 kg/ha) and large farmer (8890 Kg/ha) because of practicing intensive use of labour, fertilizer and irrigation. Considering all categories of farmers, the farmer received on an average Tk.205896/ha as gross return (Table 2). The gross return was the highest for small farmers (Tk.218989/ha) than those of medium (Tk.189880/ha) and large farmers (Tk.164129/ha) due to geting higher yield per unit of land. The net return was also the highest for small farmers (Tk.94350/ha) than those of medium (Tk.78098/ha) and large (Tk.67545/ha) farmers. Farmers obtained gross margin of Tk.99670/ha at the aggregate level. Estimated gross margin amounted Tk. 107993, 91766 and 80939 per hectare for small, medium and large farmers, respectively. The average undiscounted benefit cost ratio was 1.74, which was found to be the highest for small farmers (1.77) followed by medium (1.70) and large (1.69) farmers, respectively. That means, small, medium and large farmers received Tk. 1.77, 1.70 and 1.69 by spending Tk. 1.00 for onion cultivation, respectively.

Technological Gap and Potentiality

The technological gap (TG) in onion production represents the missing/lacking in the adoption of recommended technology (RT) by the farmers (Arya: 2003).

Table 2: Yield, return and yield gap of onion production

Items	Small farmers	Medium farmers	Large farmers	All farmers	Output range (Kg/ha)		Yield gap (%)
					RT	FT	
Bulb onion/ha (kg)	10717	9850	8890	9985	12000-16000	8890-10717	-(26-33)
Gross return/ha (Tk)	218989	189880	164129	205896	-	-	-
Total cost/ha (T k)	124639	111782	96584	118495	-	-	-
Gross margin/ha (Tk)	107993	91766	80939	99670	-	-	-
Net return/ha (Tk)	94350	78098	67545	87401	-	-	-
Benefit Cost Ratio (undiscounted)	1.77	1.70	1.69	1.74	-	-	-

Note: RT=Recommended technology, FT= Farmers technology, TG=Technological Gap (Percent), Market price varied Tk. 12-35/Kg

Secondly, potentiality means up to that level of production, which might be achieved if the farmers could have applied the recommended doses or amount of different inputs through improved culture and management. Apart from cereals, vegetables and horticultural crops, there are some farmers who came up and raised onion crop commercially in selected areas of Bangladesh. Table 2 depicted the scenario of yield gap and potentiality of onion production in Bangladesh. However, considering the production practices and inputs used for onion, it appears from Table 2 that there is a huge potentiality to increase yield (26-33%) and income of this crop by using recommended technology.

Resource Use Efficiency of Spices Production

Technical efficiency refers to the ability of a farm to produce the maximum possible output from a given set of inputs under certain production technology. A technically efficient firm will operate on its frontier production function. A firm is technically efficient if it produces on its outer-bound production function to obtain the maximum possible output which is feasible under the current production technology. Measuring efficiency is important because this is the first step in a process that might lead to substantial resource savings. These resource savings have important implications for both policy formulation and firm management. For individual firms, gains in efficiency are particularly important during the periods of financial stress. Efficient firms are more likely to generate higher incomes and thus stand a better chance of surviving and prospering.

The simultaneous maximum likelihood estimates for parameters of the Cobb-Douglas stochastic frontier production function and technical inefficiency effect model for onion production for small, medium and large, and all farms are presented in Table 3. For comparison purposes OLS estimates are also shown. The coefficient of farm size for all farms is 0.2994, which implies that a 1% increase in area results in 0.29% increase in output. The coefficients of seed, inorganic fertilizer, organic fertilizer, age and education are positive and significant in the Cobb-Douglas stochastic frontier for all farm categories implying that the above variables increase the onion production significantly. The coefficient of farming experience is positive and significant for only medium and large farm whereas the coefficient of training is positive and significant for all farms. The coefficient of the cost of power tiller and draft power is also positive but not significant. The coefficient of farming experience is negative and insignificant for small and all farms. Insignificant coefficient indicates no impact of the respective explanatory variable on the output. The quasi-function coefficients which are sum of all the coefficients except intercept term are, respectively, 1.33, 3.81 and 1.17 for small, medium and large, all farms for average C-D function and whereas they are, respectively, 1.69, 2.37 and 1.49 for the above farm categories for C-D frontier indicating that there is increasing returns to scale prevailing in the production process of onion.

The model is well fitted to the data ($F = 17.34^{**}$, 21.53^{**} and 47.42^{**}). In other words, we can say that specification of the model and inclusion of the various explanatory variables in the model are correct.

In the technical inefficiency effect model, farm size, experience and training have expected (negative) coefficients. The negative and significant coefficient of farm size for all farms implies that large farm households are technically more efficient than small farm households. The coefficients of age are positive and significant for small, and medium and large farms indicating that farmers with higher ages are more inefficient (or less efficient) than their younger counter parts.

The coefficient of training is negative and insignificant meaning that this factor has no impact on the technical inefficiency. The significant values of γ (gamma) indicate that there are significant technical inefficiency effects in the production of onion. Adjusted $R^2 = 0.83$, which indicates that 83 percent of total variation of onion production could be explained by all the explanatory variables included in the model.

IV. Conclusion and Recommendtaion

Onion production is cost effective and profitable for all categories of farmers. Since the production of onion is profitable, all the sample farmers produced onion commercially to earn higher economic return from these crops. In the recent past, areas of traditional varieties have begun to be replaced by introducing HYV of onion crops. As result, productivity of onion is increasing day by day. Though such condition of yield gap still prevails in the farmers' field, there is huge potentiality to increase yield and production of onion with the introduction of improved variety and better cultural management.

Following recommendations are made for improving technology and production of onion and increasing returns from onion:

- SRC, BARI should come forward to develop technologies and HYV of onion, which might be considered eco friendly and cost-effective, and would bring beneficial change to the farmers.
- Governments' on-going credit program to the spices farmers (2% interest) should be more effective so that the onion farmers could avail of this opportunity.
- Home-made storage facilities should be developed to avoid the storage loss and to keep the onion stored in good conditions.

Marketing system and marketing facilities should be promoted so that the spices farmers could receive fair and competitive price. In the time of harvesting the onion, import restriction should be imposed and that would help receive higher price for onion the farmers produced.

Table 3: Ordinary Least Squares (OLS) and Maximum Likelihood (ML) Estimates for parameters of Cobb-Douglas(C-D) Stochastic Frontier Production Function and Technical Inefficiency Model for all farmers of

Variables	Small farm		Medium & large farm		All farms	
	OLS Estimates (Std. error)	ML Estimates (Asymptotic Std. error)	OLS Estimates (Std. error)	ML Estimates (Asymptotic Std. error)	OLS Estimates (Std. error)	ML Estimates (Asymptotic Std. error)
Intercept	7.9899*	7.1256**	-8.9682*	-3.1148	3.3696**	3.7918**
	(1.4217)	(1.1419)	(5.3789)	(1.2737)	(0.6486)	(0.8180)
Farm size (X_1)	0.4322*	0.4677**	1.1850*	0.6966**	0.2994**	0.2479**
	(0.1156)	(0.1082)	(0.5627)	(0.12261)	(0.0692)	(0.0703)
Seed (X_2)	0.12425	0.1321**	0.4113**	0.1941**	0.5454**	0.5103**
	(0.0593)	(0.0510)	(0.1831)	(0.05677)	(0.0624)	(0.0622)
Inorganic	0.3437*	0.3185**	0.1655	0.4232**	0.0295*	0.0319*
fertilizer (X_3)	(0.0903)	(0.0795)	(0.5163)	(0.1216)	(0.0124)	(0.0126)
Organic	0.0336*	0.0259*	0.1936**	0.2274**	0.0765**	0.0672**
fertilizer(X_4)	(0.0151)	(0.0125)	(0.0430)	(0.0504)	(0.0232)	(0.0222)
Power tiller and	0.0270	0.04204	0.4790	0.1940	0.0265	0.0262
draft power (X_5)	(0.0867)	(0.0782)	(0.3114)	(0.0806)	(0.0355)	(0.0328)
Age of	0.3556*	0.6814**	1.3075**	0.0566**	0.2993*	0.3667**
farmer (X_6)	(0.1848)	(0.1761)	(0.1783)	(0.0152)	(0.1406)	(0.2008)
Education of	0.01656	0.0686**	0.3269	0.2812**	0.0226**	0.1132**
farmer (X_7)	(0.01411	(0.0185)	(0.5159)	(0.1057)	(0.0084)	(0.0171)
Farming	0.0011	-0.0364	0.2263	0.4668**	-0.0899	-0.0493
experience (X_8)	(0.0634)	(0.0705)	(0.6186)	(0.1134)	(0.0533)	(0.0736)
Training of	-	-	-0.4810	-0.1670	0.0759	0.3867*
farmer (X_9)			(0.2806)	(0.09132)	(0.1217)	(0.1959)
Function coefficient	1.3340	1.6998	3.8141	2.3729	1.17	1.49
Adjusted R^2	0.70	-	0.85	-	0.8250	-
F- value	17.34**	-	21.53**	-	47.42**	-
Technical Inefficiency Model						
Intercept	-	-3.0140	-	-2.4129	-	0.1882
		(1.1109)		(1.1339)		(0.5080)
Farm size	-	-0.0014	-	-0.0109	-	-0.0008*
		(0.0029)		(0.0518)		(0.0004)
Age of	-	0.03708**	-	0.2529*	-	0.0049
farmer		(0.01609)		(0.1233)		(0.1261)
Education	-	-0.2190**	-	-0.8004	-	0.0248
		(0.05027)		(0.2589)		(0.0345)
Experience	-	-0.0145	-	-0.0022	-	-0.0034
		(0.0133)		(0.0025)		(0.0142)
Training of	-	-	-	-0.1602	-	-3.0958
farmer(Dummy				(0.0589)		(2.5963)
Variance Parameters						
	0.1702	0.1960	-58.6953	1.4466	0.1092	0.1506**
ó^2		(0.0553)		(0.3050)		(0.0453)
γ	-	0.4179*	-	0.9985**	-	0.8925**
		(0.1804)		(0.0044)		(0.0985)
Log-likelihood function	-35.7710	-32.4828	-58.6932	-5.2730	-32.1566	-20.5546

Note: Figures in the parentheses indicate standard errors. * and ** indicate significances at 0.05 and 0.01 probability level, respectively.

References

1. Arya, P.S. 2003. *Spices Crops of India*, Taj Press A-35/4, Maya Puri Phase-1, New Delhi-64
2. BBS.1997-2009. *Statistical Yearbook of Bangladesh*. Bangladesh Bureau of Statistics. Planning Division. Ministry of Planning, Dhaka.
3. Hasan, M.K., M.S. Islam and M.M. Ahmed. 2011. "Economic Analysis of Onion Storing – An Empirical Study of Farmer Practices in Bangladesh". *Bangladesh Journal of Training and Development*, Graduate Training Institute, BAU, Mymensingh. Vol.
4. Khan, M.A, M.K. Hasan, M.A.J. Miah, M.M. Alam and A.S.M.H Masum, 2003. "Effect of Plant Spacing on the Growth and Yield of Different Varieties of Onion". *Pakistan Journal of Biological Sciences*,18:1582-1585.
5. Shukla, D. 2009. *Indian Scenario and Global review of onion and garlic production, export and Import.* Training Manual, National Horticultural Research and Development Foundation, Nasik, India.
6. Spices Experts. 2005. *Action Plan for Increasing Spices Production Further 25%.* Ministry of Agriculture, Dhaka.