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"Economic Analysis of Onion Production in Sujanagar and Santhia Areas of Pabna, Bangladesh"

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ABSTRACT: *The study investigated the productivity, profitability and resource use efficiency of onion production in Sujanagar and Santhia areas of Pabna district, Bangladesh. The multi-stage sampling technique was employed for collecting primary data from a sample of 100 onion farmers elected randomly from four villages in the study area. Findings indicated that the socio-economic characteristics played important role in producing onion where most of the farmers were male, middle aged (41-60), more or less experienced and illiterate and Cobb-Douglas production function was applied for estimating the onion production function which implied the elasticity of output with respect to seed, cultivation, fertilizer, insecticide labor and irrigation that were positive values of 0.136, 0.244, 0.211, 0.130, 0.159 and 0.200 respectively and also significant. The yields, costs of production and net benefit of onion production were 1535.6 kg, Tk. 26329.63 and Tk. 26883.48 per bigha respectively which proved that the onion production was profitable over the study area. But the onion producers faced some major problems such as the lack of appropriate storage facility and technical knowledge, lack of efficient human labor and its higher price, unavailability of high yielding seed and higher input cost in the study area.*

Keyword: *Onion, Productivity, Profitability, Resource use efficiency, Pabna.*

I. INTRODUCTION

Bangladesh is one of the most important developing counties in the world and also known as evergreen, riverine and agro-based country which produces various agricultural products viz. Jute, Rice, Potato, Maize, Onion, Spices, tropical fruits, banana, Garlic etc. (Bapari and Joy, 2016). The country is blessed with numerous natural gifts such as various favorable climatic zones and enormous effective resources for which onion production is very potential for the production, marketing, processing and exportation.

Onion is an important spice crop and herbaceous bulb in Bangladesh as well as in the whole world. It ranks first (1159259 MT) and second (335233Acres) among the spices and condiment crops grown in production and area in Bangladesh (BBS, 2012). The country was 16th largest onion producer countries in the world (FOA, 2010). It covers 36% of the total areas under herbaceous bulb and spices. The mean yield of onion to the world average of 17.27 t/ha compared to Bangladesh is very low 4 t/ha (FOA, 1998). According to BBS in 2005 and 2012 onion production is slowly increased from 6.83 t/ha to 8.58 t/ha in Bangladesh. In 2010-2011, onion was produced 316058 acres area of Bangladesh and the production was 1051347 metric ton (YASB, 2012). Due to the increase in population it is not possible to meet the domestic demand even though the production of onion is increasing over the period of time in Bangladesh (Haque et al. 2011). As a result, Bangladesh has to import a large amount of onion from neighboring countries like India, Myanmar, China, Pakistan and other country and as for example, the import of onion is 55499 metric tons in 2005 (BBS, 2007).

Onion plays a vital role in the economy of Bangladesh. It helps to ensure rural empowerment opportunity because the onion production is more labor intensive than others cultivation. Onion was used to be a medicine in the ancient period of time. In 16th century, doctors were prescribed of eating onion to fertile the infertility of women. The gladiators of Greece and Roman believed that the balance of blood could be lifted and their muscles could be firmed up by eating onion. Onion contains vitamin B (Thiamine, Riboflavin, Niacin, Pantothenic acid, Vitamin B6, Folate) Vitamin C, minerals (Calcium, Iron, Magnesium, Manganese, Phosphorus, Potassium, Zinc) and Raw onion contain about 89% water, 4% sugar, 1% protein, 2% fiber, and 0.1% fat (http://www.aaravagro.in/applications/onion-nutrition-info.html). During winter, onion is cultivated almost all districts in Bangladesh and widely in commercial base in the greater districts of Pabna, Rajshahi, Faridpur, Dhaka, Dinajpur, Jessore, Kushtia and Rangpur.

Onion is the most important horticulture crop. A worldwide view of major vegetables shows that onion ranks are second under the area of cultivation in the world. Pabna district is very familiar as an agro-based

region in Bangladesh and here, onion is cultivated in almost all areas as the most important horticulture spice and very useful vegetable in the daily diet list. The cultivation of onion in Pabna was 82341 acres and the production was 305545 Metric tons (BBS, 2011-2012).

So, the basic objectives of this study are designed as follows: (1) find out the factors affecting the onion production and the allocative efficiency of the inputs (2) determine the vital cost items in onion production over the study area and (3) analyze the socio-economic characteristics of the onion growers and finally make some effective policy recommendations to increase onion productivity in future.

II. LITERATURE REVIEW

Several studies have been done by many researchers, experts and agronomists in both home and abroad. A study conducted by Grema and Gashua (2014) on economic analysis of onion production focusing on the economic activities, descriptive statistics, budgeting models and inferential statistics, which have had to find the substantial experience in onion cultivation. The farm income analysis showed that onion production was profitable (N 98,134/ha). But the producers face some problems as high cost of production input, lack of storage facilities, limited access to improved seeds and high cost of transport etc. Finally, to improve market structure and transport system were preferred as policy recommendations for high productivity of onion.

Haque et al. (2011) studied the profitability of onion production by taking three major onion growing districts in Bangladesh. The cost of onion cultivation was found to be Tk. 93517 per hector in which seeding cost (41%) and labor cost (24%) were the major cost items and the yield of onion was found 9869 metric ton per hector. The gross margin and gross return were found to be Tk. 85308 and 79487 per hectare respectively. They found out the non-availability of HYV onion seed at the proper time, lack of technical knowledge of onion growers, high price in the cultivation time and non-availability of qualified fertilizer in time as the major problems of onion cultivation in the study areas and finally they suggested that both governmental and non-governmental organizations should come forward and take proper step to solve these problems.

Baree (2012) focused a study on the overall farm-specific technical efficiency or inefficiency of onion farms in Bangladesh. The elasticity of output with respect to land, labor and capital cost was estimated to the positive values and also significant on the other hand, seed and irrigation was found to be insignificant. The efficiency of onion farms varied from 58% to 99% with mean value of 83% which implies that there is a scope to increase output per hectare of onion by 17% through the efficient use of production technology.

Haile (2015) explained the determinants of technical, allocative and economic efficiencies among small scale onion growers in the irrigation agriculture of Ethiopia. He found that land related factors described much of technical efficiencies and the socio-economic characteristics of the farmers (age, market access, training access, experience, farm income, responsibility and field visit) significantly and positively effect on both the technical and productive efficiencies. Age of households, plot distance, fertility, source of irrigation water, experience of the farmers, farm income and land fragmentation, and extension visit were treated as the major determinants of economic efficiency.

III. METHODOLOGY

Selection of Study Areas and the rationale

In the present study, the researcher selects the study areas with great care so that real results are representative. In selecting the sample areas the researcher has to consider the limitation of his intellectual and financial capabilities and his time limitations. Thus, the present study was confined to Pabna district purposively. Then the researcher selects two unions randomly from Sujanagar and Santhia Upazila of the Pabna district. One is Tatibondo union taken from Sujanagar and the other Khatupara union from Santhia Upazila. Considering the constraints of time and fund, two villages were selected randomly from each union through the random sampling table. The selected villages are Ghoradha and Perghoradha from Tatibondo union and Joshomontodulia and Hoijor from Khatupara union. The rationale behind this selection is that Pabna district is predominantly agro- based, onion is the second single dominant crop (first is jute). Farming is the principal occupation of majority of the population and their livelihood almost completely depends on agricultural activities. They have also very little scope for complementary occupations during the crop seasons. The study areas are almost single and triple cropping areas and onion is grown extensively and there is a sufficient scope to improve yield frontier through agronomic practices. All these features confirm to the typical characteristics of Bangladesh agriculture and these areas can be considered as area representative of the research objectives.

Sample selection

A total of 100 onion farmers were randomly selected and twenty five were randomly selected from each of the four villages in the study area. The researcher has selected the sample of onion growers in such a way that can represent the whole onion growers in the study areas and provide effective results for the higher productivity of onion in future.

Sources of Data

This research study has mainly based on primary data. Primary data has been collected from the selected sample villages in December 2015 using a well-prepared questionnaire. However, for this research some secondary data have also been collected. These secondary data has been collected from various government and non-government organizations such as Yearbook of Agriculture Statistics of Bangladesh (YASB), Bangladesh Bureau of statistics (BBS), Bangladesh economic review (BER), Food and agriculture organization (FAO), Ministry of agriculture (MOA), Union Parishad office, various website about agriculture etc.

Empirical Model

Empirical model is used to determine the factors affecting the onion production and production function shows the purely technical relation between inputs and output of a given product. The most popular model, the Cobb – Douglas production function, has been chosen as an empirical model for the onion production function as follows:

$Y = A+ \beta_1 X_1+\beta_2 X_2+ \beta_3 X_3+ \beta_4 X_4+ \beta_5 X_5+ \beta_6 X_6 + \beta_7 X_7 + \mu_i$

The log linear form of the Cobb- Douglas production function be:

$\ln Y = \ln A+ \beta_1 1n X_1+\beta_2 \ln X_2+ \beta_3 \ln X_3+ \beta_4 \ln X_4+ \beta_5 \ln X_5+ \beta_6 \ln X_6 + \beta_7 \ln X_7 + \mu_i$

Where, Y = Total Return of onion production or gross return, A =constant, X_1 = Seed cost per bigha (Tk), X_2 = Cultivation cost per bigha (Tk), X_3 = Fertilizer cost per bigha (Tk), X_4 = Insecticide cost per bigha (Tk), X_5 = labor cost (man/day) per bigha (Tk), X_6= Irrigation cost per bigha (Tk) and X_7=land rent (0.05% value of the bigha) Tk; μ_i = Error term.

Assuming that μ_i is normally distributed having constant mean and zero variance. All variables are expressed in monetary terms. From this equation the researcher has been derived the values of input coefficients, T-test, adjusted R^2, F- value, and Durbin- Watson value of auto correlation.

Gross margin analysis

Gross margin analysis implicate the estimation of the costs and returns to production. The purpose of this analysis is to conclude profitability of onion production per bigha. Subsequently the fixed capital establishes an insignificant portion of the total costs of production. The implicit from is shown below.

GM=TVO-TVC

Where, GM= gross margin (tk), TVO=total variable output (mound) and TVC=total variable cost (tk)

Average rate of return

It was obtained by apportioning total gross margin by the total cost of production per bigha and multiplied by 100 as follows:

$$ARR = \frac{GM}{TC} \times 100$$

Where, ARR=Average rate of return, TC = Total cost and GM = Gross Margin.

Elasticities of production

The production Elasticities specifies the change in input, if other factors are whispered constant. Mathematically, elasticity of production is conveyed as:

$$E_p = b_i \frac{Y}{X_i} \frac{X_i}{Y}$$ (Koutsoyeannis, 1979)

Assuming a Cobb-Douglas production functions

$$E_p = b_i$$

Where bi= Regression coefficient, Q= output obtained from onion production, Xi=Resources which Elasticities are being estimated

So, If, Ep=1 Production elasticity is unity; Ep>1 production is elastic and Ep<1 production is inelastic.

Return to scale

The Return to scale is restrained by adding together the regression coefficient of projected function of all explanatory variables in Cobb-Douglas production function. Mathematically,

$$\text{RTS} = \sum_{1}^{n} bi$$

Where, RTS= Return to scale, n= number of regression, bi= regression coefficient.
Therefore, the Returns to scale will be constant, increasing and decreasing if the value of RTS is equal to unity, greater than unity and less than unity respectively.

Resource – Use Efficiency

The efficiency of resource use in the production of onion is determined by employing tools for measuring efficiency. In order to measure the efficiency of the inputs of the onion production, the ratio of Marginal Value of Product (MVP) to the Marginal Factor Cost (MFC) for each input is used and tested its equality to 1 for the optimal utilization of resources, i.e.,

$$\frac{MVP}{MFC} = 1$$

To calculate MVP, the marginal physical product (MPP) of a particular resource is needed which is defined as the addition of extra unit to gross returns in value term caused by an additional one unit of that resource keeping other inputs constant. The MVP is obtained by multiplying the product price per unit with MPP.

The most reliable, perhaps the most useful estimate of MVP is obtained by taking resources (Xi) as well as gross return (Y) at their geometric means (Dhawan and Bansal, 1977). Since all variables used in the regression model has been measured in monetary value, the slope co-efficient of those explanatory variables represented the MVPs. i.e.;

$$\text{In } Y = \text{In}a + b_i \text{ In } X_i$$

$$\frac{dY}{dXi} = bi \frac{Y}{Xi}$$

Therefore, $MVP\ (Xi) = bi \frac{Y\ (GM)}{Xi\ (GM)}$

Where, Y = Mean value of Geometric Mean (GM) of gross return in Tk. And X_i = Mean value of GM of the i^{th} resources (Tk). So, the MVPs are calculated by multiplying the regression co-efficient of given resources with the ratio of GM of both gross return and given resources.

MFC is the price of per unit of resources and if the MFCs of all resources expressed in terms of an additional, Taka, in calculating the ratio of MVP to MFC, the denominator will always be one, and therefore, the ratio will be equal to their respective MVP (Majumder et al., 2009).

IV. SOCIO- ECONOMIC CHARACTERISTICS

Socioeconomic profiles of sample farmers are important in influencing production planning. A person differs from one another in many aspects. Behaviors of an individual is largely determined by his/her characteristics. Some of the important socio-economic characteristics of the farmers such as age, Year of Experience, farm size, seed using criteria, educational status etc. are described in table (01).

Age distribution plays a vital role for the betterment of farming activities (Blijham et al., 2007). It was found that the maximum age of the respondent was 78 years and minimum age was found 25 years in the study area. An age of the onion producer was examined by classifying the farmer into three main age category. These groups are 20-40 years, 21-40 years, 41-60 years, and above 61 years and most of the farmers (51%) are included in 41-60 year. Experience is another important socio-economic characteristics of the farmers. In the study area most of the farmers was high experienced because 50% and 28% of the onion growers had 21- 40 and 41- 60 years of experience and the maximum experience of the respondent was 67 years and minimum was 6 years. The farm size is defined as a techno-economic unit of farming activities consisting of all livestock and all the land which is fully or partly used for farming purposes and is operated under a single management by one person or with others, without regard to title, size or location. It is found from the study area that, around 47% of the farmers are under 5—8 bigha and very few amount 10% of farmers are large from13 or more than 13 bigha. Developed and qualified seed is basically treated as the basic input for enhancing agricultural production which can give the self-sufficiency in food production of a country and it can be said that the effectiveness of other inputs like fertilizer and irrigation depends mostly on the improved seed. In table (01), huge number of onion producers (70%) use to prefer Rajshahi Seed (taherpuri), about 20% use Faridpuri and 10% use others like own seed etc. The educational ingenuity is very essential for farming activities when deciding a successful onion production. The table (01) shows that most of the entrepreneurs are academically inclined. This further justifies the fact most of the respondents had keep knowledge of the subject matter at hand. Hence it justified reliability of their opinion. In case of onion production educational categories imply that 46% respondents were illiterate, 30% were primary level, 14% were SSC level, 5% were HSC and 5% were Degree/Honor's/ graduate.

Table- 01: Socio – economic characteristics of the respondents.

Distribution of respondents by study area			
District	Upazila	Village	Respon-dents
Pabna	Sujanagar	Ghoradha	25
		Perghoradha	25
	Santhia	Josomontodulia	25
		Hoizor	25

Age distribution of onion farmers		
Age	Frequency	Percentage
20-40	22	22
41-60	51	51
61-<	27	27

Experience of the farmers		
Year of experience	Frequency	Percentage
1-20	19	19
21-40	50	50
41-60	28	28
61-<	3	3

Farm holding size of the respondents		
Farm (in bigha)	Frequency	Percentage
2 – 4	29	29
5 – 8	47	47
9 – 12	14	14
13 - - -	10	10

Onion seed used preference		
Variety of seed	Frequency	Percentage
Rajshahi	70	70
Faridpuri	20	20
Other (specify)	10	10

Educational status of the farmers		
Literacy level	Frequency	Percentage
Illiterate	46	46
Primary	30	30
SSC	14	14
HSC	5	5
Graduate	5	5

Source: Field Survey, 2015

V. RESULTS AND DISCUSSION

Estimation of onion production function

The primary information was collected from 100 farmers. The calculation was done for seed, cultivation, fertilizer, insecticide, labor (human), Irrigation and land cost incurred in different operations for the cultivation of onion. Similarly, the share of inputs for different operations was calculated by the production function.

Table 02: estimated regression result derived from Cobb-Douglas production function in the study area.

Variables (per bigha)	Coefficients	Standard error	t-value	Significant level
Constant	lnA= - 41.662	8.673	-4.804*	0.000
Seed cost(X_1)	B_1 = 0.136	0.486	2.441*	0.018
Cultivation cost(X_2)	B_2 = 0.244	0.332	3.131**	0.002
Insecticide(X_3)	B_3 = 0.211	0.114	3.144**	0.002
Fertilizer cost(X_4)	B_4 = 0.130	0.097	1.683*	0.096
Labor cost(X_5)	B_5 = 0.159	0.873	2.709**	0.008
Irrigation cost(X_6)	B_6 = 0.200	0.206	2.341*	0.021
Land cost(X_7)	B_7 = 0.061	0.416	1.634^{ns}	0.106
F-value: 101.744; R^2–value: 0.886; R^2- Adjusted: 0.877; and D- W: 2.039				

*P<0.01 **P<0.05 ns=not significant.

Source: Field survey, 2015

Therefore, the lead equation of onion production function is as:

$\ln Y = -41.662 + 0.136 \ln X_1 + 0.244 \ln X_2 + 0.211 \ln X_3 + 0.130 \ln X_4 + 0.159 \ln X_5 + 0.200 \ln X_6 + 0.061 \ln X_7 + U_i$

Let X_i is equal to mean value of GM of the i^{th} respondent defined in (Tk) per bigha and Y is equal to the mean value of GM of GR (gross return) defined in (Tk) per bigha.

In determining the variable influencing the productivity of onion in the study area, the analysis technique was employed Cobb- Douglas production function whose results were shown in Table (02). This was used to focus the parameters for the measurement of resource use efficiency of the onion production. Seven variables were included in the model (seed, fertilizer, irrigation, cultivation, insecticide, labor and land costs). Six variables were statistically significant but one variable i.e., Land cost was not significant. Those six variables had positive coefficient. If 1% increase in all costs like seed, cultivation, insecticide, fertilizer, labor and irrigation then the output of onion significantly increases by 0.136%, 0.244%, 0.211%, 0.130%, 0.159% and 0.200% and less significantly by 0.061% in the study area and vice versa. The result is expected since to increase farmer's technology in use of agrochemicals will increase the yield.

F- Value

The F - values of the equation derived for 101.744 were highly significant and all the explanatory variables were important for explaining the variations in gross returns of the operators.

Value of R^2

It recorded a coefficient of determination (R^2) of 0.886 and Adjusted R^2 of 0.877. The implication of this is that approximately 89% of the variations in onion output in the study area were creating by independent variables.

Returns to scale

The return to scale indicates the summation of all production coefficients. For onion production rumination of the coefficient was 1.141 which means that the production function exhibits increasing returns to scale.

Elasticities of production

The elasticity of production refers to the percentage change in output in relation to the percentage change in input and this concept of elasticity can be applied to the production function to determine the stage in which farmer can allocate their resources (Majumder et al., 2009). The elasticities of all inputs are shown in table (03).

Table 03: Elasticities of production

Inputs	Elasticity	Remark
Seed cost	0.136	Inelastic
Cultivation cost	0.244	Inelastic
Fertilizer cost	0.211	Inelastic
Insecticide cost	0.130	Inelastic
Labour cost	0.159	Inelastic
Irrigation cost	0.200	Inelastic
Land cost (rent)	0.061	Inelastic

Elasticities of all farmers in this model were greater than one indicates that the onion growers allocated their resources in the irrational stage (Stage – I) of production function where increasing returns to scale existed.

Resource Use Efficiency

It means that how the farmers can use their resources efficiently in the production process. Due to the limited resources, the estimation of the resource use efficiency is very essential in the developing countries like Bangladesh, India etc. For calculating resource use efficiency, six factors namely labor, seed, cultivation, fertilizer, insecticide and irrigation are taken into consideration. By using these six variables the MVPs were calculated and it is shown in table (04). The values of MVPs are the indicator of resource use efficiency because the MFC is assumed to be 1.

Table 04. MPVs of input in production function

Inputs	Geometric mean (GM)	Coefficient	MVP	Remarks
Gross Return	45886			
Seed cost	2987.91	0.136	2.088582	Under utilized
Cultivation cost	1986.39	0.244	5.636448	Under utilized
Fertilizer cost	2368.29	0.211	4.088159	Under utilized
Insecticide cost	901.01	0.130	6.620548	Under utilized
Labour cost	8977.22	0.159	0.81271	Over utilized
Irrigation cost	1781.70	0.200	5.150811	Under utilized
Land cost	7626.3547	0.061	0.3670228	Over utilized

Source: Regressions coefficient compound

In case of MPVs of inputs in production function, it can be seen from table (4) that the values of MPVs for Seed cost, cultivation cost, Fertilizer cost, insecticide cost, Labour cost, Irrigation cost and land cost are 2.088582, 5.636448, 4.088159, 6.620548, 0.81271, 5.150811 and 0.3670228 respectively which indicate under-utilized of the resources in the study areas. As a result, the farmers had opportunities to increase per bigha output by using more Seed, cultivation, Fertilizer, insecticide and Irrigation. Only Labour cost and land cost is over utilized. So, from the resource use efficiency it is seen that all resources are economically mis-allocated.

Table 05. The cost and return components for onion production

Variables	Average cost (Tk per bigha)	Percentage
A. Variable cost = Tk. 19002.52 A1. Material inputs		
Seed cost	2987.91	11.34%
Cultivation cost	1986.39	7.54%
Fertilizer cost	2368.29	8.99%
Insecticide cost	901.01	3.42%
Irrigation cost	1781.70	6.77%
Subtotal (A1)	10025.3	38.08%

A2. Labor inputs		
Land preparation	1496.203	5.68%
Planting	3890.129	14.77%
Weeding	897.722	3.41%
Fertilizer and insec-ticide application	1496.203	5.68%
Transportation	1196.963	4.55%
Subtotal (A2)	8977.22	32.96%
B. Fixed cost = Tk. 7626.3547		
Land rent cost (0.005%)	7626.3547	28.96%
Total cost (A1+ A2 + B)	26329.63	100%
Revenue component		
Average output (Kg per bigha)	1535.6	
Price/ Kg (According to the respondent)Tk.	29.88	
Total revenue (TVO) (Tk.)	45886	
Gross Margin (Tk.)	26883.48	
Net profit (Tk.)	19257.1253	
ARR	102.1035	

Source: Field work, 2015

Cost components

Table (05) shows per bigha costs and returns of onion production which reveals that the total cost of production was Tk. 26329.63 per bigha of all respondents. The value of the fixed cost component constituted only Tk.7626.3547 per bigha incurred from land rent cost which is the highest amount of the respondents 28.96% of the study area. This study reveals that the materials costs (seed, cultivation, fertilizer, insecticides and irrigation cost) were Tk.10025.3 per bigha which made up 38.08% of the study area. The study also reveals that Tk. 8677.979 per bigha was expended on labor which organized the highest amount and it signifies 32.96% of the total cost of production. This could be due to labor intensive nature of the onion production. The result of the survey indicated the variable cost 71.04% of the respondent.

Revenue components

The average output per bigha of onion among the respondents of the study area was found to be 1535.6 kg per bigha and the average price was assumed to the respondent selling manure that was found Tk. 29.88 per Kg onion. This result showed the gross revenue Tk. 26883.48 was realized. Hence, the cost and the return analysis specified that onion production in the study area was gainful.

VI. CONCLUSION

The core message of this study is to construct a skeleton on onion production function, measure resource use efficiency and calculate profit phenomena. To investigate these, the present study classified the whole results into some different categories namely, estimation of production function for onion, returns to scale, elasticity of production, resource use efficiency and cost – benefit analysis of the onion production. Seven explanatory variables have considered for the model specification. The present study has used multiple regression analysis to construct the onion production function and its components. Onion farming in the study area were able to make profit Tk. 26883.48 per bigha as net farm income. The study also recognized major limitations in onion production to include high cost of production inputs, inadequate storage facilities and limited access to better-quality seed.

VII. RECOMMENDATIONS

Based on the findings of this research it is necessary to recommend some policies regarding onion production. Some of the suggestions emerge from the field survey experienced by this researcher.

- ✓ Farmers should form supportive unit for the purpose of self-help in terms of input achievement and output marketing.
- ✓ Farmers need to be trained new storage technology so as to be capable to reduce losses.
- ✓ Postponement means should have an adjacent contact with the farmers during the production season so as to demonstrate to them the proper ways of input application.
- ✓ Farmer may be difficult to cultivate their crop for small and medium farmers as it requires high amount of cash. Thus, emphasis can be given to reduce input cost through input subsidy.
- ✓ The government should command DAE, BRRI, BARI, NARS institute, private companies and NGOs to develop their own hybrid seed and provide them in time to the farmers as seed plays a significant role on production.
- ✓ Loss of arable land and population growth are twin major problems in Bangladesh. Both issues should be included in the national agriculture policy (NAP).

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