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POTATO FOR FOOD SECURITY IN BANGLADESH

MD. AZIMUDDIN[1], Q.M. ALAM[2] AND M.A. BASET[3]

[1]SSO, Training and Communication Wing, BARI, Gazipur-1701, [2]CSO & Head and [3]PSO Agricultural Economics Division, BARI, Gazipur-1701, Bangladesh.

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ABSTRACT

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A survey was conducted at Comilla and Munshiganj districts during 2008 to generate information on area, production and utilization of potato. Both primary and secondary data were used in this study. A total of 100 farmers were selected randomly. Data were collected by direct interview method. Area and production of potato have been increasing rapidly compared to cereal crops like rice and wheat. Per unit of land and time potato was more productive than any other food crops. Average yield of potato was 22.25 t/h. Maximum yield was 36.23 t/h at Munshiganj. Average production cost and selling price of potato were Tk 6.95 and 10.95 per kg respectively. Benefit Cost Ratios (BCR) was 1.58. Potato contains about 16% carbohydrates of which starch is the major part i.e. about 14% starch on fresh weight basis. The potato is not an outstanding source of energy yet a good source of high quality protein. Potato is a rich source of vitamin C, it is rich in important minerals. Results showed that Potato is an efficient food crop. If percentage of potato consumption is increased pressure on rice would be reduced. Hence potato can play an important rule in the food security of Bangladesh.

Keywords: Food security, potato, benefit cost ratio

INTRODUCTION

The potato was introduced in this subcontinent in the sixteenth century. It was grown then in small plots as a vegetable. Today potato has emerged as a major crop in Bangladesh and is being cultivated on an area of 520 thousand ha. The total production is 7800 thousand tones with an average yield of 15 t/ha. Though Bangladesh has become a major potato producer in the SAARC countries, the status of this crop has remained vegetable in the country i.e. what it was four centuries ago. The time has come now for all of us to understand and appreciate the role potato can play in the present situation of Bangladesh.

One of the major problems faced by developing countries in general and Bangladesh in particular, is the ever increasing population. As per current trend, the population in Bangladesh is expected to be around 172.9 million by the year 2020. In order to increase agricultural production further, the only option is to grow high productivity crops, like potato.

We have been relying heavily on the major cereal crops- rice, wheat and maize to feed the ever increasing population in our country. Such an over dependence on cereals should be end, if we have to ensure food security, in the decades to come. Dr. M.S. Swaminathan says "The present vulnerability of national food budgets to the vagaries of weather arises from our dependence on too few crops for our daily bread". Potato can help to widen the food supply base and thereby help to minimize the risk of serious food shortages in the tropics and sub-tropics. Potato, one of the most productive crops known to man can play a significant role in ensuring foods security.

A developing country like Bangladesh needs not only the quantity of food but sufficient quantity and quality of a balanced nutritious food. It is a proven fact that if the food available provides balanced nutrition, the food intake is relatively low, e.g. in developed countries, where people consume balanced food and their dietary intake is relatively low. Whereas, in the developing countries the food availability is not well balanced, the dietary intake is higher because people tend to eat more to compensate for the poor nutrition. This results in greater demand for food and higher pressure on the limited land available to produce required quantity of food. Keeping in mind the overall food and nutrition security of the country, Bangladesh should identify and promote a crop which is not only highly productive but also nutritionally balanced. It is believed and proven beyond doubt that potato meets both these requirements. Study related to the above issue is not yet done in Bangladesh. Therefore, the study on "Potato for Food Security in Bangladesh" was taken with the following objectives.

Objectives:

i. To show the trend area and production of potato during the last two decades and to estimate their growth rates;

ii. To evaluate potato as an efficient food and nutritious crop; and

iii. To suggest how potato can reduce the dependency on major cereal crops

MATERIALS AND METHODS

Primary and secondary data were used in this study. Primary data were collected from two potato growing areas of Bangladesh namely Chandina upazila of Comilla district and Gozaria upazila of Munshiganj district by direct interview with a set of questionnaires designed for this study. The information was collected to the crop year 2007-2008. Different Software Excel, SPSS and Other programmes were used. Total Sample size was 60. Among them fifty percent were taken from Comilla district and fifty percent from Munshiganj district.

RESULTS AND DISCUSSIONS

Management of crop

Average potato yield was 22,251.98 kg per hectare for both the locations Comilla and Munshiganj whereas individual average yields at Comilla and Munshiganj were 19,754.24 and 24,749.73 kg per hectare respectively. C V(%) was 11.99 at Comilla that of Munshiganj was 21.65 (Table 1).

Table 1. Descriptive analysis as minimum, maximum, mean, standard deviation and CV% of production of potato of the study areas, during 2007-08

Production (kg/ha)	Comilla	Munshiganj	Average
Minimum	10,868.00	10,374.00	10,374.00
Maximum	23,053.33	36,226.67	36,226.67
Mean	19,754.24	24,749.73	22,251.98
Standard deviation	2,368.58	5,358.93	4,818.47
CV(%)	11.99	21.65	21.65

Source: Field Survey, 2008

Average production cost and selling price were Tk 6.95 and 10.95 per kg respectively. Benefit Cost Ratios (BCR) of potato at Comilla, Munshiganj and their average were 1.72, 1.48 and 1.58, respectively (Table 2).

Table 2. Comparative yield and cost of production of HYV potato at the study areas of Bangladesh during 2007-08

Items		Comilla	Munshiganj	Average*
Potato yield	(kg/ha)	19,754.24	24,749.73	22,251.98
Gross Return	”	220,647.34	266,628.84	243,638.09
Cost of production	”	128,620.71	180,708.51	154,664.61
Net Return	”	92,026.63	85,920.34	88,973.48
Benefit Cost Ratio(BCR)		1.72	1.48	1.58
Selling price of potato (per kg)		11.17	10.77	10.95
Cost of production	”	6.51	7.30	6.95

Source: Field Survey, 2008; *Average = Mean of Comilla and Munshiganj

Table 3. Comparative cost distribution of different items of potato cultivation at the study areas of Bangladesh, 2007-08

Cost of different Items	Comilla		Munshiganj		Average	
Tk/ha	Tk/ha	Percentage	Tk/ha	Percentage	Tk/ha	Percentage
Land Preparation	5945.19	4.62	7014.94	3.88	6480.06	4.19
Human Labour	34946.91	27.17	28349.16	15.69	31648.03	20.46
Seed	53374.00	41.50	88574.61	49.02	70974.30	45.89
Irrigation	5267.13	4.10	1677.77	0.93	3472.45	2.25
Fertilizer	20861.96	16.22	50257.22	27.81	35559.59	22.99
Insecticide / pesticide.	6470.06	5.03	3451.60	1.91	4960.83	3.21
Others	1755.46	1.36	1383.20	0.77	1569.33	1.01
Total Cost	128620.71	100.00	180708.51	100.00	154664.61	100.00

Field Survey: 2008

It is evident from the Table 3 that the Munshiganj farmers spent more money with regard to seed (49.02%) and fertilizer (27.81%) whereas the Comilla farmers spent in seed (41.50%) and fertilizer (16.22%) only considering total cost of potato production on different items.

Table 4. Price of Potato and Boro rice at the study areas of Comilla and Munshiganj of Bangladesh.

Year	Price (Tk/kg)	
	Potato	Boro Rice
1994-95	1.74	2.96
1999-00	3.07	4.72
2004-05	4.24	8.35
2006-07	8.48	12.18
2007-08	10.47	16.13

Field Survey: 2005 & 2008

Table 4 shows the trend of market prices of potato and boro rice from 1994-95 to 2007-08 at the time of harvest. Maximum prices of potato and boro rice were Tk. 10.47 and Tk. 16.13 respectively in 2007-08.

Table 5. Family size, area and production of potato and Boro rice per family at the study areas of Comilla and Munshiganj

Year	Average Family size	Potato		Boro rice	
		Area (decimal)	Production (kg)	Area decimal)	Production (kg)
1994-95	6.21	56.14	4536.00	59.58	887.20
1999-00	6.42	75.25	5975.20	60.83	1051.60
2004-05	6.64	63.85	5236.80	58.96	1180.80
2006-07	7.15	57.37	5566.00	84.92	2004.00
2007-08	7.16	70.35	6762.40	87.46	2329.20

Field Survey: 2005 & 2008

On the basis of the study average family size has been increasing. Maximum area and production of potato were 70.35 decimals and 6.76 tons per family in 2007-08. That of boro rice was 87.46 decimals and 2.33 tons per family in the same year (Table 5).

Area and production of potato during the last two decades and their growth rates

Area under potato and the total production have been increasing steadily and touched a high during the year 2007-08 (with record production of 7.8 million mt) that led to an unprecedented glut (Appendix Table 1). We were not able to utilize the surplus potatoes produced in the country this year hence a lot of wastage of the valuable food occurred.

Table 6. Growth rate Percentage of Area, Production and Yield of potatoes in Bangladesh during the last two decades

Growth Rate (%)	Area	Production	Yield
1980-81 to 1989-90	3.06	2.39	-0.67
1990-91 to 1999-00	6.91	8.79	1.88
2000-01 to 2007-08	16.96	16.03	-0.93
1980-81 to 2007-08	6.95	8.39	1.43

Source: BBS and TCRC, BARI, 2008. Growth rate % were analyzed by using Semi -log Modeling Method

Growth rate of potato and other major crops

The potato crop which was grown on a smaller area as compared to the cereals had a much higher growth rate throughout since the independence. In terms of area and production, maize showed a higher growth rate but it is not used as general food in Bangladesh (Table 7). It is mainly used as poultry food. In terms of area and production the Annual Compound Growth Rate (ACGR) of potato was much higher as compared to the two major cereals rice and wheat. Such rapid growth in potato production has gone relatively unnoticed mainly because the cereals rice and wheat are considered as major food crops.

Table 7. Compound Growth Rate (%) from 1990-91 to 2005-06 of potato and other major cereal crops in Bangladesh

Crop	Area	Production	Yield
Potato	9.07	11.38	2.31
Rice	0.44	6.41	5.96
Wheat	-0.26	0.14	0.40
Maize	23.79	36.62	12.83

Source: BBS & TCRC, BARI, 2008

It is relevant to point out that unlike in Europe where potato is growth under long days (14-16 h) that too for a longer growing period (140-180 days). Potato is growth under short days (10-11 h) for a shorter duration of about 90 days in Bangladesh. Bangladesh is one of the few countries in the world where the ACGR for both area and production of potato has been increasing steadily in contrast to Europe where the ACGR for area and production has been declining

Potato is an efficient food crop

If we take the area into consideration, then the production per unit area and time is much higher in potato as compared to rice, wheat and maize.

Potato being a high productivity crop, it produces more dry matter per unit area and time than the major cereal crops. The dry matter production in potato is 47.6 kg/ha/day whereas in wheat, rice and maize it is 18.1, 12.4 and 19.1 kg/ha/day respectively (Table 8). What is of greater interest and importance is the potential of potato to produce even higher dry matter per unit area and time. Potato has the potential to produce 111.6 kg dry matter/ha/day as compared to wheat, rice and maize whose potential dry matter production is 24, 32.2 and 12.4 kg/ha/day (Table 8).

Table 8. Potato tops in dry matter and protein production (kg/ha/day)

Crop	Crop duration (days)	With present yields		With potential yields	
		Dry matter	Edible protein	Dry matter	Edible protein
Potato	90	47.6	3.0	11.6	7.1
Wheat	120	18.1	2.5	24.0	3.2
Rice	130	12.4	1.0	32.2	2.5
Maize	140	19.1	1.2	12.4	1.6

*1995-96; **The potential yields are taken as potato=397q, wheat=33q, rice=48q and maize=20q/ha.
Source: AICRP Ann. Report, 1986-87, Directorate of Cropping Systems Research, Modipuram (Meerut)

Besides, potato produces more nutrients per unit area and time than the major cereals (Appendix Table 2). Roots & tuber crops come to mind immediately, whenever we think of crops with high productivity. As observed by Dr. W. G. Burton, an eminent potato physiologist, “It is a reasonable approximation to state that the nutritive value of the produce from a hectare of potatoes would have been about three times as great as that from a hectare of cereals”.

It is true that sweet potato can produce even more dry matter per unit area and time than potato but potato is the most productive crop taking into consideration the edible protein production (Table 9). Thus potato is certainly better than the major cereals and other root & tuber crop in terms of production of dry matter and edible protein.

Table 9. Dry matter and protein production (kg/ha/day) of potato and other roots & tubers

Crop	Dry matter	Edible protein
Potato	18	1.5
Sweet potato	22	1.0
Yam	14	1.0
Cassava	13	0.1

Source : Woolfe (1987), Horton (1987)

Potato is a low calorie food

Potato contains about 16% carbohydrates of which starch is the major part i.e. about 14% starch on fresh weight basis. The role of carbohydrates in human nutrition is to provide energy.

Potato provides high quality protein

The potato is not an outstanding source of energy yet a good source of high quality protein. This is of considerable importance in a developing country like Bangladesh where energy supplies are more readily available than the proteins. The average proteins content in potato is approximately 20% on the fresh weight basis. Potato protein content is comparable (10% on a dry weight basis) with that of the cereals. The potato has an edge over other major cereals in its high lysine content.

Potato is a rich source of vitamin C

The vitamin C content of potatoes is about 20 mg/100g of tuber fresh weight i.e. higher than other vegetables. Even in cooked form, potato contains more vitamin C than in many other foods. It has been shown that 100g of freshly harvested potatoes boiled in their skins can furnish 80% of a child's and 50% of an adult's daily requirement of vitamin C. Potatoes are a major source of vitamin C in developed countries. In Bangladesh where diets are largely based on cereals, lacking in vitamin C, potato can be used as good supplement.

Potato is rich in important minerals

Some of the important minerals and trace elements are present in potato. It contains about 40mg phosphorus/100g tuber fresh wt. The phosphorus present in potato is more assimilable than in other food crops because of the relatively small percentage of phytic acid phosphorus in potatoes.

Potatoes form a good source of iron and its iron content is comparable to most other vegetables. Potato contains more iron than white rice on either dry or cooked basis.

Potato is most versatile

There are only a few foods as versatile as the potato. It can be cooked in many ways. Potatoes can be boiled, fried, roasted, toasted, baked or steamed. Potatoes can be easily processed into chips, French fries, flakes, granules, patties etc. They can also be processed into dehydrated and canned products.

Diversification in the utilization of potatoes

A potato is a wholesome and nutritious food. Therefore, consumption of fresh potatoes should be encouraged. However, processing of potatoes is necessary because of the increasing demand for processed foods in young urban population and the surplus potatoes available in the country. Potatoes can be processed to produce a number of edible products. However, in order to sustain the increasing production of potatoes, certain amount of diversification is essential. Processing of potatoes to produce industrial raw materials is an area which has not received much attention.

Consuming more potatoes we could substantially reduce pressure on rice. It will help partially to meet up the shortage of rice.

CONCLUSION

Potato is a staple food in the developed countries and which account for 37% of the total potato production in the world (FAO and CIP, 1995). Considering the trend of population growth and consequently the increased demand for food in the country and the dwindling cultivable land area, the potato is likely to play a very important role in the future. Because of its exceptionally high productivity coupled with high food value, potato demands greater attention. Given the due attention and care, potato can contribute greatly to the food and nutrition security of our country.

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Appendix 1. Area, Production and Yield of potato in Bangladesh

Year	Area (ha)	Production (t)	Yield (t/ha)
1980-81	50994	590400	11.58
1984-85	67140	802500	11.95
1990-91	76306	893860	11.71
1994-95	84893	1151140	13.56
2000-01	162409	2600630	16.01
2006-07	377000	5400000	14.32
2007-08	520000	7800000	15.00

Source: BBS and TCRC, BARI, 2008.
Note: 1980-81 to 2005-06 considered only for HYVs of potato but 2006-07 and 2007-08 for all local and HYVs of poatato

Appendix 2. Nutrient production (ha/day) of potato, wheat, rice and maize (1995-96)

Nutrients	Potato	Wheat	Rice	Maize
Carbohydrates(kg)	42.5	14.8	11.2	7.1
Minerals (kg)	1.1	0.3	0.1	0.2
Fibre (g)	752	249	29	287
Fat (g)	188	311	72	383
Calcium (g)	18.8	8.5	14	1.1
Phosphorus (g)	75.2	63.5	22.9	37.0
Iron (g)	1.3	1.0	0.4	0.2
Vitamin-B (g)	2.5	1.3	0.3	0.3
Vitamin-C (g)	32.0	0	0	0

Source: Bist & Sharma (1997)