Brief Presentation

Agriculture in the Fragile Environment of Bangladesh: Looking into the Future

M. Giashuddin Miah[1], M. Nasimul Bari[1], Tofayel Ahamed[1] and Uttam Saha[2]

[1]BSMR Agricultural University, Gazipur-1706, Bangladesh, [2]Soil and Water Science Dept, Florida University, Gainesville, FL.

Abstract

Bangladesh with the lowest per capita arable land and poor resource base, is struggling hard to feed her 143 million people. By the year 2030, the population is likely to reach around 191 million. Demands for cereals, pulses, oilseeds, roots and tubers, vegetables, and fruits in 1995 were around 20.07, 0.66, 0.82, 18.70, 9.42, and 2.48 million metric tons, respectively. In 2030, demand for these crops has been estimated at around 31.67, 1.05, 1.27, 29.50, 14.86 and 3.91 million tones, respectively. To meet this elevated demand, production in 2030 has to be increased by around 75, 102, 170, 1450, 463, and 194%, respectively from 1995 level. To achieve this goal, productivity of these crops has to be increased from 1.71, 0.75, 0.85, 10.65, 6.51, and 8.29 to/ha in 1995 to 5.88, 1.48. 2.29, 166.67, 80.32, and 23.27 t/ha in 2030, respectively. Intensive land use, particularly, monocropping of rice with high input technologies i.e., fertilizers and pesticides are causing serious negative impact on soil and ecosystem health. Besides, shrimp farming in coastal region is making crop lands unsuitable due to increased salinity. Productivity of major crops during the same period have been found stagnant and even in declining trend due to declining soil fertility. Land degradation, climate change and other natural calamities like flood, drought, salinity, cyclone, etc. cause serious damage to crops, lives and properties every year. These scenarios will pose a serious threat to food security in the next century. Population control, integrated resource management, cop diversification with high value crops, improved but environmentally friendly technologies and management practices might be useful to combat the whole range of issues in the future.

Bangladesh Agriculture

Bangladesh agriculture has grown at 2.3 % annually since 1990 and the dominant source of this has been the crop sub-sector. In crop sector, rice occupies 71 % of the gross cropped area and accounts for over 97% of total food production. The fluctuation in agricultural productivity influences the food security and political stability.

Population

The population of Bangladesh in 1995 was 119.9 million and reached to 143.38 million, and it will be around 191.1 million in 2030 (Table 1). With the increase of population, land

man ratio will decrease and in 2030 it will be 0.050 as against in 1995. About 63 million people (44%) live in absolute poverty line (2122 Kcal per capita per day) out of which 28.7 million (20%) are hard core poor (1805 Kcal per capita per day).

Table 1. Projected population growth and land man ratio up to 2030

Parameters projected	Year				
	1995	2005	2010	2020	2030
Population growth rate (%)	2.17	1.59	1.36	1.16	0.91
Population (million)	119.90	143.38	153.44	172.90	191.09
Land:Man ratio	0.087	0.067	0.062	0.055	0.050

Land

Total area of Bangladesh is 14.39 million hectares, having the lowest per capita arable land (0.06 ha) of the world. The net cropped area is 8.9 million ha. Medium highland and highland comprises maximum part of the country accounting for 40 and 34%, respectively where soil organic matter content is very low. Rest of the area is very much prone to flooding and has only potential of growing single crop annually.

Farm size and land tenure system

Bangladesh is characterized by very small land holdings distributed rather unequally. About 21% households have no land at all, with the landless working as wage labour. About 60% have up to one hectare, 17% have land up to 3 hectares. Large farmers (having land over 3 ha) cover only 2%. Roughly 1/4th of the farm land is cultivated by tenants under sharecropping or fixed tenancy arrangements.

Crop Productivity

Productivity trend of major crops in Bangladesh during the last 20 years (1975-95) revealed that productivity of major crops remained static and in some instances declined. The productivity of wheat and pulse stagnated at around 1.94 and 0.75 ton/ha, respectively. Productivity of sugarcane and fruits showed a gradual declining trend where the yields were 44.36 and 9.81 ton/ha in 1975 which reduced to 41.18 and 7.80 ton/ha in 1995, respectively. The possible causes for declining and stagnating of productivity might be due to soil fertility degradation, and crop losses due to environmental hazards.

Food Production: A considerable success has been achieved in food production during the last three decades. The total food production has been increased from 11.4 million tons in 1974-75 to 27.26 tons in 2005-06 (Fig. 1). Increase in food production was mainly

contributed by rice production. Wheat production was also increased slowly but production of other food grains decreased during this period. .

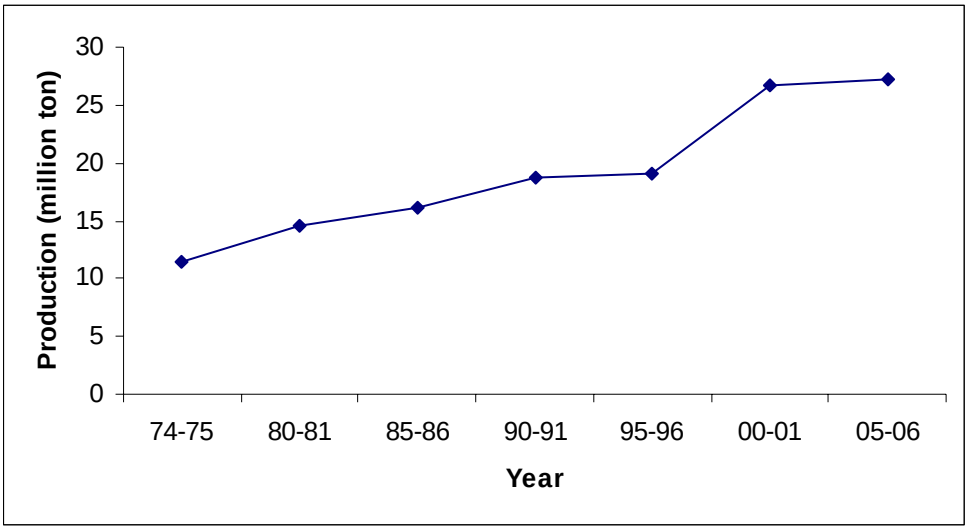

Fig.1. Production of food grain in Bangladesh during 1974-75 to 2005-06

Demand Projection for Major Crops

The demand for major crops for the projected population from 1995 to 2030 has been estimated (Table 2). To meet the projected demand, production in 2030 has to be increased by around 75, 102, 170, 1450, 463, and 194%, respectively, from 1995 level.

Table 2. Projected demand for major crops by the projected population from 2000-2030

Year	Population (million)	Required crop production (million tones)						
		Cereal	Roots & tubers	Pulses	Oilseed	Sugar	Fruit	Vegetable
1995	119.90	18.08	10.75	0.52	0.47	0.86	1.33	2.64
2000	132.42	21.49 (21)	20.44 (90)	0.73 (40)	0.88 (87)	1.40 (63)	2.71 (104)	10.30 (290)
2010	153.44	25.43 (41)	23.69 (120)	0.84 (62)	1.03 (119)	1.62 (88)	3.14 (136)	11.93 (352)
2020	172.90	28.65 (58)	26.69 (148)	0.95 (83)	1.15 (145)	1.83 (113)	3.53 (165)	13.44 (409)
2030	191.09	31.67 (75)	29.50 (174)	1.05 (102)	1.42 (202)	2.02 (135)	3.91 (194)	14.86 (463)

* Figures in the parenthesis indicate per cent production to be increased.

Environmental Scenarios

Environment and natural resource of Bangladesh are under severe threat due to many factors, some of major issues have cited below:

1. Land degradation

The limited land resources are under process of severe degradation due to deforestation, intensive cultivation (especially rice cultivation) with heavy input based technologies, indiscriminate use chemical fertilizers and insecticides, non-recycling of crop residues, cow-dung, shifting cultivation in the hills, erosion, increased salinity in the coastal zone. The depletion of land resources are severely threatening our food and energy security; economy and quality of life.

2. Soil fertility degradation

Intensive crop production with high inputs has rapidly declined fertility especially soil organic matter (Table 3). Presently average organic matter level of the 50% soil is only 1.0 or less. Depletion has occurred at a range of 9% to 46% in twenty years period.

Table 3. Organic matter content of the soils of Bangladesh

Class of soil organic matter	Total area (million ha)	% of net cropped area
Very low (< 1.0 %)	4.05	44.5
Low (1.0-1.7%)	1.56	17.1
Medium (1.8-3.5 %)	1.94	1.94
High (>3.5)	1.56	17.1

3. Salinity

The coastal part of Bangladesh which represents 1/5th of the country's landmass is facing problems due to gradual increase of salinity. Widespread intensive shrimp culture in the coastal region has aggravated the salinity problem. From an area of 52000 ha in 1983-84, it reached to almost 203000 ha by 2005-06. The extent and severity of salinity has further been aggravated by the withdrawal of Ganges water at the upstream. Shrimp farming have put severe adverse effects on livestock, poultry and fish population besides crop production. The combined effects of all those things are severely affecting the livelihoods.

Shrimp Farming in Crop Field

Scarcity of Fodder

4. Flood

About 1.32 and 5.05 m ha of the net cropped areas are severely and moderately flood-prone, respectively. Severe floods with high magnitude inundate large areas and cause widespread damage to crops, lives, and properties, and considered as major constraint to agricultural productivity. The severity of flooding is most likely to increase in the future since the river beds are rising every year due to continuous siltation.

Flood, 2007

5. Drought

Rainfall in Bangladesh is uncertain in recent years and unevenly distributed. Annual rainfall ranges from 1400 mm in the dry northwest region to over 5000 mm in the wet northeast region. About 90% of the precipitation generally occurs within July to September. Rainfed autumn rice, which contributes 50% of the total rice is mostly affected by drought. During the winter season (mid October to late February) - wheat, potato, mustard, and post winter season (March to May) -.winter and summer rice are mainly affected by drought.

Drought in crop field

6. Climate Change

Bangladesh is apprehended to be seriously affected due to the consequences of climate change. Estimates suggest that global temperature rise by 1^{o}C will raise the sea level by a margin of 1 m which means around 17.5% of the total area of the country covering entire coastal region including the Sundarbans mangrove ecosystems, the unique world heritage will be submerged under water. Rise in such sea level would have terrible consequences for the coastal population by displacing around 16 million people.

7. **Use of agro-chemicals**

Indiscriminate use of agro-chemicals especially fertilizers and pesticides in rice pose a formidable challenge to health, plants, animal, fishes, beneficial farm organism, environment and crop productivity.

Fertilizer: Modern rice cultivation is closely associated with high chemical fertilizer use, and it has been reflected in the consumption pattern of fertilizer. In 1981-82 around 0.87 million tonnes of chemical fertilizers were used while in 1994-95 the total amount increased nearly thrice with a total figure of 2.64 million tones, and in 2004-05 the figure jumped to 3.34 million tones (Fig. 2).

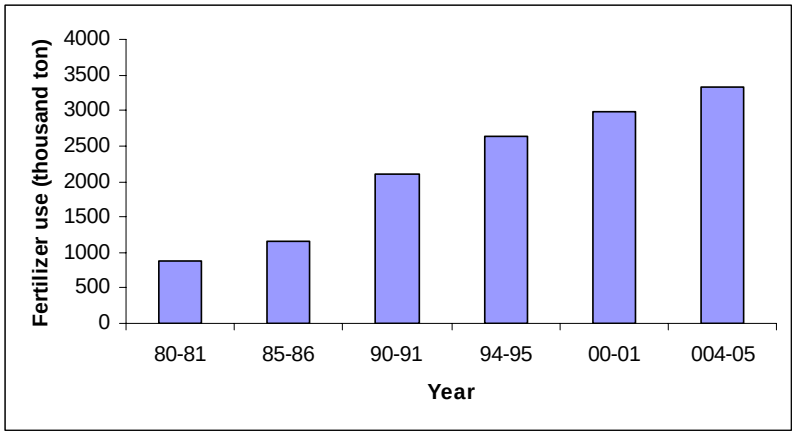

Fig. 2. Fertilizer use during 1980-2005.

Pesticide: Introduction of MV rice has led to wide and unrestricted use of pesticides during the last two decades. Utilization of pesticides in 1980-81 were around 2145 metric and the figure in 2004-05 reached to 23000 (Fig. 3) metric tones indicating an overwhelming dependence on these chemicals. Recently, pesticides are indiscriminately using in vegetable crops which are mostly detrimental to health and even officially banned in the country.

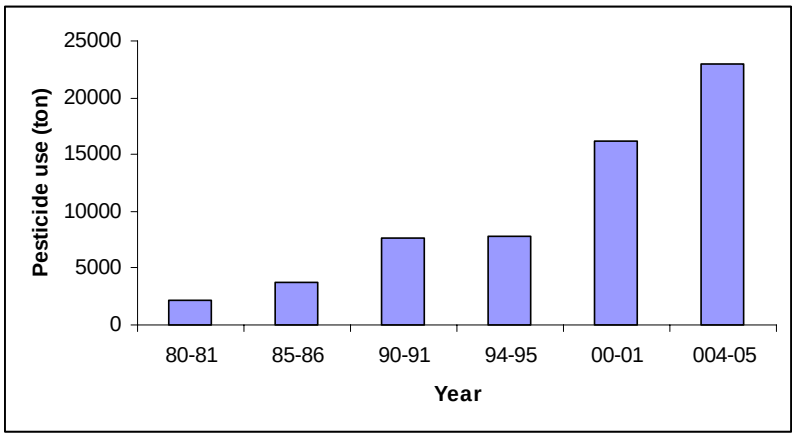

Fig. 3. Pesticide use during 1980-2005.

Pesticide use in crop field

8. **Loss of Biodiversity**

Bangladesh, once endowed with thousands of diverse species, its rich biodiversity is on the verge of rapid decline, because the current rate of extinction of different species is many times faster than what it would have been through the natural process because of different anthropogenic activities. The country have already lost a large of flora and fauna during the last century. Recent report stated that 54 inland fishes, 8 amphibians, 58 inland reptiles, 41 resident birds and 40 inland mammals have come under different categories of threat.

Future Strategy

Bangladesh has made remarkable success in agricultural production particularly food production, but the production system is under severe threat due to fragile environment. Despite this limitation, production must be increased in larger scale in improving environment through adopting development mechanisms. Some of them are:

- Population control
- Integrated resource management.
- Strengthening agricultural research for developing environment friendly varieties and production technologies.
- Crop diversification with high value crops especially pulses, oilseed and fruits.
- Bringing shrimp farms under scientific management systems
- Raising the production of fishery and livestock products.
- Developing and implementing sustainable land use policy
- Delivering safe drinking water and safe quality food.
- Capacity building and awareness raising.

Acknowledgement: The authors would like to acknowledge to the United States of America (USDA) for supporting to attend the meetings.