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ON
Contribution of Plant Breeding in Bangladesh Agriculture

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Contribution of Plant Breeding in Bangladesh Agriculture¹

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ABSTRACT

This paper has been prepared on contribution of plant breeding in Bangladesh agriculture to know the achievements of Bangladesh in agriculture sector and contribution of plant breeding to this achievements. All data and information were collected and used from secondary information. Bangladesh achieved self-sufficiency in food because of invention of High Yielding Variety (HYV), hybrid variety, varieties that are resistant to different biotic and abiotic stresses. Yield of cereals, pulses, oilseeds, vegetables etc. are almost 2 to 3 times higher than that of three decades prior. Different methods of plant breeding and improved techniques of molecular breeding assisted to enhance the contribution of plant breeding. Although food security is not ensured in Bangladesh yet, it is hoped that Bangladesh can ensure it near future through production of high yielding, nutritious, resistant variety using breeding techniques.

Key words: Plant breeding, HYV, hybrid, resistant.

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CHAPTER 1

INTRODUCTION

People started to adapt plant to meet their purposes around 10,000 years ago. They selected and retained the phenotypically best performing plants that nature provided. Again, some useful and important traits which had appeared naturally were bred into certain crops under human selection, even sometimes by going against natural selection. Towards the end of 19th century Mendel discovered the law of inheritance which opens a new era to accelerate plant modifications. In 1953, Watson and Crick discovered the double stranded structure of DNA and after this the knowledge of genetic material increased to a significant extent. New methods directly targeting DNA saw the light of day; firstly in 1960 in the form of mutation breeding followed by Recombinant DNA Technology or GM technology in 1983. Marker Assisted Selection (MAS) led to an upgrade of existing technologies. In spite of having a succession various technologies, they have not been replaced by one another. All of the techniques have their own value in specific work and existence of these techniques serves as tools to plant breeder to come up with new varieties.

Plant Breeding is the art and science of changing the existing character or traits of plant to produce desired one. Plant breeding can be accomplished through various technologies from introduction, selection, hybridization and different approaches of molecular breeding. After the independence, Bangladesh faced one of the worst famines of the twentieth century. Then some international agencies offered the country some prospects to be capable of feeding its people. Since then, Bangladesh government took food security as first priority by achieving self-sufficiency in food production.

Although our country had to depend on import of food from other country at the time of independence and later on, but now we can say that we are capable to achieve self-sufficiency in production of food specially the staple foods. Bangladesh possess a successful story that it has worldwide significance for its efforts to decrease the poverty. Bangladesh agriculture playing a significant role in producing food for 163.65 million people using merely 8.75 million hectares of agricultural land (Salam et al., 2014). This achievements was gained by some cumulative

efforts such as improved plant genetic resources, High yielding varieties, different types of resistant varieties, Advance breeding techniques, good management practices etc. After gaining self-sufficiency in food production to meet the dietary requirements, now advance breeding turns towards to meet the quality of food.

Food & Agriculture Organization (FAO) predicted that, Bangladesh has the potential to break the previous record in rice crop production in next 10 years. For assurance of food security, Bangladesh Government formulated 'Food Safety Act 2013'. Around 2.85 million metric tons of food grain have been sold after 2009. Now Government provide rice at 10 tk per kg. For the first time Bangladesh exported 25,000 MT of rice to Sri Lanka in 2014 (CRI, 2017). These evidence provides support to the contribution of plant breeding in Bangladesh agriculture. In spite of being much lacking as a developing country, we hope new technologies of plant breeding create a millstone to ensure food security in Bangladesh.

Objectives:

1. To asses the achievements in the agriculture sector of Bangladesh.
2. To know about the contribution of plant breeding in Bangladesh agriculture.

CHAPTER 2

MATERIALS AND METHODS

This seminar paper is exclusively a review paper. So, no specific methods of studies are followed to prepare this paper. All data and information were collected and used from secondary sources. This seminar paper has been prepared by reciting different books, journals, booklets, proceeding, newsletters, consultancy report which are available in the libraries of BSMRAU & internet. Some information are collected from BARI, BRRI and some private agricultural organizations. Maximum necessary supports were taken from internet searching. Finally, this seminar paper was prepared with the consultation of my respective major professor and honorable seminar course instructors.

CHAPTER 3

REVIEW OF FINDING

3.1 Plant Breeding in Agriculture

The aim of plant breeding is the production of improved or new cultivar based on our requirement or objective. The aim is to combine the parental plants to get the offspring with best characteristics. The role of breeder in agriculture is to select the parent with great potentialities based on their performance data, pedigree records and genetic information and select the suitable breeding program to create variation. Production of high yielding varieties, different resistant varieties and varieties with high quality attributes is very important for fight against the upcoming challenges. World population is increasing day by day and breeding of new varieties is essential for ensuring food security.

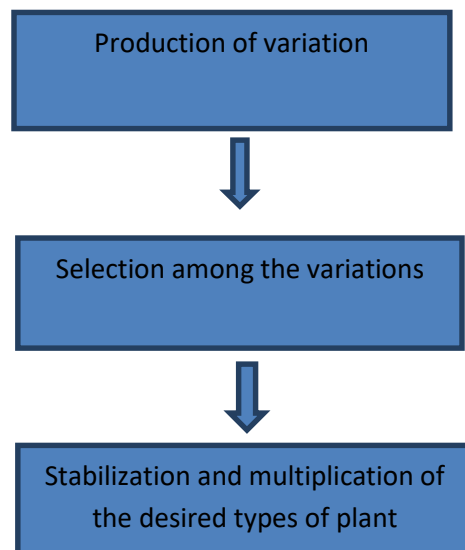


Figure 1: Diagrammatic representation of basic steps in any plant breeding program.

Source: Modified from Caligari and Forster (2012)

Table 1: Target of Plant Breeding

| Farmer | Logistics | Distributor | Consumer |
|---------------------------|------------------|-------------|---|
| Agronomic characteristics | Transportability | Storability | Organoleptic (taste,sight, smell,touch) |
| Yield | | | |
| Pest & diseaseResistance | Earliness | Appearance | Convenience |
| Abiotic stress resistance | | Price | Nutritional value |
| Earliness | | | Price |
| Harvest ability | | | |
| Marketvalue | | | |

Source: UPOV (2016)

3.2 Achievement of Plant Breeding in Bangladesh Agriculture

3.2.1 Cereal crops: Rice, Wheat, Maize

Rice

Rice (*Oryza sativa* L.) is considered as the major crop in Bangladesh as it constitutes 91.8% of the total food grain. Production of 34710 metric tons (BBS, 2016). Although Bangladesh is now on the verge of attaining self-sufficiency in cereal production, there is still a large gap between the production and demand. Plant Breeding helps a lot to cope with this situation by producing high yielding varieties, resistant varieties and better quality food to ensure the food security. The yield of hybrid rice is higher than any other variety. The varieties listed in Table 4 are popular in our country although some are showing lower yield. This is because they serve for different purposes. Such as BRRI dhan47 is for saline region, BRRI dhan34 for aromatic rice.

Table 2: A list of some cultivar of rice which are mostly cultivated in Bangladesh

| Varirty (Aus) | Features | Aman | Features | Boro | Features |
|---------------|---------------|--------------|--|--------------------|--|
| BRRRI dhan28 | Mega variety. | BR 11 | Most popular variety, high yielding. | BR 16 | Produce quality tillers |
| | | BRRRI dhan34 | Aromatic, fine grain, brown plant hopper resistant. | BRRRI dhan28 | Mega variety, high yielding than any other modern varieties. |
| | | BRRRI dhan47 | Salt tolerant. | BRRRI dhan29 | Mega variety, resistant to leaf & sheath blight |
| | | BRRRI dhan49 | Grain looks as like as Najirshail | BRRRI hybrid dhan2 | Advance high yielding variety |
| | | BRRRI dhan50 | Modern aromatic variety | | |
| | | Binadhan 7 | Short duration, high yielding, good quality, resistant to BPH & Rice hispa | | |

Source: Krishi Diary (2017); Kashem (2017)

Table 3: A list of rice varieties which are released by others organizations

| Variety | Organization |
|---------------------------------|--------------|
| Hira-5 | Supreme |
| 1202, 1203 | Syngenta |
| Shankor 3, folon, shera, sompod | ACI |
| Moyna, tiya, richer | Lalteer |
| SLH | BADC |

Source: Anonymous.

Table 4: Performance of some growth parameters and qualitative contents of popular rice varieties in Bangladesh

| Variety | Plant height (cm) | Panicle m ⁻² | Panicle length (cm) | Tillers/hill | Duration | % amylose | Yield (ton/ha) |
|-------------------|-------------------|-------------------------|---------------------|--------------|----------|-----------|----------------|
| BR 16 | 111.7 | 283.66 | 26.47 | 16.67 | 165 | 27 | 5 |
| BRR1 dhan28 | 105 | 256 | - | 11.7 | 140 | 28 | 5.74 |
| BRR1 dhan29 | 97 | 178 | 24.04 | 10.5 | 160 | 29.4 | 7.5 |
| BRR1 dhan33 | 111.33 | 264 | 25.87 | 11.67 | 118 | 25 | 4 |
| BRR1 dhan34 | 117 | 197.33 | 25.5 | 14.33 | 135 | 23 | 4.06 |
| BRR1 dhan41 | 140 | 218.33 | 26.13 | 10.33 | 100 | 24.6 | 4.01 |
| BRR1 dhan47 | 105 | - | - | - | 145 | 26.1 | 6 |
| BRR1 dhan49 | 107.76 | 320.33 | 23.06 | 16 | 135 | 25 | 5 |
| BRR1 dhan50 | 82 | 325 | - | - | 155 | 26.8 | 5.12 |
| Binadhan 7 | 96.46 | 328 | 24.51 | 14.66 | - | - | 4.68 |
| BRR1 hybrid dhan2 | 105 | - | - | - | 145 | - | 8 |

Source: Biswash et al. (2016); Kashem (2017)

Wheat

Wheat (*triticumaestivum*) is considered as one of the most outstanding cereals both in area and production (Coasta et al., 2013). It is more nutritious and contributes to human diet mostly. In Bangladesh it is second major cereal crop beyond rice at present the production of wheat is 13.75 lac MT in 4.53 lac hectares lands and average yield is 3.04 ton/ha (BBS, 2016).

Table 5: A list some high yielding & resistant cultivar of wheat in Bangladesh

| Variety Name | Features | Variety name | Features |
|--------------|---|--------------|---|
| BARI Gom-25 | HYV, yield 3800-5200 kg/ha, slightly salinity and heat tolerant | BARI Gom-29 | HYV, yield 4000-5000 kg/ha. Leaf blight and rust resistant. |
| BARI Gom-26 | HYV, yield 4000-5500 kg/ha. Heat resistant. | BARI Gom-30 | HYV, yield 4500-5500 kg/ha. Short duration and heat tolerant. |
| BARI Gom-27 | HYV, yield 4200-5500 kg/ha, short duration variety, moderately heat tolerant. | BARI Gom-31 | HYV, yield 4500-5000 kg/ha. Short duration and resistant to leaf blight and rust disease. Tolerant to heat. |

Table 5 continued

| | | | |
|-------------|---|-------------|---|
| BARI Gom-28 | HYV, yield 4000-5500 kg/ha. Short duration and heat tolerant. | BARI Gom-32 | HYV, yield 4600-5000 kg/ha, resistant to blast of wheat, leaf blight and rust disease. Heat tolerant. |
|-------------|---|-------------|---|

Source: Azad et al. (2017)

Table 6: Performance of some growth parameters and yield components of some wheat varieties in Bangladesh

| Variety name | Plant height (cm) | No. of effective tiller hill ⁻¹ | Kernel spike ⁻¹ | Days to maturity | 1000 seeds weight (gm) | Yield (ton/ha) |
|--------------|-------------------|--|----------------------------|------------------|------------------------|----------------|
| BARI Gom-25 | 97.64 | 3.58 | 38.94 | - | 51.24 | 4170 |
| BARI Gom-26 | 96.50 | 3.75 | 41.28 | - | 49.98 | 4360 |
| BARI Gom-27 | 95-100 | 4-5 | 45-50 | 107-112 | 35-40 | 4200-5500 |
| BARI Gom-28 | 95-100 | 4-5 | 45-50 | 102-108 | 43-48 | 4000-5500 |
| BARI Gom-30 | 95-100 | 4-6 | 45-50 | 100-105 | 44-48 | 4500-5500 |
| BARI Gom-31 | 95-100 | 4-6 | 45-52 | 105-109 | 46-52 | 4500-5000 |
| BARI Gom-32 | 90-95 | 4-6 | 42-47 | 95-105 | 50-58 | 4600-5000 |

Source: Kamrozzaman et al.(2016);Azad et al. (2017)

From this table we can say that Bari Gom-30, Bari Gom-31, Bari Gom-32 showed highest effective tiller per plant as well as yield of plant. Whereas BARI Gom-25 shows the lowest yield among these.

Maize

Bangladesh Agricultural Research Institute (BARI) released 7 varieties of maize by selection and 11 varieties of Hybrid Maize through hybridization. All of these are not cultivated yet.

Table 7: A list of some cultivar of maize in Bangladesh

| Variety | Features |
|-----------------------|---------------------------------------|
| BARI hybrid bhutta-5 | High Yielding, Yield 10-10.5 ton/ha |
| BARI hybrid bhutta-7 | High Yielding, Yield 10.5-11 ton/ha |
| BARI hybrid bhutta-9 | High Yielding, Yield 10.20-12 ton/ha |
| BARI hybrid bhutta-11 | High Yielding, Yield 9.5-11.5 ton/ha |
| BARI hybrid bhutta-12 | Drought resistant. Yield is also high |
| BARI hybrid bhutta-13 | Drought resistant |

Table 7 continued

| | |
|---------------------|--|
| BARI misti bhutta-1 | Yellow flint is rich in vitamin A. used as vegetables and with other preparation such as soup. Resistant to wilt |
| Khoibhutta | 90-95% khoi can be obtained from it |

Source: Azad et al. (2017)

Table 8: Performance of some growth parameters and yield components of some maize varieties in Bangladesh

| Variety name | Plant height (cm) | Length of cob (cm) | Weight of cob (gm) | Seeds per cob | 1000 seed wt (gm) | Yield (ton/ha) |
|----------------------|-----------------------------------|--------------------|--------------------|---------------|-------------------|----------------------------------|
| BARI hybrid bhutta-5 | 195-200 (robi) 110-125(kharif) | 100-110 | 250 | 420 | 290-310 | 10-10.5 (robi) 7-7.5 (kharif) |
| BARI hybrid bhutta-7 | 200-210 | 100-105 | 250 | 700-780 | 340-360 | 10.5-11 |
| BARI hybrid bhutta-9 | 208-239 | 100-115 | 185.33 | 639.7 | 340-360 | 10.20-12 |

Source: Majid et al. (2017);Azad et al. (2017)

Among all of the high yielding varieties of maize shown in table 8, BARI Hybrid bhutta 10 showed highest seeds per cob and yield i.e. 9-11.5 ton/ha. Although having some high yielding hybrid variety of maize, our farmers are using some introduced cultivar of *Zea mays*.

Table 9: A list of some introduced varieties of maize in Bangladesh

| Variety name | Organization |
|--------------------------------|--------------|
| 900 M, 900 M bold, 981, Deculb | Munsanto |
| NK-40 | Syngenta |
| Uttoron | BRAC |

Source: Anonymous.

Table 10: Areas, Yield and Production of cereals from 1988-89 to 2015-16

| Year | Area '000' (acres) | Yield (kg per acre) | Production'000' MT |
|-----------|--------------------|---------------------|--------------------|
| 1988-89 | 26938 | 618 | 16651 |
| 1990-91 | 27542 | 679 | 18937 |
| 1993-94 | 26424 | 728 | 19245 |
| 1997-1998 | 27569 | 752 | 20731 |
| 2001-2002 | 28345 | 918 | 26007 |
| 2005-06 | 27510 | 1011 | 27806 |

| Year | 30153 | 1266 | 38176 |
|---------|-------|------|-------|
| 2008-09 | 30153 | 1266 | 38176 |
| 2010-11 | 30969 | 1416 | 43861 |
| 2013-14 | 29925 | 1262 | 37784 |
| 2014-15 | 30035 | 1276 | 38332 |
| 2015-16 | 30057 | 1236 | 37156 |

Source: BBS (2012); BBS (2014); BBS (2016)

Here the production is higher than 2 times in 2011-12 than in 19988-89. Yield per unit area is increasing day by day. Now a day's different High Yielding Variety (HYV) and different pest resistant varieties are cultivating in Bangladesh. Plant breeding contributes to get self-sufficiency in food by producing HYV and hybrid varieties.

3.2.2 Pulses

Pulses are the important source of vegetable protein in Bangladesh. Protein content of pulses is varies from 20-30%. Pulse crop also contain amino acid lysine which content is low in food grains. The area under pulse production is decreasing day by day (Uddin et al., 2015). In Bangladesh most of the people suffers from malnutrition. To cope with this situation, our scientists are trying to develop high yielding variety to get more production using limited land.

Table 11: List of some cultivar of pulses in Bangladesh

| Variety | Features |
|---------------|--|
| BARI masur-7 | Suitable for all type of soil. |
| BARI masur-8 | Yield is high. Resistant to stem phylum blight and rust diseased. High Zn and Fe rich. |
| BARI chola-10 | Yield is high, yield 1800-2030 kg/ha. Early maturing. Drought and diseases tolerant. |
| Binachola-7 | High yielding, yield 1.8 ton/ha |
| Binachola-8 | High yielding, yield 1.8 ton/ha |
| Binachola-10 | High yielding, yield 1.8 ton/ha |

Source: Azad et al. (2017); Krishi Diary (2017)

Table 12: Areas, Yield and Production of pulses from 1988-89 to 2015-16

| Year | Area '000' (acres) | Yield (kg per acre) | Production'000' MT |
|-----------|--------------------|---------------------|--------------------|
| 1988-89 | 1817 | 273 | 496 |
| 1990-91 | 1799 | 291 | 523 |
| 1993-94 | 1752 | 303 | 530 |
| 1997-1998 | 1690 | 307 | 519 |

| | | | |
|-----------|------|-----|-----|
| 2001-2002 | 1115 | 307 | 341 |
| 2005-06 | 833 | 335 | 279 |
| 2008-09 | 559 | 351 | 196 |
| 2010-11 | 627 | 368 | 231 |
| 2013-14 | 823 | 427 | 352 |
| 2014-15 | 1011 | 718 | 726 |
| 2015-16 | 917 | 411 | 377 |

Source: BBS (2012); BBS (2014); BBS (2016)

The area of pulses production is decreasing day by day. It is due to the increase of population, industrialization and farmers are more interested in cultivating cereal crop specially rice. Again rice is our staple food so it is regarded as the first concern. Although area and production is showing a decreasing trend, but the yield per unit area is increasing because of different high yielding varieties and good management.

3.2.3 Oilseed (Mustard)

Brassica sp. occupies first position of the list in respect of area and production among the oilseed crops in Bangladesh (BBS, 2016).

Table 13: List of some cultivar of Mustard growing in Bangladesh

| Variety | Features | Variety | Features |
|-----------------|---|-----------------|--|
| BARI sarisha-09 | Short duration, yield is high | BARI sarisha-11 | Yield is high. Oil content also high. Drought and salinity tolerant. |
| BARI sarisha-13 | Yield is comparatively high, oil content is 42-43%. | BARI sarisha-17 | Short duration, yield 1.7-1.8 ton/ha |
| BARI sarisha-14 | Yield is high. Short duration variety. | Binasarisha-4 | High yielding |
| BARI sarisha-15 | Yield is 30-35% higher than Tori-7. Short duration | Binasarisha-10 | Average yield 1.8 ton/ha. Oil content 42%. |

Source: Azad et al. (2017); Krishi Diary (2017)

Table 14: Performance of some growth parameters and yield components of some mustard varieties in Bangladesh

| Variety name | Plant population /m ² | No. of siliqua/plant | No. of seeds/siliqua | 1000 seeds weight (gm) | Duration (days) | Seed yield (t/ha) |
|-----------------|----------------------------------|----------------------|----------------------|------------------------|-----------------|-------------------|
| Improved Tori | 52.83 | 120.27 | 19.43 | 2.90 | 71 | 1.16 |
| BARI Sarisha-9 | 53 | 105.10 | 18.20 | 3.07 | 74 | 1.09 |
| BARI Sarisha-12 | 51.33 | 95.07 | 16.77 | 3.20 | 75 | 0.95 |
| BARI Sarisha-14 | 46.67 | 99.60 | 34.30 | 3.67 | 72 | 1.29 |
| BARI Sarisha-15 | 53.67 | 101.43 | 30.40 | 3.63 | 75 | 1.29 |
| Binasarisha-4 | 49.33 | 89.43 | 30.13 | 4 | 85 | 1.19 |

Source: Helal et al. (2016)

Here, BARI Sarisha-14 and BARI Sarisha 15 showed the highest seed yield. These varieties are also showing early maturity. Although No. of siliqua per plant is high, the yield is less than BARI Sarisha-14 and BARI Sarisha-15.

Table15: Areas, Yield and Production of mustard from 1988-89 to 2015-16

| Year | Area '000' (acres) | Yield (kg per acre) | Production'000' MT |
|-----------|--------------------|---------------------|--------------------|
| 1988-89 | 1415 | 307 | 434 |
| 1990-91 | 1407 | 319 | 448 |
| 1993-94 | 1380 | 342 | 472 |
| 1997-1998 | 1387 | 348 | 483 |
| 2001-2002 | 1000 | 376 | 544 |
| 2005-06 | 846 | 745 | 657 |
| 2008-09 | 877 | 758 | 661 |
| 2010-11 | 786 | 922 | 791 |
| 2013-14 | 1071 | 790 | 847 |
| 2014-15 | 1036 | 870 | 901 |
| 2015-16 | 1124 | 830 | 933 |

Source: BBS (2012); BBS (2014); BBS (2016)

Although Mustard is the principal oil crop in Bangladesh but its area of cultivation is limiting day by day. But the yield and production is increasing. In breeding program, it is very important to develop a hybrid variety, HYV and varieties with desirable traits to increase the production.

3.2.4 Vegetables (Potato and Tomato)

Potato

Cultivated plant Potato, edible tuber of the cultivated plant *Solanumtuberosum* of the family Solanaceae. It was the major crop for the original Americans. It is now one of the staple foods in Bangladesh. Recently, the government has been trying to diversify food habits and encourage potato consumption to reduce pressure on rice. So, potato is becoming an important food for food security in Bangladesh (Chowdhury& Chowdhury, 2015).

Table 16: A list of some potato cultivars growing in Bangladesh

| Variety | Features | Variety | Features |
|-------------|--|-------------|---------------------------------------|
| BARI Alu-13 | Exportable. Popular as early variety | BARI Alu-07 | Late blight & Virus disease resistant |
| BARI Alu-25 | Suitable for processing. Scab resistant | BARI Alu-08 | Late blight & Virus disease resistant |
| BARI Alu-28 | Suitable for processing, scab resistant. | BARI Alu-53 | Late Blight resistant. |
| BARI Alu-29 | Suitable for processing | | |

Source: Azad et al. (2017)

Table 17: Performance of some growth parameters and yield components of some potato varieties in Bangladesh

| Variety Name | Plant height (cm) | No. of main stem per hill | No. of tubers per hill | Tuber yield per hill (g) | Tuber Yield (ton/ha) |
|--------------|-------------------|---------------------------|------------------------|--------------------------|----------------------|
| Diamant | 59 | 5.17 | 9.67 | 424.80 | 28.33 |
| Cardinal | 53.3 | 4.67 | 9.67 | 405 | 27 |
| Granula | 51.17 | 5.50 | 10.83 | 420 | 28 |
| Felsina | 53.83 | 4.67 | 8.67 | 375 | 25.13 |
| Provento | 54.83 | 4.67 | 9.83 | 380.67 | 25.40 |
| Asterix | 61.33 | 6.17 | 13.00 | 443.80 | 29.60 |

Source: Eaton et al. (2017)

Among these varieties, Asterix showed highest in plant height, No. of main stem per hill, No. of tubers per hill, tuber yield per hill and tuber yield where Felsina showed lowest yield.

Tomato

Tomato is one of the most widely grown vegetable crops and has got versatile use in various foods. It is mainly a winter crop. However, tomato is cultivated in summer season to some extent. Mainly, most of the tomatoes are imported from India in summer season due to lack of sufficient supply. Cultivation of tomato in summer is a new concept in Bangladesh.

Table 18: A list of some tomato cultivars growing in Bangladesh

| Variety | Features | Variety | Features |
|-----------------------|--|----------------------|---|
| BARI Tomato-1(Manik) | Bacterial wilt resistant | Binatomato-4 | Binatomato-4 is a high yielding winter tomato variety. Fruits are round, fleshy, smooth and tasty. |
| BARI Tomato-2 (Ratan) | Bacterial wilt resistant, fruit can be harvested 4-5 times | Binatomato-6 | It is suitable for cultivation throughout the year. It is moderately resistant to wilt, early blight and leaf curl, tolerant to mild salinity and water stress. |
| BARI Tomato-14 | High storage ability, Bacterial wilt tolerant, long time fruit harvesting possible | Binatomato-10 | Fruits are small and look like grape which is round and attractive red in color at ripening |
| BARI Tomato-15 | TYLCV resistant, High storage ability | BARI Hybrid Tomato-8 | Heat tolerant summer variety. Greater in size than other varieties. No need to apply artificial hormone. |
| BARI Hybrid Tomato-4 | Heat tolerant summer variety. | | |

Source: Azad et al. (2017); Krishi Diary (2017)

Table 19: Performance of some growth parameters and yield components of some tomato varieties in Bangladesh

| Varieties | Plant height (cm) | No. of fruits per plant | Fruit weight Kg/plant | Duration | Yield (t/ha) |
|----------------|-------------------|-------------------------|-----------------------|----------|--------------|
| BARI Tomato-2 | 82.5 | 21 | 1.70 | 105-110 | 80-85 |
| BARI Tomato-3 | 91.4 | 20 | 1.45 | 110-115 | 85-90 |
| BARI Tomato-8 | 87.6 | 25 | 1.58 | 100-110 | 90-95 |
| BARI Tomato-9 | 88.7 | 26 | 1.61 | 95-100 | 80-90 |
| BARI Tomato-11 | 115.3 | 34 | 1.50 | 100-110 | - |
| BARI Tomato-14 | 119.7 | 27 | 1.93 | - | 90-95 |

Source: Siddiky et al., 2012 & Azad et al., 2017

BARI Tomato 14 showed highest fruit weight per plant as well as yield (t/ha). Again BARI Tomato 11 showed highest number of fruits per plant.

There are many vegetables cultivated in Bangladesh. The yield of vegetables in Bangladesh is less than other developing countries. Lack of HYV, susceptible to pest and diseases, drought, flood are the main obstacles to produce vegetables. Figure 2 showed that both yield and production of vegetables are increasing since last five years. Bangladesh Agricultural Research Institute (BARI) released almost 107 Hybrid/OP varieties which are high yielding and resistant to biotic and abiotic stress.

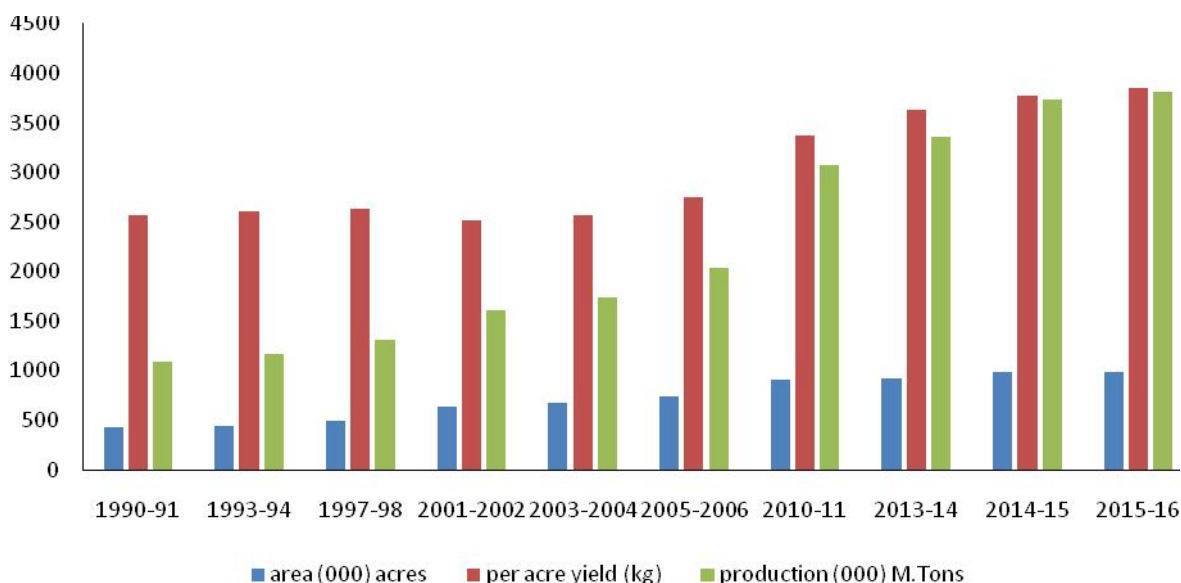


Figure 2: Areas, Yield and Production of vegetables from 1988-89 to 2015-16.

Source: Modified from BBS (2016)

3.2.5 Sugar Crop

Sugarcane

Sugarcane (*Saccharumoficinarum*) is an important sugar crop in Bangladesh as well as in the world. It is regarded as one of the major cash crop in our country. But its production is not satisfactory due to some obstacles such as biotic and abiotic stresses. Water logging is one of the most serious problem and effect the yield and juice quality of sugarcane (Islam et al., 2011). Bangladesh Sugar Crop Research Institute developed 45 varieties of sugarcane. Some of those are now cultivated according to demand.

Table 20: A list of some sugarcane cultivar growing in Bangladesh

| Variety | Features |
|--------------|--|
| Ishwardi-33 | Flood tolerant |
| Ishwardi-35 | Drought & flood tolerant |
| Ishwardi-36 | Early maturing, Drought & flood tolerant |
| Ishwardi-37 | Drought, flood and submerge tolerant |
| Ishwardi-38 | Early maturing, drought tolerant |
| Ishwardi-39 | Early maturing, drought & flood tolerant |
| BSRI aakh-41 | Early maturing, medium flood & drought resistant |
| BSRI aakh-42 | Early maturing, Salt, Drought, flood and submerge tolerant. Favorable for char & marginal land |
| BSRI aakh-43 | Early maturing, Salt, Drought, flood and submerge tolerant. Favorable for char & marginal land |
| BSRI aakh-44 | Absence of flowering Drought tolerant |
| BSRI aakh-45 | Early maturing. Drought, flood, salinity and smut disease resistant. |

Source: Krishi Diary (2017)

Figure 3 showed that the area of sugarcane production area as well as production is decreasing day by day due to increasing of population and susceptibility of sugarcane to biotic and abiotic stresses. But the yield per unit area is increased in 2016 than 1991. Plant breeders should pay more attention to increase the production.

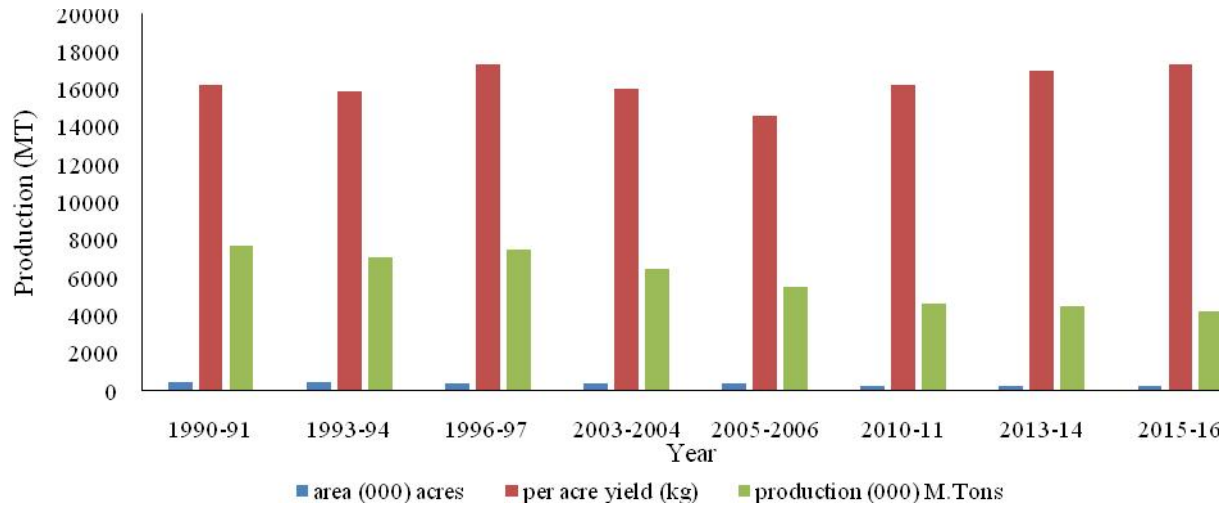


Figure 3: Areas, Yield and Production of vegetables from 1988-89 to 2015-16.
Source: Modified from BBS (2016)

3.3 Trend of pesticide use in Bangladesh

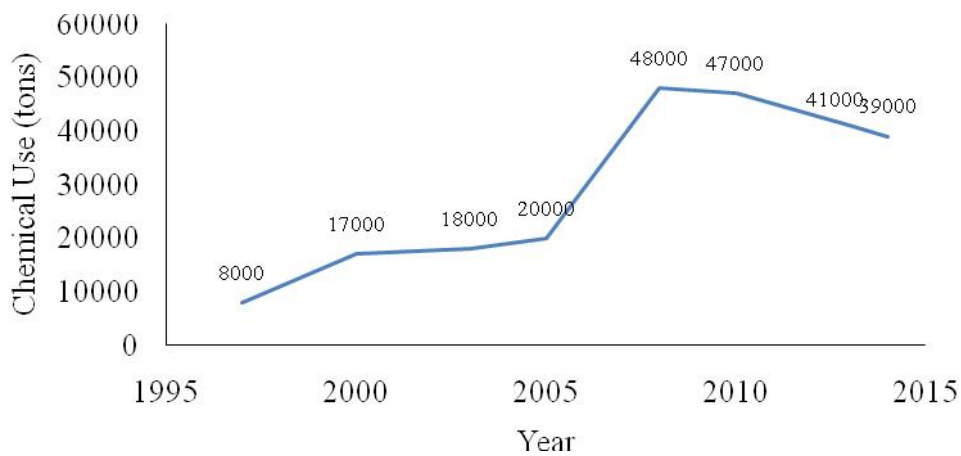


Figure 4: Trend of pesticide use in agriculture.
Source: Modified from BBS (2016)

Figure 4 showed that pesticide use in agriculture was low compared to the previous years. At that time chemical pesticide was not so popular. Then the use of pesticide increased a great extent. Then now a days it is showing that pesticide use is decreasing. Different resistant variety has been developed which limited the use of pesticides.

3.4 Contribution of plant breeding in Bangladesh agriculture

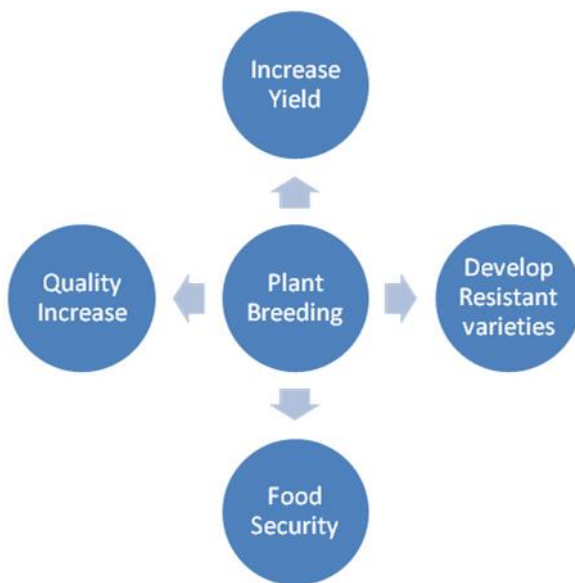


Figure 5: Contribution of plant breeding in Bangladesh agriculture.

Source: Prepared by author.

CHAPTER 4 CONCLUSION

1. Bangladesh get self-sufficiency in food. Different high yielding and resistant varieties of cereals, pulses, vegetables, oilseeds, sugar crop are great achievement for Bangladesh to remove starvation of people.
2. There is a significant contribution of plant breeding in Bangladesh agriculture, i.e. production of high yielding variety, hybrid variety, more adaptable variety, resistant variety etc. which directly and indirectly feed the people of Bangladesh and we hope activities of plant breeding will be capable of ensuring the food security in Bangladesh agriculture.

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