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EVALUATION OF GROWTH AND YIELD PERFORMANCE OF IMPORTANT THREE TOMATO VARIETIES RELEASED BY BANGLADESH AGRICULTURAL RESEARCH INSTITUTE

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ABSTRACT

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An experiment was conducted at Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD) Agricultural Farm, Kotalipara, Gopalganj during December, 2019 to May, 2020 to find out the vegetative growth and yield performance of three BARI tomato varieties viz. BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15. The plant height of BARI Tomato-11, BARI Tomato-14, BARI Tomato-15 were 8.21cm, 7.17cm, 8.82cm, 8.73cm, 7.75cm, 9.37cm, 15.40cm, 13.24cm, 14.40cm respectively at 0 DAT, 10 DAT, 20 DAT with significantly increase 20 DAT except 0 DAT and 10 DAT. First flowering of BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15 was 39 DAT, 40 DAT and 41 DAT which was statistically identical. Number of fruits per plant and weight of individual fruit of BARI Tomato-11, BARI Tomato-14, BARI Tomato-15 were 142.96, 34.92, 30.95 and 10.85gm, 78.5gm, 59.9gm respectively. In case of number of fruits per plant, BARI Tomato-11 showed the maximum but weight of individual fruit was very low because of size and shape was very small. Fruit yield of BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15 were 51.67 t/ha, 91.33 t/ha and 61.67 t/ha, respectively. The present study concluded that BARI Tomato-14 is more suitable for this area.

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INTRODUCTION

Tomato (*Lycopersicon esculentum*) is one of the most important vegetables in the world as well as in Bangladesh. It originated in western South America and Central America (Encyclopaedia Britannica, 2018). Its domestication and used as a cultivated food may have originated with the indigenous peoples of Mexico. The Aztecs used tomatoes in their cooking at the time of the Spanish conquest of the Aztec empire, and after the Spanish encountered the tomato for the first time after their contact with the Aztecs, they brought the plant to Europe. From there, the tomato was introduced to other parts of the European-colonized world during the 16th century (Encyclopedia of Life, 2014). In terms of human health, tomato fruit is a major component of daily meals in many countries and constitutes an important source of minerals, vitamins, and antioxidants (Dorais *et al.*, 2005). The fruit contains a large quantity of water, low amounts of proteins and fats, and some carbohydrates. It also contains carotenes, such as lycopene (which gives the fruit its predominantly red colour) and beta-Carotene (which gives the fruit its orange colour). Modern tomato cultivars produce fruits that contain up to 3% sugar of fresh fruit. Tomato is used as canned vegetable having multiple uses (Chowdhury, 1979). It is much popular as salad in the raw state and is made into soups, juice, ketchup, pickles, sauces, conserved puree, paste, powder and other products (Thompson and Kelly, 1983). Almost 60% of world tomato production comes from Asia, 13.3% from Europe, 11.3% from Africa, 8.7% from North America, and 6.6% from Central America and South America (FAOSTAT, 2018). According to FAOSTAT (2017), the world's top five greatest producers of tomato in 2014 were China, India, the United States, Turkey and Egypt. In Bangladesh, the area under tomato cultivation is 27518.62 hectare with a total production of 3, 89,000 metric tons having an average yield of 14.05 t/ha (BBS, 2018) whereas, the world tomato production is 200.95 million tons from the area of 4.8 million hectare with an average yield of 41.45 t/ha (FAOSTAT, 2018). Unfortunately, the average yield of tomato in Bangladesh is very low compared to that of neighboring countries like China (56.2 t/ha) and India (24.2 t/ha) (Halder *et al.*, 2003).

In Bangladesh, there is a great possibility of increasing tomato yield per unit area by selecting high yielding variety, proper use of fertilizer, appropriate sowing date etc. There are many tomato varieties have been developed by Bangladesh Agricultural Research Institute (BARI). Among these, BARI Tomato-11 was developed by applying selection method in two lines, TM 0111 and TM 0367, from the Asian Vegetable Research and Development Center (AVRDC), Thailand. Main characteristics of the BARI Tomato-11 plants are tall and less bushy. The fruit size is comparatively small and borne in cluster but the number of fruit is high. BARI Tomato-14 is suitable for late winter season. Fruit size large, round with attractive red flesh color. The fruits can be harvest for a long time (Azad, AK *et al.* 2019) and so the variety BARI Tomato-14 can fulfill our vegetable demand for a long time. Under saline condition, all plant parameters of tomato varieties were reduced compared to the control except number of fruits of BARI Tomato-14, BARI Hybrid Tomato-5 and BARI Tomato-2. Thus, BARI Tomato-14, BARI Hybrid Tomato-5 and BARI Tomato-2 can be regarded as a breeding material for development of new tomato varieties for tolerance to salinity in saline areas of Bangladesh. (Siddiky *et al.*, 2012). BARI Tomato-15 is high yielding winter variety. Thick skin and edible flesh having very good self-life. Fruit oval shape, less seeded fruits, attractive red flesh color. Yellow leaf curl virus tolerant. (Azad *et al.* 2019). These three varieties were selected to conduct the experiment at BAPARD Agricultural Farm, Kotalipara, Goplaganj. It is know that only one major crop (boro rice) is produced in this area and the salinity is increasing day by day in Gopalganj district. If the vegetables can introduce in cropping pattern, this will be helpful for farmers. The present experiment was conducted to find out the vegetative growth of the BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15 and to estimate the yield potentiality of these tomato varieties in this agro-climatic conditions of Agro Ecological Zone (AEZ-14). This help to improve the cropping pattern of this area as well as the socio-economic condition of the farmer's level.

MATERIALS AND METHODS

The field experiment was conducted at Bangabandhu Academy for Poverty Alleviation and Rural Development (BAPARD) Agricultural Farm, Kotalipara, Gopalganj during 15 December 2019 to 15 May 2020. The location of the site is between 21°51' and 23°10' North latitude and between 89°56' and 90°10' East longitude under the AEZ-14. The topography of the farm area was medium high land and the soil is sandy loam type. The average temperature of this location varies from 12.1 °C to 36.1 °C. Heavy rainfall occurred during rainy season.

Three tomato varieties BARI Tomato-11 (V_1), BARI Tomato-14 (V_2) and BARI Tomato-15 (V_3) were used as experimental materials. Seed was collected from Bangladesh Agricultural Research Institute (BARI), Joydebpur, Gazipur. The seeds were sown in seedbed on 18 December, 2019. Proper care and management were done for raising seedlings. The seedlings were transplanted at the experiment field on 20 January 2020.

The size of the experiment field was 105m². Four cross ploughing were done and raised beds were prepared. The size of the plot was (3m×2m) and 0.5m drain was kept between two plots. Total number of plot was 12. Row to row and plant to plant distance was 60cm and 50cm respectively. Randomized Completely Block Design (RCBD) was used with 4 replications and three varieties.

Fertilizer was used as the recommendation of BARI Krishi Projukti Hatboi, 2019. The fertilizer dose was cow dung 10 t/ha, urea 177 kg/ha, triple super phosphate (TSP) 150 kg/ha, muriate of potash (MoP) 81 kg/ha, boron 4 kg/ha, gypsum 88 kg/ha, zinc sulphate 5 kg/ha. Equal amount of fertilizer was used in each plot. Urea splits in 10 DAT (Days after Transplanting), 25 DAT and 35 DAT. The MoP was applied 1/3 at basal dose, 1/3 at 25 DAT and 1/3 at 35 DAT. Rest of all fertilizers were given as basal dose during land preparation. Weak, injured and dead seedlings were removed and gap filling will be done within 15 days of transplanting. Weeding was done when necessary. Irrigation was very important after transplanting. Irrigation was given depending on the soil moisture condition and almost every day at vegetative stage. Staking was done by bamboo stick. Tomato leaf curl virus and tomato mosaic virus was found on few plants and these are finally uprooting. Tomato fruit borer was controlled by using Proclaim @ 20gm/10L of water in 5 decimal areas. Aphid is also a serious pest for tomato and that was controlled by spraying Emitaf 20 SL @ 2.5 ml/10L of water in 5 decimal areas at 7 days interval.

Data were recorded on height of plant at 0 DAT, 10 DAT and 20 DAT, days required to first flowering, number of flower cluster per plant, number of flowers per cluster, number of fruits per cluster, number of fruits per plant, biological yield, and weight of fruit per plant. First harvesting was started 03 April, 2020. Final harvesting was done at 15 May, 2020.

RESULT AND DISCUSSION

Plant height

Height of plant at 0 DAT, 10 DAT and 20 DAT was observed from 7.17cm to 8.82cm, 7.75cm to 9.37cm and 13.24cm to 15.40cm respectively (Table-1). Maximum and minimum plant height of three BARI tomato varieties at 0 DAT, 10 DAT, 20 DAT were recorded with V_3 (8.82cm,9.37cm), V_1 (15.40cm) and V_2 (7.17cm, 7.75cm, 13.24cm) which were statistically identical except 20 DAT seedling. As a result, the seedling size of three BARI tomato varieties was almost same. Therefore, BARI Tomato-11 gave the highest plant height and BARI Tomato-14 gave the lowest plant height. According to Hossain *et al.* (2017) BARI Tomato-14 and BARI Tomato-15 gave 20.0cm and 22.0cm plant height at 25 DAT. According to Saha *et al.* (2019) BARI Tomato-14 and BARI Tomato-15 gave 18.30 to 19.03cm and 19.40 to 20.57cm plant height at 25 DAT.

Days to first flowering

Days required to first flowering were identified from 39.00 to 41.00 (Table1). Maximum days need in V_3 (40.75 DAT) for first flowering and minimum need V_1 (38.50 DAT) for first flowering which were insignificant. It was similar for first flowering of BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15 in this region. Mehraj *et al.* (2014) cultivated BARI Tomato-11 in summer season and found that 26.7 days after transplanting required giving first flowering. According to Hossain *et al.* (2017) BARI Tomato-14 and BARI Tomato-15 needed 25.0 and 26.0 DAT respectively for first flowering.

Number of cluster per plant

The number of cluster per plant varied from 6.25 to 13.2 (Table1). Maximum cluster was recorded with V_1 (13.2) and minimum number of cluster was found with V_3 (6.25) which was statistically similar with V_2 (7.55). As a result BARI Tomato-11 was the highest and BARI Tomato-15 was the lowest number of cluster per plant. Karim (2015) investigate that BARI Tomato-14 was found with highest 8.768 cluster per plant. Hossain *et al.* (2017) stated that BARI Tomato-14 and BARI Tomato-15 performed 8.00 and 7.83 cluster per plant respectively. Saha *et al.* (2019) found that the number of cluster per plant in BARI tomato-14 varied from 7.70 to 12.37 at different combination of organic and inorganic fertilizers.

Number of flowers per cluster

The number of flower per cluster was varied significantly from 6.06 to 11.43 (Table1). BARI Tomato-11 (11.43) gave the maximum and BARI Tomato-15 (6.06) gave the minimum number of flower per cluster. BARI Tomato-14 performed 6.18 flowers per cluster which was statistically identical with BARI Tomato-15. According to Hossain *et al.* (2017) BARI Tomato-14 gave 3.95 and BARI Tomato-15 gave 4.42 flowers per cluster. Saha *et al.* (2019) stated that the number of flower per cluster in BARI tomato-14 varied from 6.83 to 10.37 at different combination of organic and inorganic fertilizers.

Table 1. Plant height, Days of first flowering, Number of cluster/plant, Number of flowers/ cluster

Variety	Plant height(cm) 0 DAT	Plant height (cm) 10 DAT	Plant height (cm) 20 DAT	Days to first flowering (from DAT)	Number of cluster/plant	Number of flower/cluster
BARI Tomato-11 (V ₁)	8.21	8.73	15.40a	39.00	13.2a	11.43a
BARI tomato-14 (V ₂)	7.17	7.75	13.24b	40.00	7.55b	6.18b
BARI tomato-15 (V ₃)	8.82	9.37	14.40ab	41.00	6.25b	6.06b
F-test	NS	NS	*	NS	*	*

In a column, figure with same letter do not differ significantly; *Significant at 5% level of significance; NS= Non Significant

Table 2. Number of fruits/cluster, Number of fruits/plant, Weight of individual fruit (gm), Weight of fruit (kg/plant), Yield (ton/ha), Biological yield (ton/ha)

Variety	Number of fruits/cluster	Number of fruits/plant	Wt. of individual fruit (gm)	Weight of fruit (kg/plant)	Biological yield (ton/ha)	Fruit Yield (ton/ha)
BARI Tomato-11 (V ₁)	10.88a	142.96a	10.85c	1.55c	7.77	51.67c
BARI tomato-14 (V ₂)	4.63b	34.92b	78.5a	2.74a	7.29	91.33a
BARI tomato-15 (V ₃)	4.90b	30.95b	59.9b	1.85b	9.53	61.67b
F-test	*	*	*	*	NS	*

In a column, figure with same letter do not differ significantly; *Significant at 5% level of significance; NS= Non Significant

Number of fruits per cluster

The number of fruits per cluster was varied from 4.90 to 10.88 (Table2). Maximum and minimum number of fruit per cluster was recorded with V₁ (10.88) and V₂ (4.63) respectively. BARI Tomato-14 (4.63) and BARI Tomato-15 (4.90) had no significant different in number of fruit per cluster. Azad, AK *et al.* 2019 found that BARI Tomato-11 gives 15-20 fruit per cluster as like grape fruit. According to Hossain *et al.* (2017) BARI Tomato-14 gave 3.62 and BARI Tomato-15 gave 3.95 fruit per cluster. Saha *et al.* (2019) stated that the number of fruits per cluster in BARI Tomato-14 varied from 3.8 to 6.13 and the BARI Tomato-15 varied from 4.53 to 6.97 fruits per cluster at different combination of organic and inorganic fertilizers.

Number of fruits per plant

The number of fruits per plant varied from 30.95 to 142.96 (Table 2). Maximum fruit was recorded with V₁ (142.96) and minimum number of fruit was found with V₃ (30.95). These result showed that BARI Tomato-11 gave the highest number of fruit per plant and BARI Tomato-15 gave the lowest number of fruit per plant. BARI Tomato-14 gave 34.92 fruits per plant which was statistically identical with BARI Tomato-15 (30.95). Azad, AK *et al.* (2019) observed that BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15 performed 180-200, 30-35 and 40-45 fruits per plant respectively. Taufique *et al.*(2014) stated that BARI Tomato-14 gave maximum 31 fruit per plant at chicken eggshells powders as like

through organic fertilizers. Islam *et al.* (2017) found that number of fruits per plant varied from 41.33 to 67.56 into different combination of inorganic and organic fertilizers in case of BARI Tomato-15. According to Hossain *et al.* (2017) BARI Tomato-14 gave 28.66 and BARI Tomato-15 gave 30.91 fruits per plant. Tipu *et al.* (2014) stated that the number of fruit per plant in BARI tomato-14 varied from 25.87 to 29.00 and the BARI tomato-15 gave 29.60 to 34.60 fruits per plant at different mulching medium.

Weight of individual fruit (gm)

The weight of individual fruit was varied from 10.85gm to 78.5gm (Table2). Maximum and minimum weight of individual fruit was observed with V_2 (78.50gm) and V_1 (10.85gm) respectively. Result showed that BARI Tomato-14 gave weightier and BARI Tomato-11 gave the less weighty fruit in this area. Bangladesh Agricultural Research Institute (BARI) found that the fruit weight of BARI Tomato-11 is 8-10gm, BARI Tomato-14 is 90-95gm and BARI Tomato-15 is 65-70gm. According to Hossain *et al.* (2017) the weight of individual fruit of BARI Tomato-14 and BARI Tomato-15 was 74.19gm and 50.61gm respectively. Saha *et al.* (2019) stated that the weight of individual fruit in BARI tomato-14 varied from 71.00 gm to 91.43 gm and BARI tomato-15 varied from 59.97 gm to 73.63 gm at different combination of organic and inorganic fertilizers.

Total weight of fruit per plant

Total weight of fruit per plant was varied from 1.55 kg to 2.74 kg (Table2). Maximum and minimum were recorded with V_2 (2.74 kg) and V_1 (1.55 kg) respectively. As a result BARI Tomato-14 gave the highest and BARI Tomato-11 gave the lowest weight of fruit per plant. Karim (2015) found that BARI Tomato 14 gave 2.79 kg fruit per plant where present study found BARI Tomato 14 gave 2.74 kg fruit per plant. Tipu *et al.* (2014) stated that the weight of fruit per plant in BARI tomato-15 was varied from 1.97 to 2.35 kg at different mulching medium.

Biological yield

The biological yield was observed from 7.29 t/ha to 9.53 t/ha (Table 2). Maximum and minimum biological yield were recorded with BARI Tomato-15 (9.53 t/ha) and BARI Tomato-14 (7.29 t/ha) respectively which were statistically similar.

Yield (t/ha)

Yield is an important factor. Yield varied from 51.67 to 91.33 t/ha (Table2). Maximum yield was recorded with V_2 (91.33 t/ha) and minimum yield was found with V_1 (51.67 t/ha). As a result BARI Tomato-14 gave the highest and BARI Tomato-11 gave the lowest yield. According to Azad *et al.* (2019), the yield of BARI Tomato-11, BARI Tomato-14 and BARI Tomato-15 were 35-45 t/ha, 90-95 t/ha and 80-85 t/ha respectively. Tipu *et al.* (2014) stated that the yield of BARI tomato-14 varied from 69.56 t/ha to 79.74 t/ha and the BARI tomato-15 varied from 59.37 t/ha to 72.33 t/ha at application of different mulching medium. But Saha *et al.* (2019) stated that the yield of BARI tomato-14 varied from 39.33 to 87.17 t/ha and the BARI tomato-15 gave 31.33 to 77.09 t/ha yield at different combination of organic and inorganic fertilizers.

CONCLUSION

The result of the study showed that the growth of three BARI tomato varieties at vegetative stage was almost same. BARI Tomato-11 gave flower more quickly than BARI Tomato-14 and BARI Tomato-15. In case of number of fruit, BARI Tomato-11 gave the maximum number of fruit (142.96) but the weight of individual fruit was very low (10.85gm) due to very small size and shape. The highest yield was given by BARI Tomato-14 (91.33 t/ha) and the lowest yield was given by BARI Tomato-11 (51.67 t/ha). BARI Tomato-14 showed higher fruit yield due to individual weight of fruit and also higher number of fruit than BARI Tomato-15. So the cultivation of BARI Tomato-14 is more profitable for farmer's level in the Agro Ecological Zone 14.

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CONFLICT OF INTEREST

There is no conflict of interest.

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