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ASSESSMENT OF PERFORMANCE ON YIELD AND YIELD CONTRIBUTING ATTRIBUTES OF DIFFERENT HYBRIDS TOMATO GENOTYPES IN SOUTHERN PART OF BANGLADESH

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ABSTRACT

Talukder SK, Hasan N, Mia ML, Datta P, Zahid ZH, Sarkar M, Islam MS, Mohsin GM (2023) Assessment of performance on yield and yield contributing attributes of different hybrids tomato genotypes in southern part of Bangladesh. *Int. J. Expt. Agric*. 13(2), 6-12.

Although there are a number of hybrid commercial tomatoes on the market in Bangladesh's southern region, but farmers in Noakhali still continue to grow the local varieties. Therefore, an experiment was conducted in the field of Inu Agro Farm, Sonapur, Noakhali, Bangladesh during 2020-21 to evaluate the effectiveness of several commercial tomato hybrids and identify the best tomato hybrids. The experiment comprised five treatments such as BARI Hybrid Tomato-4 (as control, T_0), Lal Bahadur (T_1), Mintoo super (T_2), Udayon-F_1 (T_3), and Roma VF (T_4). The experiment followed randomized complete block design with three replications. The findings revealed that Mintoo super had the largest plant height and Roma VF had the shortest plant height at various days after transplanting, including final harvest. The most fruit was produced by Udayon F_1, which statistically compared to Lal Bahadur. Roma VF had the fewest fruit plant^{-1}, the smallest individual fruit weight, and the most seeds fruit^{-1}, whereas Udayon F_1 had the most fruit plant^{-1}. Mintoo Super and Roma VF produced fruits with maximum length and width, while Lal Bahadur and Udayon F_1 produced fruits with minimal length and width. The largest number of locules fruit^{-1} was discovered in Lal Bahadur, while the lowest number was discovered in Roma VF. The largest pericarp thickness was displayed by the variety Mintoo Super, and the least thickness was displayed by BARI Hybrid Tomato-4. The fruit with the highest Total Soluble Solids and longest shelf life was Roma VF. Mintoo super had the best individual fruit weight and fruit yield plant^{-1}. Lal Bahadur and Udayon-F_1, BARI Hybrid Tomato-4, and Roma VF were next in line. The largest yield was obtained by Mintoo Super, next by Udayon-F_1, and Lal Bahadur. The T_2 (Mintoo super) treatment had the best overall performance for tomatoes in the experiment when compared to the other treatments and control kinds.

Key words: *tomato, hybrid, southern part, yield*

INTRODUCTION

One of the most significant and nutrient-dense vegetables in the world, the tomato (*Lycopersicon esculentum*) is a member of the solanaceae family. Tomatoes come in an amazing variety of forms, dimensions, and hues, providing a wide range of culinary possibilities. Every kind of tomato, from the tiny, sweet cherry tomatoes to the meaty beefsteak variants, has a unique flavor profile and culinary use. Heirloom tomatoes are prized for their distinctive flavors and vivid colors, whereas plum tomatoes are best for creating sauces (National Garden Bureau 2021). The FAO estimates that the global tomato production for 2021 was little over 189.1 million metric tonnes (FAO 2021). Tomato is a popular vegetable crop in Bangladesh. It is grown in both summer and winter seasons, but the production is higher in summer. According to the (BBS 2020), tomato production in Bangladesh was around 4.4 million metric tons. The demand for tomatoes is rising daily due to population growth. Producing and exporting high-quality tomatoes is another way to make a significant quantity of foreign currency. Only by increasing production unit^{-1} area will the rising demand be satisfied (Ali *et al*. 2014). To enhance production from a limited amount of land, it is necessary to raise productivity unit^{-1} area because tomatoes are a crucial crop from both a production and industrial standpoint. Utilizing conventional plant breeding techniques to increase output makes it sustainable, inexpensive, and environmentally beneficial. In the tomato industry, commercial F_1 hybrids are popular, and the process of choosing younger parents with higher heterosis is ongoing. High hybrid vigor is typically expected from different parents, and it is frequently possible to combine desired alleles regularly without having to wait for a longer period of time like in the case of developing open pollinated cultivars. There are several commercial tomato hybrids on the market in Bangladesh's southern region, but in Noakhali, farmers continue to raise the native variety. There was, however, no comparison research of these hybrids' performance as of November 2020 (Islam *et al*. 2014). The farmers in this area are in a difficult situation and unsure of which hybrids would perform best for them.

The goal of the current inquiry was to evaluate the effectiveness of several commercial tomato hybrids and identify the best tomato hybrids. Four marketable tomato hybrids were chosen for the study, along with one well-known cultivar that are widely farmed in the southern region.

MATERIALS AND METHODS

Experimental Site

The experiment was carried out in Sonapur, Noakhali's Inu Agro Farm from 20 November 2020 to 20 March 2021. Sites that are part of the Young Meghna Estuarine Flood Plain fall under AEZ 18. Using an EC meter (SenslON+EC7), the salt content of the experiment was evaluated in the Department of Agriculture laboratory at Noakhali Science and Technology University. The soil was classified as non-saline since its EC value was 0.91 dm^{-1}. The Soil Resource and Development Institute (SRDI) of the Noakhali District provided the data.

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Experimental treatment

Four tomato varieties were studied, along with one control variety that was gathered in Datterhat, Noakhali. T_1= Lal Bahadur, T_2= Mintoo Super, T_3= Udayan F_1, T_4= Roma VF, and T_0= BARI Hybrid Tomato-4 are the different cultivars.

Fertilizer Application

Urea, Triple Super Phosphate (TSP), Murate of Potash and cow dung are examples of nutrient supplies. The amount of fertilizer needed for each seedbed for urea, TSP, MoP, and cow dung was calculated to be 165 g, 135 g, 75 g, and 4.2 kg, respectively. The fertilizer was applied in the same quantity to each seedbed.

Seedling Transplanting in the Main bed

For each treatment, individual seedlings were cultivated in various seedbeds. On December 15, 2020; healthy, uniform-sized seedlings that were 25 days old were removed in groups and put into the experimental field while keeping a 60 cm and 40 cm distance between the rows and the plants, respectively. To avoid harm to the roots, the seed beds were irrigated before the seedlings were uprooted. The late nighttime hours were used for this activity. After transplantation, the seedlings received water.

Staking and pruning practices

Daincha (*Sesbania* sp.) sticks were used as anchoring once the plants had established themselves well to keep them upright. As the plants grew after a few days of staking, they were consistently clipped to have one main stem plant^{-1}.

Supporting

As the plant developed, bamboo sticks were used to give it extra support. To keep the plants upright and guard them from harm from any kind of difficulty, the sticks were thrown around among the plants in a random fashion.

Pest and Disease Control

Tomatoes rarely experience insect attacks, although white flies frequently do. This tiny bug prefers to live on the underside of leaves and is quite small. The vector of the tomato leaf curl can be observed as a white bug. Spraying diazinon at a rate of 1 ml L^{-1} every 15 days will control this bug. It is advised to stop spraying 15 days before to fruit gathering.

Harvesting

At 73 DAT, the first harvest of ripe tomatoes began. Tomatoes were initially harvested every three days, and after 80 days, they were harvested every day. By March 2021, harvest had finished.

Collection of Data

Plant height (cm), number of branches plant^{-1}, number of leaves plant^{-1}, days to first flowering, number of clusters plant^{-1}, number of fruits plant^{-1}, number of fruits cluster^{-1}, number of fruits in lower cluster, number of fruits in upper cluster, length (cm), width (cm), thickness of pericarp fruit^{-1}, number of locules fruit^{-1}, number of seeds fruit^{-1}, total soluble solid (%), individual fruit weight (g), shelf life (days), total weight of fruit plant^{-1}, yield plot^{-1}, and yield (t ha^{-1}) are all given.

Statistical analysis

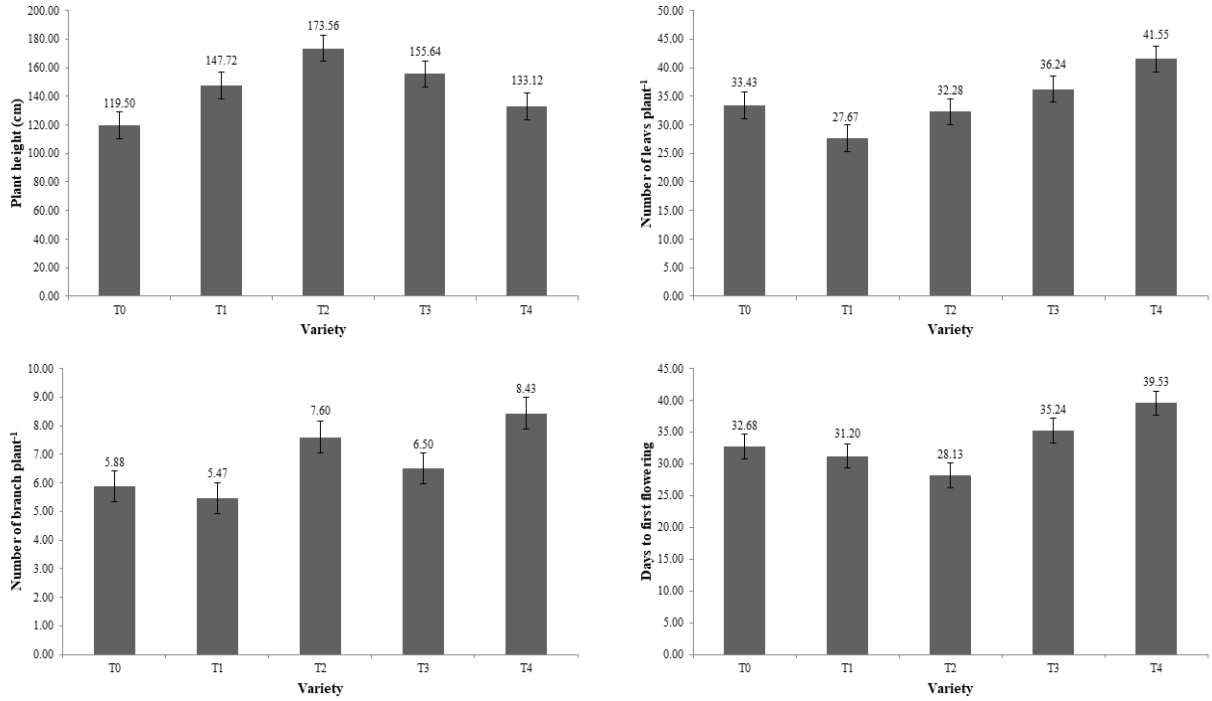
To determine the suitable effects of growth, yield, and yield-contributing characteristics of various hybrid kinds of tomatoes among five treatments, data from various crop growth stages were correctly recorded and collated for statistical analysis. To determine the statistical significance of the differences between the treatments, the recorded data for the various parameters in this study were statistically evaluated using the Minitab 17 statistical software tool (Minitab Inc., State College, PA, USA). The Least Significant Difference (LSD) test was used to determine the significance of the differences between treatment means at the 5% level of probability.

RESULTS AND DISCUSSION

Plant Height and Days to First Flowering

When the plant height of each type was measured, there was a significant difference between treatments (Figure 1). T_2 (Mintoo Super), T_3 (Udayan F_1), and T_1 (Lal Bahadur), all of which were considerably different from the control variety T_0 (BARI Hybrid Tomato-4), had the tallest plants 173.56 cm, 155.64 cm, and 147.72 cm, respectively. On the other hand, T_4 (Roma VF) 133.12 cm had the least plant height (78.7 cm). Data investigation on the plant height of tomatoes revealed a substantial variance among the morphological traits. Plant height is a significant component, according to Mehta and Asati (2010), as it has the most beneficial impact on fruit yield. Islam *et al*. (2014) also reported a finding that was similar. The T_4 (Roma VF) plant had the most leaves plant^{-1} (41.55), followed by the T_3 (Udayon-F_1) plant (36.24), while the T_1 (Lal Bahadur) and T_2 (Mintoo super) plants (32.28) had the fewest leaves (27.67) compared to the control variety (Figure 1). The

number of leaves at 75 DAT varied significantly among tomato cultivars, ranging from 27.67 to 41.55. Because leaves play a crucial physiological function in photosynthetic activities and because they are directly related to tomato yield generation, the number of leaves on a plant is a crucial characteristic. Similar findings were made in Ogunleye *et al*. (2021). The number of branches plant^{-1} was statistically insignificant in five different kinds. The average number of branches plant^{-1} for T_4 (Roma VF), T_2 (Mintoo super), T_3 (Udayon-F_1), and T_1 (Lal Bahadur) was 8.43, 7.60, 6.50, and 5.47, respectively (Figure 1). T_1 had the fewest branches plant^{-1} (5.47), which was statistically equal to the check variety, whereas T_4 (Roma VF) had the most branches plant^{-1} (8.43). larger leaves, which are connected with larger yields, are produced in proportion to the number of branches. Aklile *et al.* (2016) also reported on these kinds of findings. As can be shown in Figure 1, different tomato types had significantly varying days to first blooming. It was noted that T_4 took more time (39.53 DAT) than other kinds for the beginning of flowering. Additionally, it was noted that T_2 took the least amount of time (28.13 DAT) to reach first flowering, followed by T_1 (31.21 DAT) and the check variety (32.68 DAT). 28 to 40 days on average were needed for the first flowering to occur. Early flowering is a sign of early fruit production, which helps to produce early crops with high yields. A possible explanation for the early bloom initiation is the increased capacity of these growing kinds. Sinha *et al*. (2020) confirmed similar findings of significant differences in days to first flowering among cultivars and potential utilization of these growth conditions for early bloom initiation.



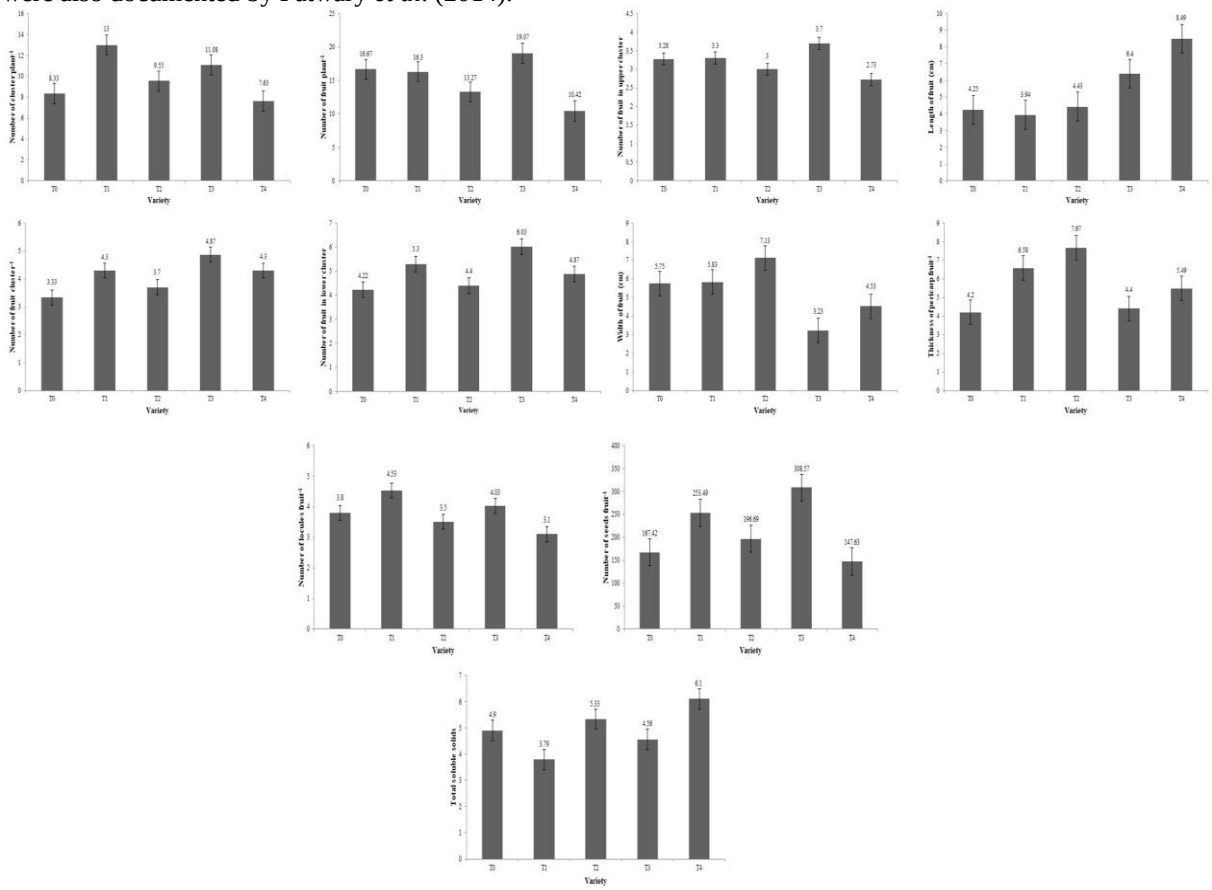
T_0= BARI Hybrid Tomato-4, T_1= Lal Bahadur, T_2= Mintoo super, T_3= Udayon-F_1, T_4= Roma VF

Fig. 1. Performance of treatments on vegetative traits and days to first flowering.

Flowering and Fruiting Characters

The output of clusters plant^{-1} varies significantly among tomato cultivars depending on their genetic makeup (Figure 2). The outcomes showed that Lal Bahadur (T_1) produced the most flower clusters (13.00), which was much more than the other kinds. The Roma VF (T_4) yielded the fewest flower clusters (7.63). Roma VF and BARI Hybrid Toamto-4 (check variety) both generated a statistically equivalent amount of flower clusters when it came to cluster production. Leonard *et al*. (1983) noted a similar tendency in cluster production. In the case of five types, the number of fruits plant^{-1} was statistically significant (Figure 2). The variety Udayon F_1 (T_3), which was statistically significant compared to other kinds, produced the most fruit (19.07 plant^{-1}) than any other variety. The tomato variety Roma VF (T_4) produced the fewest fruits (10.42 plant^{-1}), which was statistically distinct from other tomato varieties. According to Patwary *et al*. (2014), there is also a considerable variance in the quantity of fruit plants among tomato kinds and lines. There was no discernible difference in the number of fruits per cluster between the kinds. T_3 (Udayon-F_1) had the most fruit cluster^{-1} (4.87), whereas check variety had the fewest (3.33), which was inferior to Mintoo super (Figure 2). The potential for increased yields is one of the main factors to consider when choosing a cultivar. Although fruit size also affects the yield estimation, in general, the more fruits cluster^{-1}, the higher the projected fruit production (Pandey *et al*. 2006). Parveen *et al*. (2019) cited similar findings. Figure 2 showed that the quantity of lower cluster fruits plant^{-1} varied across five

kinds, from 4.22 to 6.03. T_3 (Udayon-F_1) produced the most fruits plant^{-1} (6.03 in the lower cluster). The check variety had 4.22 as the bare minimum number of fruits in the bottom cluster per plant. The Figure 2 showed that there were between 2.73 and 3.70 fruits in the upper cluster for each of the five types of plants. T_3 (Udayon-F_1) produced the most fruits plant^{-1} (3.70 in the upper cluster). Similar to this, the T_4 (Roma VF) was found to have a minimum of 2.73 fruits in the lowest cluster plant^{-1}. The T_4 (Roma VF) plant produced the most fruit plant^{-1} (8.49), followed by the T_3 (Udayon-F_1) plant (6.40), and the T_1 (Lal Bahadur) plant (4.43), followed by the T_2 (Mintoo super) plant (4.43), and the check variety (3.94). Range of fruit length and fruit width (Figure 2) reflected the diversity among the cultivars backed by Pavan *et al*. (2018). The fruit width clearly demonstrated that there were differences between all of the experimental treatments (Figure 2). Mintoo Super's maximum fruit width (7.13 cm) was discovered to be substantially greater than that of the other types. The T_1 (5.7 cm), which was statistically comparable with check types, came next. The Udayon F_1 variety's minimum fruit width (3.23 cm) was noted. T_2 (Mintoo super) had the thickest pericarp (7.67 mm), which was significantly different from the other kinds (Figure 2). After that came the T_1 (6.58 mm). The check variety has the thinnest pericarp (4.20 mm), followed by the T_4 (5.49 mm). All of the treatments were significantly different from one another (Figure 2), with T_1 (Lal Bahadur) producing the highest locules number (4.53), whereas T_4 (Roma VF) produced the lowest (3.10). In five treatments, the number of seeds fruit^{-1} varied significantly (Figure 2). For T_1 (Lal Bahadur), T_2 (Mintoo super), T_3 (Udayon-F_1), T_4 (Roma VF), and T_0 (BARI Hybrid Tomato-4), the average number of seeds fruit^{-1} were 253.49, 196.69, 308.57, 147.63, and 167.42, respectively. The highest number of seeds fruit^{-1} (308.57) came from T_3 (Udayon-F_1), while the lowest number (147.63) was found at T_4 (Roma VF). The same conclusion was reached by Pervez *et al*. (2009). For a variety of crops, measuring total soluble solids (%) or "Degrees Brix" is crucial. It is a measurement of the total amount of soluble solids in fruit juice. The tomato fruit pulp is mostly composed of sugars (sucrose and hexoses make up 65%), acids (citrate and malate make up 13%), and a little amount of phenols, amino acids, soluble pectins, ascorbic acid, and minerals (Beckles 2012). '°Brix' (Brix), a unit of sugar measurement, is used to express sugar content and describes how sweet a fruit is. Total soluble solids content (%) varies amongst tomato types in their fruits. Roma VF fruit has the highest total soluble solids (6.10%), varying significantly from other types (Figure 2). The fruit of Lal Bahadur (T_1) had the lowest total soluble solids (3.79%), which was also noticeably lower than those of other kinds. Significant variations in the total soluble solid content of fruits from various tomato lines and varieties were also documented by Patwary *et al*. (2014).

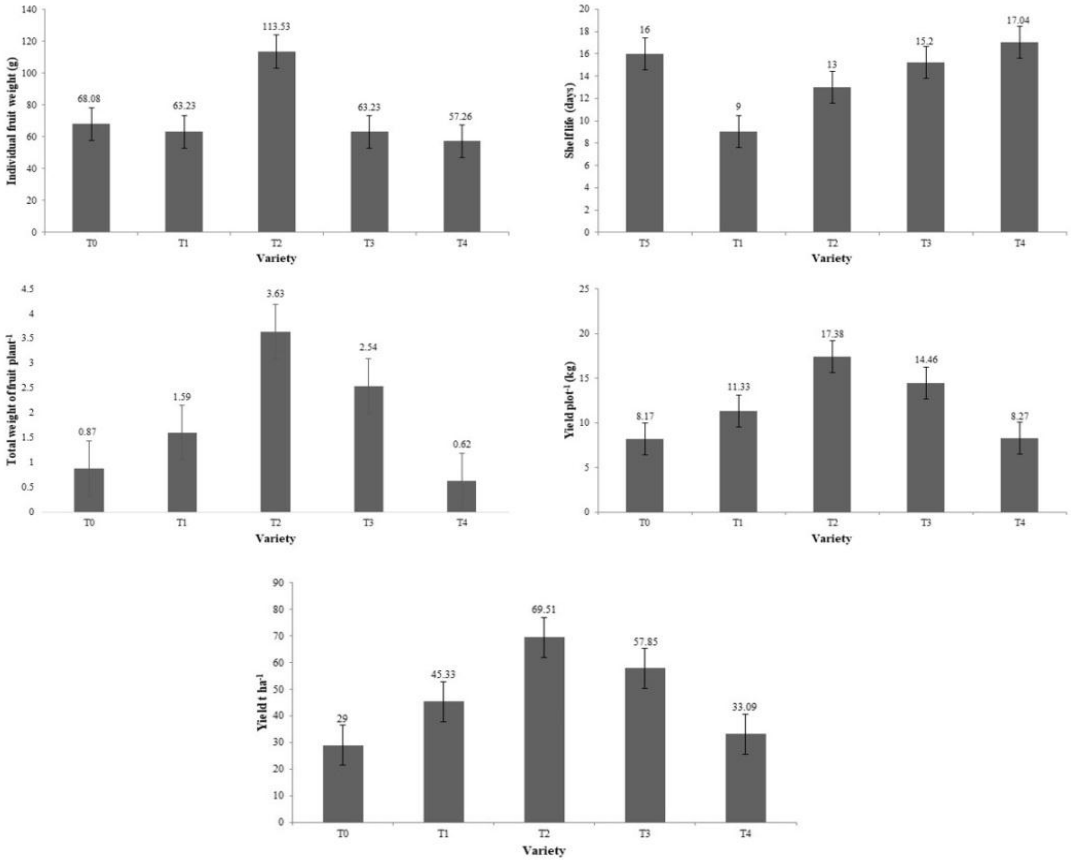


T_0= BARI Hybrid Tomato-4, T_1= Lal Bahadur, T_2= Mintoo super, T_3= Udayon-F_1, T_4= Roma VF

Fig. 2. Performance of treatments on flowering and fruiting characters

Yield and Yield Contributing Characters

Individual fruit weights varied significantly between the treatments (Figure 3). The average fruit weight for varieties T_1 (Lal Bahadur), T_2 (Mintoo super), T_3 (Udayon-F_1), T_4 (Roma VF), and T_0 (Check variety) was 63.23 g, 113.53 g, 63.23 g, 57.26 g, and 68.08 g, respectively. The highest individual weight of 113.53 was obtained in T_2 (Mintoo super), whilst T_4 (Roma VF) had the lowest individual fruit weight of 57.26. The results of this study are supported by Hasanuzzaman *et al*. (2014) who observed a considerable variation among the hybrids. Maximum shelf life of 17.04 was observed in T_4 (Roma VF), followed by a shelf life of 16 days in T_0 (check variety) (Figure 3). T_1 (Lal Bahadur) had the shortest shelf life, which was 9.00 days. The results of this study are supported by Hasanuzzaman *et al*. (2014) who observed a considerable variation among the hybrids. The outcome showed that there was a substantial difference in the overall weight of fruit plant^{-1} across all treatments (Figure 3). The T_2 (Mintoo super) plant produced the most fruit overall, weighing 3.63 kg, while the T_4 (Roma VF) plant produced the least amount, 0.62 kg. Singh *et al*. (2013) noted a similar outcome. The T_2 (Mintoo super) condition had the highest yield plot^{-1} (17.38 kg) (Figure 3), whereas the T_0 (BARI Hybrid Tomato-4) condition had the lowest yield (8.17 kg). The same conclusion about fruit yield plot^{-1} was reached by Mehraj *et al*. (2014). Tomato fruit yield plot^{-1} was translated to tomato fruit yield hectare^{-1} and represented in tons. Different cultivars had a big impact on yield hectare^{-1}. The maximum yield hectare^{-1} was found in T_2 (Mintoo super), at 69.51 t ha^{-1}, followed by T_3 (Udayon-F_1), at 57.85 t ha^{-1}. On the other hand, BARI Hybrid Tomato-4 (T_0) had the lowest yield (29.0 t ha^{-1}) followed by Roma VF (T_4) (33.09 t ha^{-1}) (Figure 3). When it came to total yield hectare^{-1}, there was a considerable variation between the treatments. Hasan *et al*. (2005); Ali *et al*. (2014) examined tomato variability and found significantly substantial variations in yields per hectare among the cultivars. The biggest variance was noted for yield hectare^{-1}, which is supported by the current findings (Hussain *et al*. 2001; Karim 2005). Ashrafuzzaman *et al*. (2010) also noted that variations in genotype, seasons, and experimental design could account for the varying yield potentialities seen in various researches.



T_0= BARI Hybrid Tomato-4, T_1= Lal Bahadur, T_2= Mintoo super, T_3= Udayon-F1, T_4=Roma VF

Fig. 3. Performance of treatments on yield and yield contributing characters.

SUMMARY AND CONCLUSION

The features of tomato varieties varied greatly in terms of development and productivity. There was a significant difference between the kinds in terms of plant height, branch count, days till first flowering, pericarp thickness, individual fruit weight, total weight of fruit plant^{-1}, yield plot^{-1}, and overall yield t ha^{-1}. In the experiment, T_2 (Mintoo super) outperformed the other varietal treatments and control variety in terms of growth and yield. The

T_4 (Roma VF) type, on the other hand, exhibited the lowest reaction across all criteria. It is therefore reasonable to draw the conclusion that the tested types acted noticeably differently in terms of a number of criteria. The study results showed that T_2 (Mintoo super) tomato variety had the maximum yield and financial advantages when compared to T_1 (Lal Bahadur), T_3 (Udayon F_1), and even types in all saline-prone zones in Bangladesh. With this therapy combination, additional study can be done in other AEZs and locales.

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