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Forecasting Tomato Variety for Different Seasons and Regions of Bangladesh hospital

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Tomato, Variety, Season, Region, Yield

ABSTRACT

Centre", of Patuakhali Science and Technology University, to find out suitable temperature, variety for winter season and promising heat tolerant variety for summer season in different regions of Bangladesh. The experiment comprised of ten varieties of tomato namely, BARI tomato 2 (Roton), BARI tomato 3, BARI tomato 9 (Lalima), BARI tomato 14, Surakkha, BARI hybrid tomato 5, BARI hybrid tomato 6, Mintoo tomato (Lal Teer Seed Ltd.), Tidy tomato (Metal Seed Ltd.) and Roma VF (ACI Seed Ltd) and three temperature conditions viz., normal temperature (10-20°C), medium temperature (21-25°C) and high temperature (26-35°C). a total of 30 treatment combinations with three replications were arranged into the pots. Both different temperature conditions, varieties of tomato independently and also in combination showed significant influence on different parameters of tomato plant. Medium temperature was noticed for healthy growth and flowering but not for higher yield and yield traits. Variety engaged in vegetative acceleration (Tidy, BARI tomato 3), did not convalesced yield and yield attributes. The results indicated the higher heat tolerance ability of BARI tomato 2 and lower tolerance ability of variety Mintoo. Therefore, BARI tomato 2 might be recommend for all seasons and regions of Bangladesh. Meanwhile, variety Mintoo might be recommended only for winter and for northern region whereas Roma VF and BARI tomato 3 for middle-southern region during autumn seasons of Bangladesh.

INTRODUCTION

Tomato (Lycopersicon esculentum Mill.) belongs to the family Solanaceae and is normally a self-pollinated annual crop. Tomato is a universally known vegetable and is one of the widest grown vegetables in the world and ranked third in respect of vegetable production in the world next to potato and sweet potato (Hossain et al., 2010). According to Guan et al. (2018), FAO (2017) claimed to produced 170 million tons fresh and processed tomato globally in 2014. Among the vegetables tomato is important for vitamin A, C and minerals (Islam, 1996). Nutritive elements are almost double compared to apple which proved superiority in regard to food values (Barman, 2007). Due to its phytonutrients mainly antioxidant elements such as lycopene and β carotene, it prevents cancer and many human diseases (Hossain & Abdullah, 2015; Islam et al., 2021). It occupies an area of 0.15 million hectares with annual production of about 0.60 million tons in Bangladesh (BBS, 2011). Although the total cultivated area and production of tomato in our country have been increased gradually over the last few years, the productivity is still very low (9.4 t/ha) compared to the average yield (26.29 t/ha) of the world (FAO, 2002; Mazed et al., 2015). Although tomato can grow under a wide range of climatic conditions, but sensitive to a number of environmental stresses, especially extreme temperature, drought, salinity and inadequate moisture stresses (Kalloo, 1993). They are also extremely sensitive to hot and wet growing condition, limiting its adaptation in humid tropics, the weather which prevails in the summer-rainy season of Bangladesh (Zaman et al., 2006). Fruit setting in tomato is reportedly interrupted at temperature above 26/20° C Day/night, respectively and is often completely arrested above 38/27° C Day/night (Ei-Ahmadi & Stevens, 1979; Kuo et al., 1979 and Stevens and Rudich, 1978). Consequently, flower abortion and frequent fruits drop causes very poor yield of tomato (Nahir & Ullah, 2012). For optimum fruit setting, tomato requires a night temperature of 15 to 20ºC (Charles & Harris,1972; Schaible, 1962; Verkerk, 1955; Osborne & Went, 1953; Went, 1944 & 1945). The optimum condition for fruit setting in Bangladesh is only available in winter season (November to February), but best growing areas are Chittagong, Comilla and Rajshahi (Hossain & Abdulla, 2015). This mentioned uneven temperature condition (low in northern and high in southern region) within the season at different region of Bangladesh. Bangladesh Agricultural Research Institute (BARI) has released 21 open-pollinated (OP) and 11 hybrid tomato varieties so far (Islam et al. 2021). Simultaneously various seed companies are also providing different varieties from their farm and through import abroad. The Asian Vegetable Research and Development Center (AVRDC) and BARI began its tomato improvement program for the tropics and already succeeded to develop some heat tolerant open pollinated (OP) tomato varieties. Performance trials for prophecy of these varieties for different seasons and regions are badly needed to get best yield and economic return in Bangladesh. But limited efforts have been employed so far to endorse best variety for particular season and region for Bangladesh. Therefore, the proposed study has been undertaken to generate information of different

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varieties under various growing temperatures and to fulfill the objectives: (1) to evaluate morpho-physiological and biochemical characteristics under optimum and high temperature condition, (2) to predict suitable variety for particular region of Bangladesh and (3) to ascertain heat tolerant tomato variety for summer season in Bangladesh.

MATERIALS AND METHODS

The experiment was carried out at the Horticultural Nursery and Germplasm Center", of Patuakhali Science and Technology University, Patuakhali during winter from October to March. Geographically the experimental area is located at 20°20" N latitude and 90°20" E longitude. It belongs to the Agro Ecological Zones 13 (AEZ-13) named Ganges Tidal Flood Plain soils of clay loam in texture (UNDP and FAO, 1988) with pH 8.0. This area belongs to southern region of Bangladesh having medium low temperature and low rainfall with high humidity from October to February. The experiment consisted of two factors including one different levels of temperature conditions viz., normal temperature (10-20º C), medium temperature (21-25º C), and high temperature (26-35º C) and ten tomato varieties namely, BARI tomato 2 (Roton), BARI tomato 3, BARI tomato 9 (Lalima), BARI tomato 14, Surakkha, BARI hybrid tomato 5, BARI hybrid tomato 6, Mintoo tomato (Lal Teer Seed Ltd.), Tidy tomato (Metal Seed Ltd.) and Roma VF (ACI Seed Ltd). The two-factor experiment was laid out in split plot design replicating each treatment three times. Each replication consists of 30 (10 × 3) pots. The seedlings of ten tomato varieties were raised in ten distinct seed beds of 3 m × 1 m size under special cares. Healthy seedlings of 30 days -¬¬¬¬aged uniform size were transplanted from seedbed to the experimental pots on Mid November. Pots were arranged maintaining 60 cm × 60 cm plant spacing. Manures and fertilizers were applied according to the recommendation guide BARI, 2004 and were calculated for each pot considering the dose of 1 hectare soil at the depth of 20 cm, one million kg. By this way, each pot was filled with 10 kg soils and 100 g well decomposed cowdung + 5 g of urea + 4 g of TSP (triple super phosphate) + 3 g of MoP (Muriate of potash). Different intercultural operations along with irrigation and pest control were taken when necessary. Data were collected on different parameter such as plant height, branch per plant, cluster per plant, flower per cluster, fruit per cluster, fruit per plant, fruit weight per plant, total chlorophyll content and yield per hectare. The collected data representing growth, yield traits and yield were analyzed statistically to obtain the level of significance following the analysis of variance (ANOVA) technique by "F" variance test. The mean differences were compared by Duncan's Multiple Range Test (DMRT) at 5% level of probability (Gomez and Gomez, 1984) using the statistical computer package program, MSTAT-C (Russell, 1986).

Determination of chlorophyll content in leaves

Fresh leaf of 0.5 g was taken (60 days after transplanting), grinded and made into paste. Then it was taken in centrifuge tube and diluted with 4 ml (80%) acetone and centrifuged at 3000 rpm for 10 minutes and made volume up to 20 ml with 80% acetone. The centrifuged sample was incubated in darkness for 30 minutes. Finally, the reading was taken at 645 nm with the use of UV-VIS spectrophotometer and expressed as mgg-1 fw (Arnon, 1949).

Calculation:

The formula for computing total chlorophyll, chlorophyll-a and chlorophyll-b were

Total chlorophyll = (20.2 x D645 + 8.20 x D663) x DF

Chlorophyll-a = (12.7 x D663 - 2.69 x D645) x DF

Chlorophyll-b = (22.9 x D645 – 4.68 x D663) x DF

Where,

D645 = Absorbance at 645 nm wave length

D663 = Absorbance at 663 nm wave length

20.2, 8.02, 12.7, 2.69, 22.9 and 4.68 = Absorbance co-efficient

DF = Dilution factor = (200/1000) x 0.05

RESULTS AND DISCUSSION

Main effect of different temperature conditions

Different temperature conditions had highly significant effect on plant height, branch per plant, cluster per plant, flower per cluster, fruit per cluster, fruit per plant, fruit weight per plant and yield per hectare at different days after transplanting. It was observed that the highest plant height (86.43cm) was obtained from the normal temperature and the shortest plant height (81.53cm) was recorded from the high temperature (Figure 1a). The maximum number of branch per plant (11.3) was recorded from medium temperature, whereas the lowest number of branch (9.37) was recorded from normal temperature (Figure 1b).

The maximum number of cluster per plant (9.07) was obtained from the medium temperature. The minimum cluster number per plant (8.40) was obtained from normal temperature. Flower number decreased at normal temperature. The lowest flower number per cluster (5.44) was counted from normal temperature while, the highest flower number per cluster (7.05) was recorded from medium temperature. The lowest number of fruit per cluster (3.43) was obtained from high temperature and the highest number of fruit per cluster (4.08) was obtained from normal temperature (Table 1). The normal temperature produced the maximum number of fruit per plant (33.90) while the high temperature produced the minimum number of fruit per plant (30.30). Consequently, normal temperature condition produced the maximum yield (62.86 t/ha), whereas high temperature produced the minimum (44.51 t/ha) yield (Figure 1d). The treatment medium temperature produced the highest total chlorophyll in leaves (1.13 mg/gfw), whereas high temperature produced the lowest (1.04 mg/gfw) total chlorophyll content in leaves.

Above results indicated that medium temperature (21-250 C) was suitable for photosynthetic activity, branching and flowering, while comparatively lower temperature (10-200 C) imposed to higher plant height subsequently increased fruit setting lowering the flower and fruit abortion.

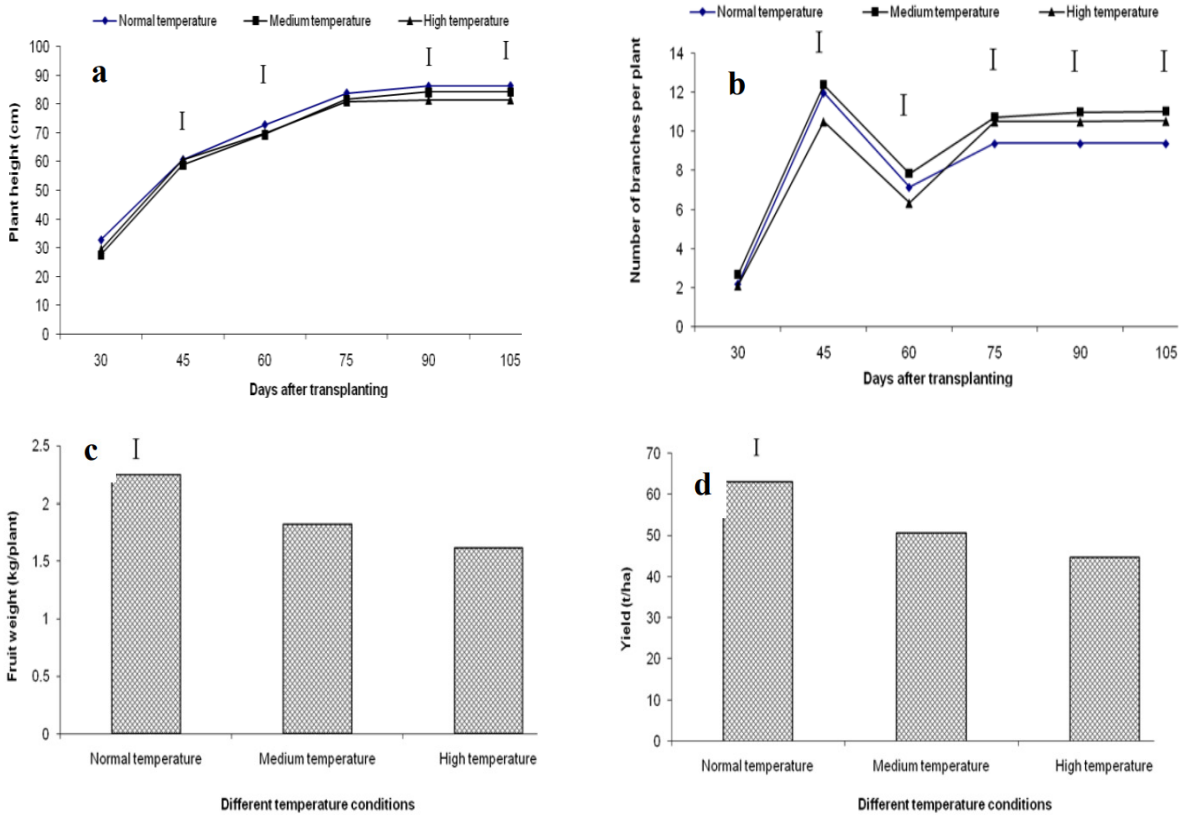

Figure 1. Effect of different temperature conditions on the growth and yield of tomato (The vertical bars represent the level of significant at 0.05).

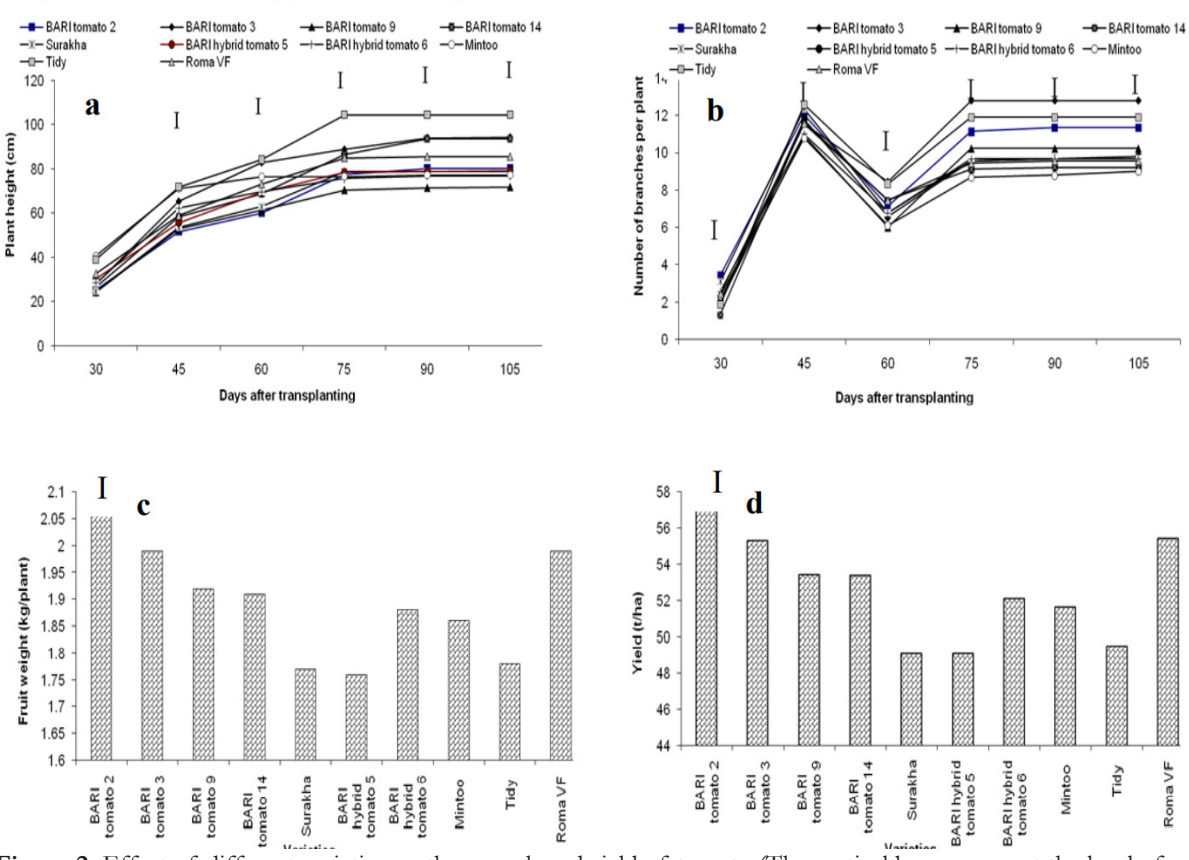

Figure 2. Effect of different varieties on the growth and yield of tomato (The vertical bars represent the level of significant at 0.05).

Eventually the higher yield of tomato was obtained from lower normal temperature. These confirmed that tomato is low to medium temperature loving plant Hewitt & Curtis (1948) observed reduced photosynthesis with higher respiration and carbohydrate depletion causing reduced flowering at temperatures above 35°C. At higher temperature Saito & Ito (1967) and Khalequzzaman (1996) reported smaller flower size with small anthers and abortive pollen, while Sawhney & Polowick (1985) reported that fruits were larger at low temperature than high temperature fruits.

Main Effects of variety

Different varieties also had highly significant effect on plant height, branch per plant, cluster per plant, flower per cluster, fruit per cluster, fruit per plant, fruit weight per plant, yield per hectare and chlorophyll content. The highest plant height (104.4 cm) was recorded from the variety Tidy (Figure 2a). However, the lowest plant height (76.56 cm) was recorded from the variety BARI tomato 9. the variety BARI tomato 3 produced the maximum branch per plant (12.78), whereas the variety Mintoo produced the minimum number of branches per plant (9.00) (Figure 2b).

The variety Mintoo produced the highest number of cluster per plant (10.89) and variety BARI tomato 2 produced the second highest number of cluster per plant (9.33). The lowest number of cluster per plant (5.89) was recorded from the variety BARI tomato 14.

Table 1. Main effect of different temperatures and varieties on the yield and yield traits of tomato plant

Treatments	Number of cluster per plant	Number of flower per cluster	Number of fruit per cluster	Number of fruit per plant	Chlorophyll a (mg g-1 fw)	Chlorophyll b (mg g-1 fw)	Total Chlorophyll (mg g-1 fw)
Different temperature conditions							
T1	8.40 b	5.44 b	4.08 a	33.90 a	0.92 b	0.24 b	1.08 b
T2	9.07 a	7.05a	3.62 b	31.50 b	0.94 a	0.26 a	1.13 a
T3	8.90 a	5.60 b	3.43 b	30.30 c	0.87 c	0.20 c	1.04 c
Level of significance	**	*	**	**	**	**	**
CV %	14.68	8.42	12.48	4.31	2.63	4.74	1.83
LSD (0.05)	0.32	1.01	0.27	1.13	0.02	0.01	0.01
Varieties							
V_1	9.33 b	5.54 de	3.87 ab	35.33 ab	1.00 a	0.25 a	1.23 a
V_2	9.44 b	5.75 cde	3.47 bc	32.00 d	0.90 cd	0.22 c	1.08 de
V_3	9.00 bc	5.59 de	3.32 c	29.44 e	0.90 cd	0.21 d	1.083 d
V_4	5.89 d	6.00 bcd	3.83 ab	22.33 f	0.97 b	0.25 a	1.15 b
V_5	7.89 c	6.46 ab	4.28 a	33.44 c	0.85 e	0.23 c	0.99 g
V_6	7.89 c	6.31 ab	4.08 a	31.89 d	0.85 e	0.21 d	1.01 f
V_7	10.2 ab	6.17 abc	3.30 c	33.33 c	0.90 cd	0.22 c	1.06 e
V_8	10.89 a	6.44 ab	3.17 c	34.11 bc	0.89 d	0.22 c	1.07 de
V_9	9.56 b	5.43 e	3.79 ab	36.00 a	0.92 cd	0.24 b	1.08 de
V_{10}	7.78 c	6.58 a	4.03 a	31.11 d	0.93 c	0.25 a	1.11 c
Level of significance	**	**	**	**	**	**	**
CV %	14.68	8.42	12.48	4.31	2.63	4.74	1.83
LSD (0.05)	1.22	0.48	0.44	1.30	0.03	0.01	0.02

Note: Different temperature conditions

T1: Normal temperature (10-20°C)
T2 : Medium temperature (21-25°C)
T3 : High temperature (26-30°C)

Variety

V_1 : BARI tomato 2 (Roton)
V_2 : BARI tomato 3
V_3 : BARI tomato 9 (Lalima)
V_4 : BARI tomato 14
V_5 : Surakkha
V_6 : BARI hybrid tomato 5
V_7 : BARI hybrid tomato 6
V_8 : Mintoo (Lal Teer Seed Ltd)
V_9 : Tidy (Metal Seed Ltd.)
V_{10} : Roma VF ((ACI Seed Ltd.)

LSD (0.05) : Significant at 5% level of probability (*)
LSD (0.01) : Significant at 1% level of probability (**)
NS : Not significant

The variety Roma VF produced the maximum flower number per cluster (6.58) whereas the variety Tidy produced the minimum number of flower (5.43) per cluster (Table 6). The variety Surakha gave the highest number of fruit per cluster (4.28), which was statistically identical to variety BARI tomato 2 (3.87), whereas the variety Mintoo produced the lowest number of fruits per cluster (3.17) (Table 6). The variety Tidy tomato produced the maximum number of fruit per plant (36.00), while the minimum number of fruit per plant (22.33) was recorded from the variety BARI tomato 14 (Table 1). The variety BARI tomato 2 gave the highest yield (2.06 kg/plant and 57.06 t/ha), while BARI tomato 3 and Roma VF were also promising. However, the variety Surokkha and Tidy were performed poor in respect of yield along with the variety BARI hybrid tomato 5 (1.76 kg/plant and 49.10 t/ha) (Figure 2C&D). Moreover, the variety BARI tomato 2 produced the highest total chlorophyll in leaves (1.23 mg/gfw), whereas the variety BARI hybrid tomato 5 produced the lowest (0.99 mg/gfw) total chlorophyll in leaves. (Table 1).

Variety Tidy was involved in vegetative growth (plant height) but failed to provide desired yield, while fruit abortion was minimum in Tidy and maximum in Mintoo. Although the variety Surokkha gave higher fruit/cluster but also failed to yield may be due to the smaller sized fruits. Therefore, varieties BARI tomato 2 &3, Roma VF and Tidy might be promising to cultivate in many regions of Bangladesh. Yield of BARI tomato 2 (Roton) was also reported up to 66.86 t/ha during winter season at central region of Bangladesh (medium temperature) by Mazed et al. (2015). Several authors also cited growth, yield and yield traits differenced due to genotypic diversity (Rana & Kalloo,1989; Phookan & Shadeque, 1995; Phookan et al., 1998).

Interaction effect of different temperatures and varieties

Interaction effect between different temperature conditions and varieties was significant in respect of growth and yield traits. Results indicated (Figure 3a&b) that comparatively medium temperature influenced the Growth parameters. The longest plant height (105.3 cm) and the highest number of branches (14.00) were obtained from the treatment combination of medium temperature × Tidy and BARI tomato 3, respectively. Both low and high temperature conditions hampered the vegetative growth (Fleisher et al., 2006) and this fact also exposed by Sawant (2021) who mentioned ideal temperature 20-250 C for plant growth and develop fruit color. However, shortest plant height (70.33 cm) was obtained from the treatment combination of high temperature × BARI tomato 9 and whereas the lowest number of branch (7.67) was recorded from the treatment combination of normal temperature × Mintoo at 105 DAT.

There was found not significant interaction effect between different temperature conditions and varieties in respect of number of cluster per plant, number of fruit per cluster and number of fruit per plant (Table 2). However, still cluster per plant was higher in medium temperature compare to low and high but fruit setting per cluster and per plant were higher in lower/normal temperature which indicated higher fruit abortion due to temperature above 200 C. The highest number of flower per cluster (8.33) was recorded from the treatment combination of medium temperature x Mintoo. On the other hand, the lowest number of flower per cluster (5.00) was obtained from the variety Tidy × high temperature (Table 2). These results corroborate with Lohas & Peat (1998) who reported similar vulnerable flower and fruit setting at high temperature.

The highest total chlorophyll in leaves (1.29 mg/gfw) was found in medium temperature × BARI tomato 2, whereas the treatment combination high temperature × BARI hybrid tomato 5 and high temperature × Tidy produced the lowest total chlorophyll (0.99 mg/gfw) in leaves (Table 2). However, total chlorophyll in leaves deteriorated with increase of temperature from medium to high but the variety BARI tomato 2 also performed highest in this respect leaf chlorophyll content (1.16 mg/gfw) when grown under high temperature condition. This indicated that variety BARI tomato 2 had highest resistance to heat. Although variety Tidy, Mintoo and BARI tomato 2 were promising in all temperature conditions but Tidy did not provide yield better. In normal/low temperature conditions the variety Mintoo gave the highest yield (66.68 t/ha), while variety BARI tomato 2 (65.50 t/ha) was identical. Reversely, the lowest fruit weight per plant (40.23 t/ha) was found from the variety Mintoo in the high temperature but the variety BARI tomato 2 provided the highest yield (49.39 t/ha) this time. BARI tomato 2 also afforded higher yield in medium temperature, where Roma VF and BARI tomato 3 were also closely associated. These results indicated the higher heat tolerance ability of BARI tomato 2 and lower tolerance ability of variety Mintoo.

Table 2. Interaction effect of different temperatures and varieties on the yield and yield components of tomato plant

Treatments	Number of cluster per plant	Number of flower per cluster	Number of fruit per cluster	Number of fruit per plant	Chlorophyll a (mg g-1 fw)	Chlorophyll b (mg g-1 fw)	Total Chlorophyll (mg g-1 fw)
$T1V_1$	9.00	5.18 hij	4.11	36.67	1.01 ab	0.26 cde	1.23 b
$T1V_2$	8.67	5.25 g-j	3.93	34.00	0.87 fgh	0.21 lmn	1.03 gh
$T1V_3$	8.33	5.33 g-j	3.72	31.00	0.87 fgh	0.23 i-l	1.08 f
$T1V_4$	5.67	5.50 g-j	4.20	23.67	0.97 a-d	0.26 cde	1.15 d
$T1V_5$	7.67	5.80 f-j	4.71	36.00	0.85 ghi	0.21 k-m	0.97 j
$T1V_6$	7.67	5.50 g-j	4.43	33.67	0.89 efg	0.23 h-k	1.01 ghi
$T1V_7$	10.00	5.50 g-j	3.63	36.33	0.98 a-d	0.25 def	1.12 e
$T1V_8$	10.33	5.67 g-j	3.48	36.00	0.92 def	0.23 i-l	1.08 f
$T1V_9$	9.33	5.11 j	4.15	38.67	0.95 bcd	0.24 e-h	1.07 f
$T1V_{10}$	7.33	5.50 g-j	4.51	33.00	0.95 bcd	0.25 efg	1.11 ef
$T2V_1$	9.67	5.93 f-j	3.96	35.33	1.03 a	0.29 a	1.29 a
$T2V_2$	10.00	7.00 cde	3.41	32.00	0.99 abc	0.27 b-e	1.19 cd
$T2V_3$	9.33	6.26 efg	3.18	29.33	0.97 a-d	0.26 cde	1.16 cd
$T2V_4$	6.00	6.73 def	3.67	22.00	0.99 ab	0.28 abc	1.17 cd
$T2V_5$	8.00	7.67 abc	4.13	32.67	0.89 efg	0.29 a	1.00 ghi
$T2V_6$	8.00	7.28 bcd	3.95	31.33	0.81 i	0.20 mn	0.99 ij
$T2V_7$	10.67	7.00 cde	3.32	32.33	0.87 e-h	0.21 j-m	1.04 g
$T2V_8$	11.33	8.33 a	3.04	33.67	0.93 cde	0.23 g-j	1.12 e
$T2V_9$	9.67	6.18 e-h	3.73	35.67	0.96 bcd	0.27 a-d	1.17 cd
$T2V_{10}$	8.00	8.04 ab	3.87	30.67	0.98 a-d	0.28 ab	1.20 bc
$T3V_1$	9.33	5.50 g-j	3.53	34.00	0.98 a-d	0.22 i-m	1.16 cd
$T3V_2$	9.67	5.00 j	3.08	30.00	0.84 ghi	0.20 mno	1.01 ghi
$T3V_3$	9.33	5.16 ij	3.06	28.00	0.87 f-i	0.14 p	1.01 ghi
$T3V_4$	6.00	5.78 f-j	3.62	21.33	0.96 bcd	0.22 i-m	1.12 e
$T3V_5$	8.00	5.90 f-j	3.99	31.67	0.82 hi	0.19 no	0.99 ij
$T3V_6$	8.00	6.14 e-i	3.87	30.67	0.84 ghi	0.18 o	1.04 g
$T3V_7$	10.00	6.00 f-j	2.95	31.33	0.86 ghi	0.20 mno	1.02 ghi
$T3V_8$	11.00	5.33 g-j	2.98	32.67	0.82 hi	0.21 j-m	1.01 ghi
$T3V_9$	9.67	5.00 j	3.51	33.67	0.86 ghi	0.21 k-n	0.99 hij
$T3V_{10}$	8.00	6.19 e-h	3.73	29.67	0.86 f-i	0.24 f-i	1.03 gh
Level of significance	NS	*	NS	NS	**	**	**
CV %	14.68	8.42	12.48	4.31	2.63	4.74	1.83
LSD (0.05)	2.11	0.83	0.76	2.25	0.05	0.02	0.03

Note

Different temperature conditions

T1: Normal temperature (10-20°C)

T2 : Medium temperature (21-25°C)

T3 : High temperature (26-30°C)

Variety

V_1 : BARI tomato 2 (Roton)
V_2 : BARI tomato 3
V_3 : BARI tomato 9 (Lalima)
V_4 : BARI tomato 14
V_5 : Surakkha
V_6 : BARI hybrid tomato 5
V_7 : BARI hybrid tomato 6
V_8 : Mintoo (Lal Teer Seed Ltd)
V_9 : Tidy (Metal Seed Ltd.)
V_{10} : Roma VF (CI Seed Ltd.)

LSD (0.05) : Significant at 5% level of probability (*)
LSD (0.01) : Significant at 1% level of probability (**)
NS : Not significant

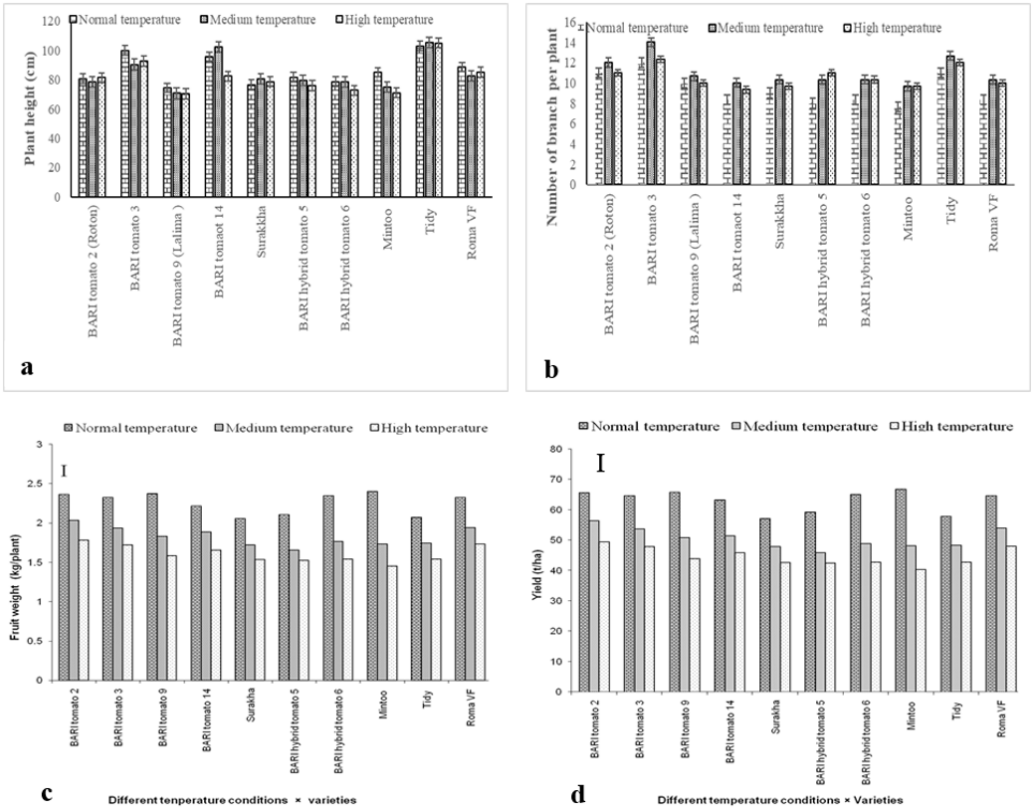

Figure 3. Interaction effect of different temperatures and varieties on the growth and yield of tomato (The vertical bars represent the level of significant at 0.05).

CONCLUSION

Almost all the studied parameters responded negatively at higher temperature (26-350 C). Medium temperature (21-250 C) was favorable for tomato growth and flowering but flower and fruit abortion were higher. Successful yield and yield traits required comparatively low temperature (10-200 C) during fruit setting. BARI tomato 2 (Roton) performed better yield and yield attributes under low-high temperature conditions, while variety Mintoo performed only under lower or normal temperature. Variety Roma VF and BARI tomato 3 also performed closely along with BARI tomato 2 when grown under medium temperature. Therefore, BARI tomato 2 might be recommend for all seasons and regions of Bangladesh. Meanwhile, variety Mintoo might be recommended only for winter and for northern region whereas Roma VF and BARI tomato 3 for middle-southern region during autumn seasons of Bangladesh. Maintaining different temperature conditions in the field was very challenging and suspicious to be accurate. Further studies and regional trails with more varieties are suggested to detect the most suitable condition of temperature and variety for higher production of tomato for different seasons and regions of Bangladesh. These results will also help to conduct research in different part of the world along with AVRDC varieties and genotypes.

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