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ESTIMATION OF YIELD AND QUALITY TRAITS OF CHERRY TOMATO (*Solanum lycopersicum* VAR. *Cerasiforme*) AS INFLUENCED BY MICRONUTRIENTS AND PLANT GROWTH REGULATORS UNDER PROTECTED CONDITIONS

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ABSTRACT

The present investigation entitled "Estimation of Yield and Quality Traits of Cherry Tomato (*Solanum lycopersicum* var. *cerasiforme*) as Influenced by Micronutrients and Plant Growth Regulators under Protected Conditions" was conducted during the Kharif season of 2025–26 at the Department of Vegetable Science, Horticultural Research Centre (HRC), COH, SVPUAT, Meerut, Uttar Pradesh. The study was undertaken to evaluate the effects of different plant growth regulators and micronutrients on the yield and quality attributes of cherry tomato under protected cultivation. The observations recorded for various yield, quality and economic parameters were subjected to appropriate statistical analysis to determine the significance of treatment effects. The results revealed that foliar application of plant growth regulators, namely GA_3 and NAA, in combination with boron and zinc significantly influenced the yield and quality attributes of cherry tomato. Among the treatments, T_{10} (NAA @ 75 ppm + GA_3 @ 50 ppm + boron @ 75 ppm + $ZnSO_4$ @ 50 ppm) recorded the highest number of fruits per plant (110.49), number of fruits per cluster (12.11), fruit diameter (3.01 cm), fruit weight (13.27 g), fruit yield per plant (1466.23 g) and fruit yield per hectare (494.88 q ha^{-1}). The same treatment also recorded the highest total soluble solids (10.93 °Brix), shelf life (11.28 days) and ascorbic acid content (32.91 mg 100 g^{-1}). Thus, the combined application of NAA, GA_3, boron and zinc, particularly T_{10}, proved to be the most effective treatment for enhancing the productivity and quality of cherry tomato under protected cultivation.

***Key words*:** Cherry tomato, plant growth regulators, GA_3, NAA, boron, zinc, yield, fruit quality, protected cultivation.

Introduction

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) belongs to the family Solanaceae and genus *Solanum*. It is a diploid crop with a somatic chromosome number of 2n = 24, having a basic chromosome number of x = 12. Tomato and its closely related wild species are native to western South America, particularly the Andean regions of Ecuador, Peru and northern Chile. The Andean region is considered an important centre of diversity and early evolution of tomato. *Solanum lycopersicum* var. *cerasiforme*, commonly known as cherry tomato, occurs naturally and in cultivated forms in the Andean region, particularly Ecuador and Peru, and occupies an important position in the evolutionary history of cultivated tomato. Genetic and genomic studies indicate that *S. lycopersicum* var. *cerasiforme* is closely related to *S. pimpinellifolium* and represents an important intermediate form in the evolution and domestication of cultivated tomato (Blanca *et al.*, 2015). The domestication process is generally considered to have involved an early phase in the Andean region followed by further domestication and selection in Mesoamerica.

Because of its genetic diversity, small-fruited phenotype and adaptation to diverse environments, cherry tomato is an important genetic resource for tomato breeding programmes aimed at improving fruit yield, quality, nutritional characteristics and environmental adaptation (Blanca *et al.*, 2012). Tomato (*Solanum lycopersicum* L.) is one of the most important vegetable crops grown worldwide due to its high nutritional, economic, and culinary value. It is a rich source of lycopene, vitamins, minerals, and antioxidants. Tomato production and fruit quality are influenced by genotype, environmental conditions, nutrient availability, and crop management practices.

Although cherry tomato has considerable yield potential, its productivity and fruit quality are strongly influenced by the availability and balance of essential nutrients, environmental conditions and the coordination between vegetative and reproductive growth. Micronutrients such as zinc (Zn), boron (B), copper (Cu), manganese (Mn), iron (Fe) and magnesium (Mg) are required in relatively small quantities, but they play vital roles in various physiological and biochemical processes associated with plant growth, flowering, fruit set and fruit development. Zinc contributes to enzyme activation, protein synthesis, carbohydrate metabolism, membrane integrity and regulation of plant growth, whereas boron is essential for cell-wall formation, cell division, pollen germination, pollen-tube growth, reproductive development and the transport of assimilates. Iron and manganese are important for chlorophyll synthesis, photosynthetic electron transport and several enzymatic reactions, while copper participates in photosynthesis, respiration and antioxidant defence mechanisms. Magnesium is a central constituent of the chlorophyll molecule and is involved in photosynthesis, enzyme activation and carbohydrate translocation (Pramod *et al.*, 2025). An adequate and balanced supply of these micronutrients can therefore improve physiological efficiency, flowering, fruit setting, yield attributes and quality characteristics of tomato fruits. Recent studies in cherry tomato and tomato have demonstrated that micronutrient application can positively influence fruit yield and important quality parameters such as total soluble solids, ascorbic acid and lycopene (Kushwaha *et al.*, 2025).

Tomato is one of the most important vegetable crops grown in India and plays a significant role in vegetable production and human nutrition. Recent ICAR data indicate that tomato is cultivated over approximately 0.809 million ha, with a production of 19.697 million tonnes and an average productivity of about 24.34 t/ha. In recent years, cherry tomato has also gained considerable importance because of its small fruit size, attractive appearance, high sweetness, good flavour and increasing consumer demand. Among the improved cherry tomato varieties, Pusa Cherry Tomato-1 has an average yield of about 30.25 t/ha, whereas the newly developed Pusa Red Cherry Tomato-3 has an average yield of 35.78 t/ha (358 q/ha) (NHB).

Foliar application of micronutrients is an effective approach for improving nutrient availability, particularly during periods of rapid vegetative growth, flowering and fruit development. It can provide nutrients directly to plant tissues and may overcome limitations associated with soil nutrient availability and root uptake. A recent study by Pramod *et al.*, (2025) on cherry tomato under protected conditions demonstrated that foliar application of micronutrients significantly influenced growth, yield and quality attributes. Application of a commercial micronutrient mixture resulted in 62.83 t ha^{-1} yield, along with higher fruit weight, total soluble solids (8.76 °Brix), ascorbic acid (56.01 mg 100 g^{-1}) and lycopene (6.65 mg 100 g^{-1}), indicating the potential of balanced micronutrient nutrition for improving both productivity and fruit quality of cherry tomato.

Plant growth regulators (PGRs) are another important group of crop-management inputs that influence plant growth, flowering, fruit set, fruit development and assimilate partitioning. Regulators such as gibberellic acid (GA_3), naphthalene acetic acid (NAA), cytokinins such as benzylaminopurine (BAP), and other growth-promoting substances can modify physiological processes by influencing cell division, cell elongation, flowering and reproductive development. Their effectiveness depends on the type of regulator, concentration, application method and stage of crop development. Recent research has emphasized that inappropriate or excessive use of PGRs can negatively affect fruit quality, making optimization of concentration and application timing essential.

Material and Method

Experimental site, design and Soil properties

The experimental site was located at HRC, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut at 29.01* North latitude, 77.75* East longitude and an altitude of 237 meter above mean sea level (MSL). The soil in the experimental field had a sandy clay loam texture, was neutral in reactivity, and had a low N content, and a medium P, K and Zn content.

Treatment combination

The experiment consisted of eleven treatments,

including a control (T_0) and ten combinations of plant growth regulators and micronutrients. T_0 – Control; T_1 – GA_3 @ 50 ppm; T_2 – NAA @ 75 ppm; T_3 – GA_3 @ 50 ppm + Boron (H_3BO_3) @ 75 ppm; T_4 – GA_3 @ 50 ppm + Zn ($ZnSO_4$) @ 50 ppm; T_5 – GA_3 @ 50 ppm + Boron @ 75 ppm + Zn @ 50 ppm; T_6 – NAA @ 75 ppm + Boron @ 75 ppm; T_7 – NAA @ 75 ppm + Zn ($ZnSO_4$) @ 50 ppm; T_8 – NAA @ 75 ppm + Zn @ 50 ppm + Boron @ 75 ppm; T_9 – NAA @ 75 ppm + GA_3 @ 50 ppm + Boron @ 75 ppm + Zn @ 50 ppm; and T_{10} – NAA 75 ppm + GA_3 50 ppm + Boron (H_3BO_4) 75 ppm + Zn ($ZnSO_4$) 50 ppm. These treatments were evaluated to determine the individual and combined effects of plant growth regulators and micronutrients on growth, yield, and fruit quality of Cherry tomato.

Methodology

The experiment was conducted on Cherry Tomato using Pusa Cherry Tomato-1, with germplasm procured from ICAR–Indian Agricultural Research Institute (IARI), New Delhi. The experiment was laid out in a Randomized Complete Block Design (RCBD) with 3 replications and a total of 30 plots. A spacing of 60 cm × 45 cm was maintained between plants and rows. The experiment was conducted during the Kharif season of 2025, and the plants were grown in 15–18-inch growing bags under the experimental conditions. The observations were recorded on various yield and quality parameters, viz., number of fruits per plant, number of fruits per cluster, fruit diameter (cm), fruit yield per plant (g), fruit yield per hectare (q), ascorbic acid content (mg/100 g), total soluble solids (TSS) (°Brix), and shelf life (days).

Statistical analysis

Data collected during this study were subjected to ANOVA table. Statistical software OPSTAT used for the analysis, while the critical differences at 5% level of probability.

Results and Discussion

Cherry tomato yield parameters include number of fruits per plant, number of fruits per cluster, fruit diameter (cm), fruit yield per plant (g), fruit yield per hectare (q). These parameters determine the productivity and economic performance of the crop. Quality parameters mainly include total soluble solids (TSS), ascorbic acid content and shelf life, which indicate the nutritional value, taste and post-harvest keeping quality of the fruits. Proper application of plant growth regulators and micronutrients can improve both yield and quality attributes of cherry tomato.

Yield and Yield Attributes

The data presented in Table 1 and Fig. 1 revealed that different foliar applications of plant growth regulators (GA_3 and NAA) in combination with micronutrients (boron and zinc) significantly influenced the yield attributes and yield parameters of cherry tomato. The treatments showed significant variation in the number of fruits per plant, number of fruits per cluster, fruit diameter, fruit weight, fruit yield per plant and fruit yield per hectare. In general, the combined application of plant growth regulators and micronutrients markedly improved all yield-contributing characters and yield over the control, indicating a positive synergistic effect of these inputs on fruit development and productivity.

Number of fruits per plant

The number of fruits per plant varied significantly among the treatments and ranged from 100.46 to 110.49. The maximum number of fruits per plant (110.49) was recorded under T_{10} (foliar application of NAA @ 75 ppm + GA_3 @ 50 ppm + boron @ 75 ppm + $ZnSO_4$ @ 50 ppm), which was significantly superior to all other treatments. This was followed by T_9 (108.76) and T_6 (108.57), while T_7, T_8, T_4 and T_5 recorded 106.71, 106.44, 105.78 and 105.70 fruits per plant, respectively. Treatments T_3 (102.64) and T_2 (102.41) also produced significantly higher fruit numbers than the control. The minimum number of fruits per plant (100.46) was observed under T_1 (control). The overall mean was 105.80, with SE(m) ±, CD (P=0.05) and CV of 1.25, 3.74 and 2.05%, respectively. The increase in fruit number may be attributed to improved flowering, fruit set and photosynthate translocation by PGRs and micronutrients. Similar improvements in fruit number and yield with GA_3, NAA, boron and zinc application in tomato have been reported by Kavitha *et al.*, (2023), Sultana *et al.*, (2016) and Kumar *et al*., (2024).

Number of fruits per cluster

A significant variation was also observed in the number of fruits per cluster, which ranged from 9.47 to

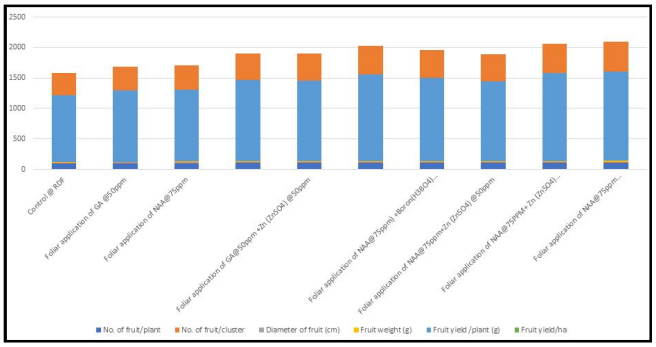


Fig. 1: Effect of Different Treatments on Yield and Yield Attributes like No. of fruit/plant, No. of fruit/cluster and Diameter of fruit (cm) Fruit weight (g), Fruit yield / plant (g) and Fruit yield/ha of Cherry Tomato.

Table 1: Effect of Different Treatments on Yield and Yield Attributes like No. of fruit/plant, No. of fruit/cluster and Diameter of fruit (cm) Fruit weight (g), Fruit yield /plant (g) and Fruit yield/ha of Cherry Tomato.

S. No	Treatments	NFP	NFC	DF	FW	FYP	FY
T_1	**Control @ RDF**	100.46	9.47	1.86	10.91	1095.65	365.21
T_2	**Foliar application of GA @50ppm**	102.41	10.28	2.04	11.39	1166.83	388.94
T_3	**Foliar application of NAA@75ppm**	102.64	10.45	1.93	11.52	1182.07	394.02
T_4	**Foliar application of GA@50ppm+ Boron(H3BO4) @75ppm**	105.78	10.61	2.48	12.59	1332.12	444.04
T_5	**Foliar application of GA@50ppm +Zn ($ZnSO_4$) @50ppm**	105.70	10.52	2.48	12.56	1327.94	442.64
T_6	**Foliar application of GA@50ppm +Boron(H3BO4) @75+Zn ($ZnSO_4$) @50ppm**	108.57	11.61	2.78	13.10	1422.31	474.10
T_7	**Foliar application of NAA@75ppm) +Boron(H3BO4) @75ppm**	106.71	10.91	2.67	12.86	1372.69	457.56
T_8	**Foliar application of NAA@75ppm+Zn ($ZnSO_4$) @50ppm**	106.44	10.70	2.58	12.32	1311.01	448.82
T_9	**Foliar application of NAA@75PPM+ Zn ($ZnSO_4$) @50ppm+ Boron(H3BO4) @75ppm**	108.76	11.84	2.90	13.26	1442.48	480.82
T_{10}	**Foliar application of NAA@75ppm +GA@50ppm+Boron (H3BO4) @75ppm+Zn ($ZnSO_4$) @50ppm**	110.49	12.11	3.01	13.27	1466.23	494.88
	Mean	105.80	10.85	2.47	12.38	1311.93	439.10
	SE(m) ±	1.25	0.26	0.05	0.28	29.35	11.04
	C.D. at 5%	3.74	0.77	0.14	0.83	87.89	33.04
	C.V. (%)	2.05	4.12	3.36	3.88	3.88	4.35

NFP: No. of fruit/plant; NFC: No. of fruit/cluster; DF: Diameter of fruit (cm);
FW: Fruit weight (g); FYP: Fruit yield /plant (g); FY: Fruit yield/ha

12.11. The highest number of fruits per cluster (12.11) was recorded under T_{10}, followed by T_9 (11.84) and T_6 (11.61). Treatments T_7, T_8, T_4, T_5, T_3 and T_2 recorded 10.91, 10.70, 10.61, 10.52, 10.45 and 10.28 fruits per cluster, respectively. The lowest value (9.47) was recorded under the control (T_1). The overall mean was 10.85, while SE(m) ±, CD (P=0.05) and CV were 0.26, 0.77 and 4.12%, respectively. The increase in fruits per cluster under combined application may be attributed to enhanced flowering, fruit setting and better nutrient availability. Similar improvement in yield-attributing traits of tomato through the application of plant growth regulators and micronutrients has been reported by Kumar *et al.,* (2024) and Sultana *et al.,* (2016).

Fruit diameter

Fruit diameter was significantly influenced by the different foliar treatments and ranged from 1.86 to 3.01 cm. The maximum fruit diameter (3.01 cm) was recorded under T_{10} and was significantly superior to all other treatments. The next best treatments were T_9 (2.90 cm) and T_6 (2.78 cm), followed by T_7 (2.67 cm), T_8 (2.58 cm), T_4 (2.48 cm) and T_5 (2.48 cm). Treatments T_2 (2.04 cm) and T_3 (1.93 cm) also recorded higher fruit diameter than the control, whereas the minimum fruit diameter (1.86 cm) was observed under T_1. The overall mean fruit diameter was 2.47 cm, with SE(m) ±, CD (P=0.05) and CV of 0.05 cm, 0.14 cm and 3.36%, respectively. The increase in fruit diameter may be attributed to enhanced cell division, cell enlargement and improved photosynthate accumulation due to PGR and micronutrient application. Similar increases in tomato fruit diameter following foliar application of GA_3 and micronutrients such as zinc and boron have been reported by Ray *et al.,* (2023), Sultana *et al.,* (2016), and Ali *et al.,* (2015).

Fruit weight

Fruit weight varied significantly among the treatments and ranged from 10.91 to 13.27 g. The maximum fruit weight (13.27 g) was recorded under T_{10}, which was statistically at par with T_9 (13.26 g) but significantly superior to the remaining treatments. The next best treatment was T_6 (13.10 g), followed by T_7 (12.86 g), T_4 (12.59 g), T_5 (12.56 g) and T_8 (12.32 g). Treatments T_3 (11.52 g) and T_2 (11.39 g) also recorded higher fruit weight than the control. The minimum fruit weight (10.91 g) was recorded under T_1. The overall mean fruit weight was 12.38 g, while SE(m) ±, CD (P=0.05) and CV were 0.28 g, 0.83 g and 3.88%, respectively. The increase in fruit weight under combined application may be attributed to enhanced cell division and enlargement, better fruit development and improved translocation of photosynthates. Similar increases in fruit weight following application of GA_3 and other plant growth regulators have been reported in cherry tomato by Kavitha *et al.,* (2023).

Fruit yield per plant

Fruit yield per plant was significantly influenced by the different foliar treatments and ranged from 1095.65 to 1466.23 g. The highest fruit yield per plant (1466.23 g)

Table 2: Effect of Different Treatments on quality Attributes like. Total soluble solids (%), Shelf life(days) and Ascorbic acid(mg/100) of Cherry Tomato.

S. No	Treatments	TSS	SL	AA
T_1	**Control @ RDF**	7.70	7.05	21.55
T_2	**Foliar application of GA @50ppm**	8.03	8.27	24.13
T_3	**Foliar application of NAA@75ppm**	8.12	8.37	24.78
T_4	**Foliar application of GA@50ppm+ Boron(H3BO4) @75ppm**	9.41	9.30	26.96
T_5	**Foliar application of GA@50ppm +Zn ($ZnSO_4$) @50ppm**	9.20	9.18	26.22
T_6	**Foliar application of GA@50ppm +Boron(H3BO4) @75+Zn ($ZnSO_4$) @50ppm**	10.30	10.66	31.43
T_7	**Foliar application of NAA@75ppm) +Boron(H3BO4) @75ppm**	9.85	9.68	29.77
T_8	**Foliar application of NAA@75ppm+Zn ($ZnSO_4$) @50ppm**	9.68	9.60	29.54
T_9	**Foliar application of NAA@75PPM+ Zn ($ZnSO_4$) @50ppm+Boron(H3BO4) @75ppm**	10.54	10.85	32.08
T_{10}	**Foliar application of NAA@75ppm +GA@50ppm+Boron(H3BO4) @75ppm+Zn ($ZnSO_4$) @50ppm**	10.93	11.28	32.91
	Mean	**9.38**	**9.42**	**27.94**
	SE(m) ±	**0.22**	**0.22**	**0.68**
	C.D. at 5%	**0.66**	**0.65**	**2.04**
	C.V. (%)	**4.05**	**4.00**	**4.22**

TSS: Total soluble solids (%); SL: Shelf life(days); AA: Ascorbic acid(mg/100)

was recorded under T_{10}, followed by T_9 (1442.48 g) and T_6 (1422.31 g). Treatments T_7, T_4, T_5 and T_8 recorded 1372.69, 1332.12, 1327.94 and 1311.01 g per plant, respectively. Treatments T_3 (1182.07 g) and T_2 (1166.83 g) also produced significantly higher yields than the control. The lowest fruit yield per plant (1095.65 g) was recorded under T_1. The overall mean was 1311.93 g, with SE(m) ±, CD (P=0.05) and CV of 29.35 g, 87.89 g and 3.88%, respectively. The higher fruit yield per plant under combined application may be attributed to improved flowering, fruit set, fruit development and efficient utilization of nutrients. Similar improvement in yield per plant due to application of plant growth regulators in cherry tomato was reported by Kavitha *et al.*, (2023).

Fruit yield per hectare

Fruit yield per hectare was also significantly affected by the foliar application of plant growth regulators and micronutrients. The maximum fruit yield (494.88 q ha^{-1}) was recorded under T_{10}, which was significantly superior to all other treatments. This was followed by T_9 (480.82 q ha^{-1}) and T_6 (474.10 q ha^{-1}). Treatments T_7, T_8, T_4 and T_5 recorded 457.56, 448.82, 444.04 and 442.64 q ha^{-1}, respectively. Treatments T_3 (394.02 q ha^{-1}) and T_2 (388.94 q ha^{-1}) also recorded higher yields than the control. The minimum fruit yield (365.21 q ha^{-1}) was obtained under T_1. The overall mean fruit yield was 439.10 q ha^{-1}, while SE(m) ±, CD (P=0.05) and CV were 11.04 q ha^{-1}, 33.04 q ha^{-1} and 4.35%, respectively, indicating good experimental precision. The higher fruit yield under combined application may be attributed to improved fruit set, fruit development and efficient nutrient utilization. Similar enhancement in tomato yield through the combined use of PGRs and micronutrients has been reported by Kumar *et al.*, (2024) and Kushwaha *et al.*, (2025).

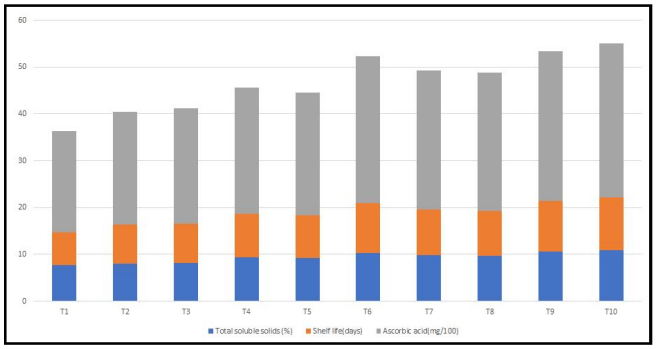


Fig. 2: Effect of Different Treatments on quality Attributes like. Total soluble solids (%), Shelf life(days) and Ascorbic acid(mg/100) of Cherry Tomato.

Quality Parameters

The data presented in Table 2 and Fig. 2 revealed that the application of different plant growth regulators and micronutrients significantly influenced the quality attributes of cherry tomato fruits. The quality parameters studied included total soluble solids (TSS), shelf life and ascorbic acid content. Significant differences were observed among the treatments for all the quality parameters. The combined application of plant growth regulators with boron and zinc resulted in considerable improvement in fruit quality as compared with the control.

Total Soluble Solids (TSS, °Brix)

The total soluble solids content of cherry tomato fruits differed significantly among the treatments and ranged from 7.70 to 10.93 °Brix. The maximum TSS content (10.93 °Brix) was recorded in T_{10} [NAA @ 75 ppm + GA_3 @ 50 ppm + Boron @ 75 ppm + $ZnSO_4$ @ 50 ppm],

which was significantly superior to the other treatments. The next higher values were recorded in T_9 (10.54 °Brix) and T_6 (10.30 °Brix). Treatments T_7, T_8, T_4 and T_5 recorded 9.85, 9.68, 9.41 and 9.20 °Brix, respectively. Treatments T_3 and T_2 recorded 8.12 and 8.03 °Brix, respectively. The minimum TSS content (7.70 °Brix) was recorded in T_1 (Control). The overall mean was 9.38 °Brix, while the SE(m) ±, CD at 5% and CV were 0.22, 0.66 and 4.05%, respectively. he increases in TSS under combined application of plant growth regulators and micronutrients may be attributed to enhanced carbohydrate metabolism and assimilate accumulation in the fruits. Similar improvement in TSS due to foliar application of zinc and boron in cherry tomato has been reported by Singh *et al.*, (2017), who recorded the highest TSS of 13.10 °Brix under combined Zn and B application. More recently, Shahni and Bahadur (2025) also reported significant improvement in TSS of cherry tomato with combined foliar application of zinc and boron.

Shelf Life (Days)

The shelf life of cherry tomato fruits was significantly affected by different treatments and ranged from 7.05 to 11.28 days. The maximum shelf life (11.28 days) was recorded in T_{10}, followed by T_9 (10.85 days) and T_6 (10.66 days). Treatments T_7, T_8, T_4 and T_5 recorded shelf lives of 9.68, 9.60, 9.30 and 9.18 days, respectively. Treatments T_3 and T_2 recorded 8.37 and 8.27 days, respectively. The minimum shelf life (7.05 days) was observed in T_1 (Control). The overall mean shelf life was 9.42 days, whereas the SE(m) ±, CD at 5% and CV were 0.22 days, 0.65 days and 4.00%, respectively. The improvement in shelf life under T_{10} may be attributed to the combined effect of NAA, GA_3, boron and zinc, which may help maintain fruit firmness, reduce physiological deterioration and delay ripening during storage. Similar findings were reported by Islam *et al.*, (2016)

Ascorbic Acid Content (mg 100 g^{-1})

The ascorbic acid content of cherry tomato fruits was significantly influenced by different treatments and ranged from 21.55 to 32.91 mg 100 g^{-1}. The highest ascorbic acid content (32.91 mg 100 g^{-1}) was recorded in T_{10}, which was significantly superior to the other treatments. This was followed by T_9 (32.08 mg 100 g^{-1}) and T_6 (31.43 mg 100 g^{-1}). Treatments T_7, T_8, T_4 and T_5 recorded 29.77, 29.54, 26.96 and 26.22 mg 100 g^{-1}, respectively. Treatments T_3 and T_2 recorded 24.78 and 24.13 mg 100 g^{-1}, respectively. The minimum ascorbic acid content (21.55 mg 100 g^{-1}) was recorded in T_1 (Control). The overall mean was 27.94 mg 100 g^{-1}, while the SE(m) ±, CD at 5% and CV were 0.68, 2.04 and 4.22%, respectively. The increase in ascorbic acid content under T_{10} may be attributed to the synergistic effect of NAA, GA_3, boron and zinc, which may enhance metabolic activity and antioxidant synthesis in the developing fruits. Similar findings were reported by Singh *et al.*, (2017), who observed higher vitamin C content in cherry tomato with combined foliar application of zinc and boron. Likewise, Shahni and Bahadur (2025) reported that foliar application of zinc and boron significantly improved vitamin C content in cherry tomato. In tomato, Khan *et al.*, (2024) also reported that zinc application significantly increased fruit ascorbic acid content, with the highest value recorded under 0.5% Zn application.

Conclusion

The present investigation demonstrated that foliar application of plant growth regulators (GA_3 and NAA) in combination with boron and zinc significantly improved the yield and quality attributes of cherry tomato. Among all treatments, T_{10} (NAA @ 75 ppm + GA_3 @ 50 ppm + boron @ 75 ppm + $ZnSO_4$ @ 50 ppm) recorded the highest number of fruits per plant (110.49), fruits per cluster (12.11), fruit diameter (3.01 cm), fruit weight (13.27 g), fruit yield per plant (1466.23 g) and fruit yield per hectare (494.88 q). The same treatment also recorded the highest TSS (10.93 °Brix), shelf life (11.28 days) and ascorbic acid content (32.91 mg 100 g^{-1}). Thus, the combined application of GA_3, NAA, boron and zinc, particularly T_{10}, proved most effective for enhancing both productivity and fruit quality of cherry tomato under the conditions of the present study.

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