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VEGETATIVE PROPAGATION OF F$_1$ HYBRID CHERRY TOMATO VIA SIDE SHOOT CUTTINGS: OPTIMIZING ROOT PROMOTERS AND MEDIA TO FIX HYBRID VIGOUR

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ABSTRACT

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is a high-value crop, but dependence on costly hybrid seeds constrains its large-scale cultivation. In indeterminate types, side shoots pruned during crop maintenance can serve as valuable propagules for vegetative multiplication. This study optimized root promoters and media combinations for efficient propagation of an F$_1$ hybrid through side shoot cuttings to retain hybrid vigour. A two-factor CRD evaluated IBA, NAA and cow urine across three rooting media. Significant variation was observed among treatments. IBA 150 ppm with cocopeat + FYM (1:1) produced the highest rooting response, while IBA 150 ppm with soil + FYM (1:1) gave maximum survival. The protocol offers an efficient, low-cost method for clonal propagation and hybrid vigour maintenance in cherry tomato.
***Keywords*:** Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*), vegetative propagation, side shoot cuttings

Introduction

Cherry tomato (*Solanum lycopersicum* var. *cerasiforme*) is a high value, export-oriented vegetable crop renowned for its rich nutritional profile, fresh consumption potential and increasing global demand. Hybrid indeterminate cultivars of cherry tomato have become integral to modern cultivation due to their uniformity, higher yield potential and improved stress resilience. Hybrid vigour (heterosis), the enhanced performance of F$_1$ progeny relative to parental lines, manifests as increased biomass, vigour and reproductive efficiency (Birchler *et al.*, 2006). Harnessing heterosis is central to breeding programs aimed at improving both quantitative and qualitative traits in tomato.

Despite its benefits, hybrid seed production presents significant constraints. Hybrid seeds are costly, scarce and cannot reliably be saved for subsequent seasons because meiotic recombination disrupts the genetic integrity of F$_1$ progeny. Maintaining parent lines for seed production requires extensive labour, controlled environments and substantial economic investment (Richharia, 1962). These limitations restrict smallholder farmers' access to superior hybrids.

Vegetative propagation offers a strategic solution by preserving the heterozygosity and hybrid vigour of the parent genotype. Pruned side shoots, when treated with effective rooting agents and grown on optimized media, can serve as true-to-type planting material, enabling continuous production and reducing dependence on commercial seeds. This approach is particularly valuable for cherry tomato cultivated in protected condition, where side-shoot pruning is routinely practiced to improve plant architecture, fruit quality and yield.

The success of vegetative propagation hinges on the interplay between root promoters and rooting substrates. Auxins, such as indole-3-butyric acid (IBA) and α-naphthalene acetic acid (NAA), are widely used to stimulate adventitious root formation by enhancing cell division, callus differentiation and elongation at the cutting base (Woodward and Bartel, 2005). Exogenous auxin application elevates endogenous auxin levels in the basal tissues, coordinating root initiation with cellular expansion and vascular differentiation (Wiesman *et al*., 1988). In addition, organic alternatives like cow urine, rich in urea, trace elements, hormones and antimicrobial compounds, can enhance rooting by providing nutritional and bioactive support (Bhadauria, 2002).

The choice of rooting media is equally critical, as it governs water retention, aeration, nutrient availability and anchorage. Soil, sand and cocopeat are commonly used substrates, often combined with farmyard manure (FYM) to enhance nutrient content, microbial activity and physical structure. Soil–FYM mixtures support robust root elongation and biomass accumulation, sand ensures optimal drainage and moisture distribution and cocopeat offers superior porosity, capillarity and pH stability, promoting rapid root initiation. The synergistic interaction between root promoters and media creates an ideal physiological and physical environment for successful propagation.

Given the importance of these factors, the present study was undertaken to evaluate the influence of different concentrations of root promoters and rooting media on the vegetative propagation of hybrid cherry tomato through side shoot cuttings, with the aim of optimizing protocols for producing vigorous, true-to-type planting material while maintaining hybrid vigour.

Material and Methods

Experimental details

The experiment was conducted at the Department of Vegetable Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, Arunachal Pradesh, to evaluate the effect of different root promoters and rooting media on root initiation in side shoot cuttings of hybrid cherry tomato (*Solanum lycopersicum* var. *cerasiforme*).

A two-factor Completely Randomized Design (CRD) with three replications was followed using the F_1 hybrid ($G_2 \times G_7$) developed by the department. Factor I comprised thirteen root promoters Indole-3-butyric acid (IBA) at six concentrations (50–300 ppm), Naphthalene acetic acid (NAA) at five concentrations (50–250 ppm) and cow urine, a natural growth enhancer containing water, urea, salts, hormones and enzymes, at two concentrations (25% and 50%). Factor II included three rooting media: soil + FYM (1:1), sand + FYM (1:1) and cocopeat + FYM (1:1), forming 39 treatment combinations (13 × 3) evaluated under controlled polyhouse conditions.

Preparation of stem cuttings and application of growth regulators

Side shoots (12–15 cm) from healthy hybrid plants were prepared with a slant cut at the base, disinfected cutting tools were used and the basal ends were dipped in respective root-promoting solutions for 30 minutes before planting in root trainers filled with the designated medium. Light irrigation was applied immediately and the trays were maintained under a poly tunnel to ensure high humidity and favourable rooting conditions.

Data collection and statistical analysis

Rooting parameters were assessed 28 days after planting using five randomly selected cuttings per replication. The number of roots per cutting was determined with a Biovis PSM Root Analyzer and the mean was calculated. The length of the longest root was measured with a 30 cm scale (cm). Fresh root weight was recorded after washing and separating the roots and dry weight was obtained by oven-drying at 70°C for 24 hours, with both expressed in milligrams (mg). Survival percentage was calculated as the proportion of rooted cuttings relative to the total planted. Data were analysed by two-factor ANOVA to evaluate treatment effects and interactions and significant differences among means were compared using the least significant difference (LSD) test at 5% significance.

Results and Discussion

Cherry tomato side-shoot cuttings treated with different concentrations of IBA, NAA and cow urine showed significant variation in the number of roots, root length, root weight (fresh and dry weight) and survival percentage.

Number of roots

The highest number of roots were observed in cutting treated with IBA 150 ppm (95.56), followed by IBA 200 ppm (87.67) and cow urine 25% (79.44), which was statistically on par with IBA 250 ppm (77.78) (Table 1). These findings indicate that IBA was the most effective rooting promoter, particularly at 150 ppm, which might be attributed to its greater chemical stability and slower translocation within plant tissues, resulting in sustained physiological activity. At optimum concentrations, IBA enhances cambial dedifferentiation and callus formation, which further differentiates into root initials (Shiri *et al.*, 2019). However, a reduction in root number was observed beyond 150 ppm IBA, likely due to the inhibitory or toxic effects of higher auxin concentrations. Elevated levels of IBA can suppress callus formation and root initiation due to physiological toxicity (Gilani *et al.*, 2019).

Rooting media also had a significant influence on root number. The highest root number was recorded in cocopeat + FYM (1:1) (65.18), followed by sand + FYM (1:1) (55.18) (Table 1). The superior performance of cocopeat + FYM attributed to its favourable physical properties low bulk and particle density, high porosity and strong capillary action which ensure better aeration and uniform moisture distribution around the root zone (Raviv and Lieth, 2008). Moreover, cocopeat possesses high water holding capacity and cation exchange potential, which facilitate nutrient availability and support root proliferation (Pascual *et al.*, 2018). Similar findings were reported by Ochoa *et al.* (2003) in oleander, where cocopeat based media significantly improved root formation.

The interaction between root promoters and rooting media was significant. The highest number of roots was obtained in IBA 150 ppm + cocopeat + FYM (1:1) (105.67), followed by IBA 200 ppm + cocopeat + FYM (1:1) (99.33) (Fig. 1). The lowest number of roots was recorded in NAA 250 ppm + soil + FYM (1:1) (13.67), which was statistically comparable with NAA 250 ppm + sand + FYM (1:1) (14.67). The superior combination of IBA 150 ppm with cocopeat + FYM likely provided an optimal physiological and physical environment for root initiation and elongation. While IBA enhanced internal hormonal regulation conducive to rooting, cocopeat ensured adequate moisture retention and oxygenation at the root zone, resulting in synergistic effects on root proliferation.

Root length

The influence of different concentrations of root promoters and rooting media on root elongation in hybrid cherry tomato cuttings was found to be highly significant. Among the IBA treatments, cuttings treated with 150 ppm IBA produced the longest roots (15.03 cm), followed by 200 ppm IBA (11.98 cm), while the lowest occurred at 250 ppm (4.29 cm). Similarly, among cow urine treatments, 25% concentration resulted in longer roots (9.30 cm) compared with 50% concentration (6.36 cm) (Table 1). Overall, IBA 150 ppm proved most effective for promoting root elongation, while NAA 250 ppm resulted in the poorest performance.

Auxins play a crucial role in the initiation and elongation of adventitious roots by stimulating cell division and elongation in the root primordia. During root formation, the cell wall components such as cellulose, hemicellulose, pectin and structural proteins undergo modification, which facilitates cell expansion (Safari *et al.*, 2018). Auxins induce apoplastic acidification and activate wall-loosening proteins, thereby promoting root elongation (Wei *et al.*, 2019). The application of optimal IBA concentrations enhances cambial dedifferentiation, increases hydrolytic enzyme activity and promotes callus formation, all of which collectively contribute to greater root elongation (Kumar *et al.*, 2015). However, at higher concentrations, auxin accumulation can become toxic, causing cellular damage in the epidermal layer and reducing root growth, as observed in treatments beyond IBA 150 ppm.

Rooting media also had a significant effect on root length. Among the three media tested, soil + FYM (1:1) recorded the longest roots (10.29 cm), followed by sand + FYM (1:1) (7.99 cm), whereas cocopeat + FYM (1:1) produced the shortest roots (6.29 cm) (Fig. 2). A significant interaction was observed between root promoters and rooting media. The combination of IBA 150 ppm with soil + FYM (1:1) produced the maximum root length (20.52 cm), followed by IBA 200 ppm + soil + FYM (1:1) (16.09 cm). The shortest roots were recorded in NAA 250 ppm + cocopeat + FYM (1:1) (2.47 cm), which was statistically comparable with NAA 200 ppm + cocopeat + FYM (1:1) (3.25 cm).

Among the rooting media, the combination of soil + FYM (1:1) provided favorable conditions for root elongation. This medium likely enhanced nutrient availability, improved aeration and maintained better moisture balance compared to other media. These findings are consistent with those of Baghel and Saraswat (1989) and Kumar *et al.* (2021), who reported superior root development in soil + FYM mixtures in pomegranate and other crops. FYM enriches the rooting environment by supplying essential nutrients and humic substances while improving physical and biological soil properties. Additionally, the lower number of roots formed in soil + FYM medium may have reduced competition for nutrients, thereby promoting elongation of individual roots.

Root weight

The fresh and dry weights of roots were significantly influenced by different concentrations of root promoters and rooting media in hybrid cherry tomato cuttings. Among the IBA treatments, cuttings treated with IBA 150 ppm recorded the highest fresh (1629.44 mg) and dry (219.33 mg) root weights, followed by IBA 200 ppm with 1508.89 mg and 196.89 mg, respectively. The lowest fresh and dry weights were obtained in NAA 250 ppm (946.11 mg and 90.67 mg). Among cow urine treatments, 25% concentration resulted in greater fresh (1458.56 mg) and dry (174.67 mg) root weights than 50% concentration (1078.22 mg and 113.22 mg).

The superior performance of IBA 150 ppm in promoting root biomass may be attributed to its optimal auxin concentration, which stimulates root initiation and elongation, thereby enhancing overall root mass (Taha *et al.*, 2013). The decrease in root weight at higher IBA concentrations could be due to the inhibitory or toxic effects of excess auxin on cell division in the rooting zone (Waheed *et al.*, 2015).

Rooting media also exhibited a significant effect on root biomass. Cuttings grown in soil + FYM (1:1) recorded the maximum fresh (1373.21 mg) and dry (170.23 mg) weights, followed by sand + FYM (1:1) (1311.64 mg and 151.56 mg), while cocopeat + FYM (1:1) produced the least (1224.15 mg and 122.69 mg).

Variations in rooting media also affected root development, likely due to differences in nutrient availability and aeration. Soil + FYM (1:1) provided an ideal balance of moisture retention, nutrients and microbial activity, promoting better root growth. FYM enriches the media with organic matter, improving its physicochemical properties and facilitating nutrient absorption. Comparable findings were reported by Kumar *et al.* (2021) and Yesuf *et al.* (2021) in pomegranate cuttings, who noted that nutrient rich media enhance biomass accumulation through improved root system development. Adugna *et al.* (2015) also emphasized that deeper and more extensive root systems improve water and nutrient uptake, resulting in greater fresh and dry weights.

Overall, the combination IBA 150 ppm with cocopeat + FYM (1:1) was most effective for promoting root initiation, while IBA 150 ppm with soil + FYM (1:1) enhanced root elongation and biomass accumulation. The results clearly indicate that both auxin concentration and rooting media composition play complementary roles in determining the rooting efficiency of hybrid cherry tomato cuttings. The synergistic action of an optimal hormonal environment and suitable rooting substrate ensures better root proliferation, elongation and biomass production, thereby enhancing the overall success of vegetative propagation.

Survival per centage

The survival percentage of hybrid cherry tomato cuttings was significantly influenced by the type and concentration of root promoters as well as by the rooting media and their interaction. Among the different concentrations of IBA, the highest survival percentage was recorded in cuttings treated with IBA 150 ppm (74.22%), followed by 25% cow urine (67.56%), whereas higher concentrations of NAA were inhibitory. The superior performance of IBA at moderate concentration may be attributed to its higher chemical stability and prolonged activity at the basal end of cuttings, promoting callus formation and subsequent root development. The optimum auxin level facilitates the dissolution of the cuticular barrier at the basal end, improving moisture and nutrient absorption and preventing decay (Shiri *et al.*, 2019). Conversely, elevated auxin concentrations may exert toxic effects by causing potassium ion imbalance, leading to epidermal damage and reduced survival (Shiri *et al.*, 2019).

The effectiveness of cow urine in enhancing survival percentage is consistent with findings by Riski *et al.* (2016) and Widiana *et al.* (2016), who reported improved root initiation and survival in cuttings treated with diluted animal urine solutions. The positive response of cow urine at 25% may be due to the presence of natural growth promoters (possibly auxins or cytokinin) and a rich nutrient composition that supports early root establishment and overall cutting vigour.

Rooting media also had a significant effect on survival percentage. Among the three tested media, soil + FYM (1:1) recorded the highest survival (45.85%), followed by sand + FYM (1:1) (34.15%), whereas cocopeat + FYM (1:1) showed the lowest (29.64%) (Table 2). The superior performance of soil + FYM could be due to its balanced nutrient availability, better moisture retention and adequate aeration, all of which are essential for maintaining physiological activity during rooting. This observation is in agreement with Okolie *et al.* (2021), Alam *et al.* (2020), Subbaiah *et al.* (2018) and Tiwari *et al.* (2020), who reported improved survival of cuttings in nutrient-enriched and well-aerated soil-based substrates. Soil and FYM together provide a favorable physical and chemical environment, ensuring proper anchorage, aeration and nutrient supply, which minimizes rotting and enhances the establishment of cuttings.

A significant interaction effect between root promoters and rooting media was also observed. The highest survival percentage was recorded in the treatment combination of IBA 150 ppm + soil + FYM (1:1) (85.33%), followed by IBA 200 ppm + soil + FYM (1:1) (76.00%), which was statistically on par with cow urine 25% + soil + FYM (1:1) (74.67%) and

IBA 150 ppm + sand + FYM (1:1) (72.00%). In contrast, the lowest survival was observed in NAA 250 ppm + cocopeat + FYM (1:1) (4.00%) (Fig. 3).

The superior performance of IBA 150 ppm in combination with soil + FYM could be attributed to the synergistic effect of an optimal hormonal balance and a nutrient-rich rooting medium. Adequate auxin concentration stimulates root initiation, while the favourable physicochemical properties of soil + FYM support root elongation and prevent desiccation or decay. Similar interactions between growth regulators and substrate properties have been documented by Kumar *et al.* (2015), Mehra *et al.* (2019) and Kachru *et al.* (2017). Conversely, higher auxin concentrations such as NAA 250 ppm may induce oxidative stress and cell damage at the basal end of cuttings, thereby reducing survival.

Cow urine at 25% concentration combined with soil + FYM also showed high survival, likely due to the dual benefit of natural growth-promoting compounds in cow urine and the nutrient enrichment of the medium. This interaction provided both hormonal stimulation and a conducive rooting environment, resulting in healthier and more viable cuttings.

Conclusion

The study revealed that both root promoters and rooting media significantly influenced root initiation, elongation, biomass accumulation and survival in hybrid cherry tomato cuttings. Among the treatments, IBA at 150 ppm was most effective, producing the highest number and length of roots, as well as superior fresh and dry weights. Its optimal concentration ensured sustained auxin activity that enhanced cell division and root differentiation without causing toxicity. Among rooting media, cocopeat + FYM (1:1) promoted better root initiation due to its favourable aeration and moisture retention, while soil + FYM (1:1) supported greater root elongation, biomass and survival owing to its nutrient-enriched and well-balanced properties. The interaction between IBA 150 ppm and these media showed a synergistic effect, with IBA 150 ppm + cocopeat + FYM (1:1) excelling in root initiation and IBA 150 ppm + soil + FYM (1:1) enhancing root growth and survival.

Overall, the combination of IBA 150 ppm with either soil + FYM (1:1) can be recommended for efficient vegetative propagation of hybrid cherry tomato through side shoot cuttings, ensuring vigorous rooting and high establishment success.

Table 1: Interaction effect of root promoters and rooting media on number of roots, longest root length and fresh root weight of cherry tomato F_1 hybrid side shoot cuttings.

Root promoter (H)	Number of roots / Media (Mean ± SE_M)				Longest root length (cm) / Media (Mean ± SE_M)				Fresh Weight (mg) / Media (Mean ± SEM)			
	Soil+ FYM (1:1)	Sand+ FYM (1:1)	Cocopeat + FYM (1:1)	H Mean	Soil+ FYM (1:1)	Sand+ FYM (1:1)	Cocopeat + FYM (1:1)	H Mean	Soil+ FYM (1:1)	Sand+ FYM (1:1)	Cocopeat + FYM (1:1)	H Mean
IBA 50 ppm (H1)	56.00 ±1.53	60.00 ±3.21	67.33 ±1.20	**61.11**	8.79 ±0.57	6.09 ±0.40	4.83 ±0.22	**6.57**	1475.33 ±29.33	1311.67 ±16.66	1306.00 ±1.29	**1364.33**
IBA100 ppm (H2)	62.00 ±0.00	68.33 ±0.33	74.00 ±0.00	**68.11**	10.89 ±0.30	9.4 ±0.23	7.84 ±0.56	**9.38**	1504.67 ±7.83	1453.67 ±7.57	1423.33 ±17.78	**1460.56**
IBA 150 ppm (H3)	88.33 ±1.67	92.67 ±0.33	105.67 ±0.33	**95.56**	20.52 ±0.15	13.76 ±0.31	10.82 ±0.13	**15.03**	1690.00 ±42.22	1637.67 ±2.56	1560.67 ±34.92	**1629.44**
IBA 200 ppm (H4)	78.00 ±0.00	85.67 ±0.33	99.33 ±0.67	**87.67**	16.09 ±0.53	11.02 ±0.07	8.82 ±0.10	**11.98**	1582.33 ±6.59	1519.33 ±11.86	1425.00 ±25.96	**1508.89**
IBA 250 ppm (H5)	70.00 ±0.00	72.00 ±0.00	91.33 ±0.67	**77.78**	11.63 ±0.17	8.01± 0.30	7.13 ±0.07	**8.93**	1444.67 ±17.29	1413.00 ±20.59	1387.33 ±17.33	**1415**
IBA 300 ppm (H6)	50.33 ±0.33	54.33 ±0.67	76.33 ±0.33	**60.33**	8.45 ±0.20	7.40 ±0.11	6.73 ±0.39	**7.53**	1407.00 ±8.79	1356.33 ±21.88	1214.33 ±30.97	**1325.89**
NAA 50 ppm (H7)	45.67 ±0.33	49.00 ±0.00	55.67 ±0.33	**50.11**	9.36 ±0.42	8.16 ±0.27	5.78 ±0.47	**7.78**	1376.33 ±10.03	1341.67 ±19.55	1166.33 ±29.74	**1294.78**
NAA 100 ppm (H8)	35.00 ±0.58	38.33 ±1.20	40.67 ±0.67	**38.00**	7.81 ±0.43	6.80 ±0.40	6.32 ±0.32	**6.98**	1306.33 ±1.36	1277.67 ±15.96	1114.67 ±2.32	**1232.89**
NAA 150 ppm (H9)	32.00 ±0.00	34.67 ±0.33	35.00 ±0.00	**33.89**	7.67 ±0.32	6.69 ±0.35	5.11 ±0.12	**6.49**	1232.00 ±25.65	1133.67 ±25.37	1083.00 ±12.96	**1149.56**
NAA 200 ppm (H10)	20.00 ±1.15	23.33 ±1.76	24.67 ±0.33	**22.67**	7.00 ±0.55	6.42 ±0.18	3.25 ±0.15	**5.56**	1192.33 ±21.10	1097.67 ±9.71	934.33 ±8.27	**1074.78**
NAA 250 ppm (H11)	13.67 ±0.33	14.67 ±0.88	22.00 ±7.21	**16.78**	6.49 ±0.20	3.92 ±0.24	2.47 ±0.34	**4.29**	978.67 ±11.71	942.00 ±13.24	917.67 ±4.30	**946.11**
Cow Urine 25% (H12)	70.33 ±0.33	80.00 ±2.89	88.00 ±1.53	**79.44**	11.06 ±0.41	9.64 ±0.21	8.11 ±0.28	**9.6**	1509.67 ±8.53	1483.33 ±0.77	1382.67 ±7.57	**1458.56**

Cow Urine 50% (H13)	36.67 ±0.33	44.33 ±0.33	67.33 ±0.88	**49.44**	7.98 ±0.45	6.52 ±0.22	4.56 ±0.20	**6.36**	1152.33 ±10.19	1083.67 ±0.77	998.67 ±7.57	**1078.22**
Media Mean	**50.62**	**55.18**	**65.18**		**10.29**	**7.99**	**6.29**		**1373.21**	**1311.64**	**1224.15**	
CD at 5%	**Root promoter (H)**		**2.68**		**0.60**				**34.12**			
	Media (M)		**1.29**		**0.29**				**16.39**			
	Interaction effect (H×M)		**4.65**		**1.04**				**59.02**			

Table 2: Interaction effect of root promoters and rooting media on dry root weight and survival percentage of cherry tomato F_1 hybrid side shoot cuttings.

Root promoter (H)	Dry Weight (mg) / Media (Mean ± SE_M)				Survival percentage (%) / Media (Mean ± SE_M)			
	Soil+ FYM (1:1)	Sand+ FYM (1:1)	Cocopeat + FYM (1:1)	H Mean	Soil+ FYM (1:1)	Sand+ FYM (1:1)	Cocopeat + FYM (1:1)	H Mean
IBA 50 ppm (H1)	163.33±4.08	137.00±1.31	130.67±0.73	143.67	24.00±2.31	24.00±2.31	24.00±2.31	24.00
IBA100 ppm (H2)	188.33±2.16	178.00±2.50	165.67±1.38	177.33	60.00±2.31	33.33±1.33	32.00±0.00	41.78
IBA 150 ppm (H3)	240.00±3.50	220.67±4.48	197.33±0.41	219.33	85.33±1.33	72.00±2.31	65.33±3.53	74.22
IBA 200 ppm (H4)	216.67±3.04	204.67±1.28	169.33±0.26	196.89	76.00±0.00	57.33±1.33	54.67±1.33	62.67
IBA 250 ppm (H5)	193.67±2.52	175.33±0.64	149.33±2.25	172.78	72.00±0.00	48.00±0.00	41.33±5.81	53.78
IBA 300 ppm (H6)	180.00±4.22	162.67±0.51	118.00±2.95	153.56	66.67±1.33	40.00±0.00	32.00±2.31	46.22
NAA 50 ppm (H7)	166.67±2.88	152.67±0.79	108.00±0.62	142.44	42.67±1.33	26.67±1.33	22.67±1.33	30.67
NAA 100 ppm (H8)	153.33±2.15	136.00±0.70	92.67±0.39	127.33	26.67±2.67	17.33±1.33	13.33±1.33	19.11
NAA 150 ppm (H9)	138.33±0.14	118.67±0.64	77.67±0.61	111.56	16.00±0.00	12.00±0.00	8.00±2.31	12.00
NAA 200 ppm (H10)	134.33±1.89	107.33±1.34	66.33±0.97	102.67	10.67±1.33	10.67±1.33	6.67±1.33	9.33
NAA 250 ppm (H11)	113.33±1.42	97.33±1.57	61.33±0.41	90.67	6.67±1.33	5.33±1.33	4.00±0.00	5.33
Cow Urine 25% (H12)	196.67±0.61	167.00±2.00	160.33±3.34	174.67	74.67±1.33	68.00±2.31	60.00±2.31	67.56
Cow Urine 50% (H13)	128.33±2.54	113.00±2.41	98.33±1.23	113.22	34.67±1.33	29.33±1.33	21.33±1.33	28.44
Media Mean	**170.23**	**151.56**	**122.69**		**45.85**	**34.15**	**29.64**	
CD at 5%	**Root promoter (H)**		**3.89**		**3.54**			
	Media (M)		**1.87**		**1.70**			
	Interaction effect (H×M)		**6.73**		**6.13**			

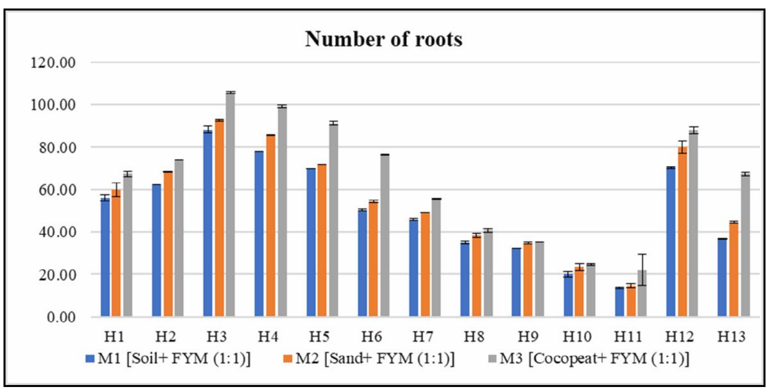

Fig. 1: Interaction effect of root promoter and rooting media on number of roots per cutting of F_1 hybrid cherry tomato

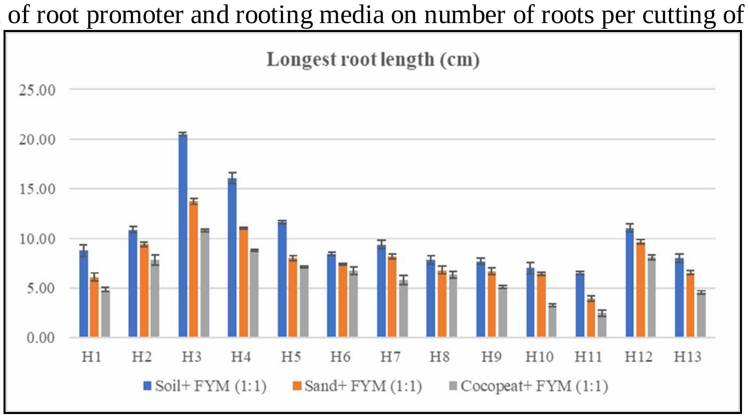

Fig. 2 : Interaction effect of root promoter and rooting media on root length of F_1 hybrid cherry tomato

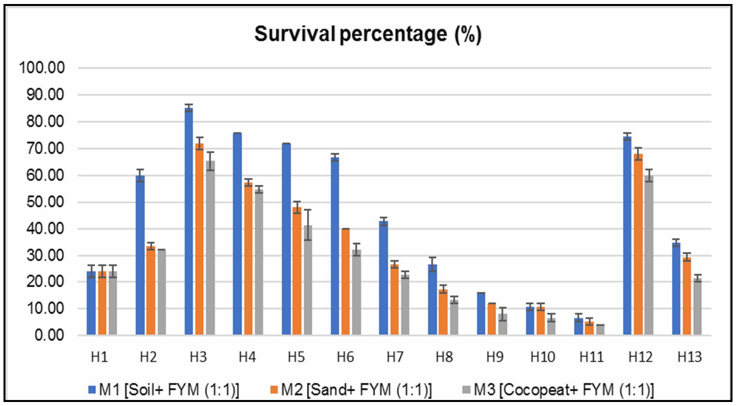

Fig. 3: Interaction effect of root promoter and rooting media on survival percentage of F_1 hybrid cherry tomato

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