



RESEARCH ARTICLE

Interspecific grafting compatibility studies between tomato (*Solanum lycopersicum*) grafted on eggplant (*Solanum melongena*) and its wild relatives

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Abstract

Tomato grafting has proven to overcome biotic and abiotic stresses as well as improve growth, yield, and fruit quality. However, in India, the graft compatibility between eggplant rootstocks and tomato varieties has not been explored extensively. The total 18 grafting combinations were developed by using three different (including two breeding lines) varieties of tomato as a scion and varieties of brinjal, including two wild species, i.e., ST05 and SG06. Tomato var. EC97, EC98 and, DOrg and Brinjal varieties and their wild species, i.e., SM01, SM02, SM03, SM04, ST05 and SG06, were used as rootstock for this study. The experiment was laid out in randomized block design (RBD) with 18 treatments and 3 replications and data were analyzed statistically. The results revealed that the plants are compatible with the grafting through cleft grafting method viz., graft success rate (95.71%), days taken to sprouting (10.60 days), number of leaves (27.12), plant height (32.99 cm), stem diameter (0.45 cm), root length (21.59 cm), root fresh weight (16.23 g) and root dry weight (10.51 g) for the graft combination SM01 x DOrg. The 2nd graft combination which exhibited the highest graft success rate (93.03%) was SM01x EC98. The highest root length was recorded in graft combination SM01 x EC97 (22.85 cm), followed by ST05 x DOrg and SM01 x EC98. Better root growth as root fresh weight was recorded in graft combination ST05 x EC97 (18.39 g) followed by SM01 x EC98 and ST05 x DOrg (17.65 and 17.05 g, respectively) but root dry weight was recorded maximum in graft combinations, i.e., ST05 x DOrg (13.20g) followed by ST05 x EC98 and SM01 x EC97 (12.59 and 12.23 g, respectively). Further studies are required for the selection of the best rootstocks that support vigorous growth of the scions under interspecific grafting for improved graft compatibility and plant growth.

Keywords: Tomato, Brinjal, *S. torvum*, *S. gilo*, Graft compatibility.

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Citation: Yadav P.K., Agarwal, A., Kumar, H., Kumar, S., Prakash, O., Ballabh, B., & Singh, D.P. (2025). Interspecific grafting compatibility studies between tomato (*Solanum lycopersicum*) grafted on eggplant (*Solanum melongena*) and its wild relatives. Vegetable Science 52 (1): 145-151.

Source of support: Nil

Conflict of interest: None.

Received: 26/03/2025 **Revised:** 02/05/2025 **Accepted:** 05/05/2025

Introduction

Tomato (*Solanum lycopersicum* Mill) is one of the most important and widely cultivated fruit vegetable crops in the world. In India the tomato crop cultivated for cash and domestic uses is produced by mostly small and medium scale farmers. Tomato wilt (fungal and bacterial), tomato leaf curl virus, late blight, early blight and root-knot nematode are some of the most devastating tomato diseases in the country. Tomato is also constrained by abiotic stresses such as drought, salinity, excessive heat and declining soil fertility (Minga *et al.*, 2011). Pesticide application is the major pest management strategy of tomato pests (Maerere *et al.*, 2010; Mamiro *et al.*, 2015), usually applied on a weekly or biweekly basis (Mtui *et al.*, 2015). This frequent pesticide application exacerbates both the cost of production, the potential for human health and environmental risks associated with pesticides (Meya *et al.*, 2014). Therefore, to mitigate the risks associated with environmental hazards and human health due to the extensive use of plant protection chemicals, the rootstock with good compatibility and tolerance or resistance to biotic and abiotic stresses is ideal for grafting

vegetables. They also encourage scion growth, increase production and do not decrease produce quality (Bletsos and Olympios, 2008). Several studies have already been conducted to investigate various eggplant wild rootstocks where tolerance to water and temperature stress was induced by *Solanum incanum* (Daunay, 2008).

Although *Solanum torvum* is the most commonly used rootstock for eggplant and tomato and has been reported to be resistant to soil-borne diseases, there is a need to find other alternative rootstock due to a lack of rapid and homogeneous seed germination (King *et al.*, 2010). Grafting with tolerance rootstocks has proven to be an effective tool to overcome biotic and abiotic stresses and increase fruit yield and quality (Rivard *et al.*, 2010). Presently, *Solanum torvum*, *Solanum macrocarpon* and *Solanum incanum* have been proven as promising rootstocks effective for resistance to soil-borne diseases and tolerance to water and temperature stress and are frequently used for tomato grafting (Bletsos, 2003). Vegetable grafting has been known for a long time, but it has recently been used more often on Solanaceae and Cucurbitaceae crops throughout the world (Kubota *et al.*, 2008; Lee *et al.*, 2010; Bahadur and Kumar 2024). Several recent reviews have explored the positive impacts of vegetable grafting for improving resilience to biotic and abiotic stress, particularly its potential for tackling challenges concerning food security (Keatinge *et al.*, 2014; Rouphael *et al.*, 2018). DIBER, DRDO has been instrumental in evaluating the various Indigenous and exotic germplasm of tomatoes for various traits, resulting in some promising germplasm (Agarwal *et al.*, 2014; Agarwal *et al.*, 2015; Agarwal *et al.*, 2017; Agarwal *et al.*, 2018, Agarwal *et al.*, 2019, Bhatt *et al.*, 2024)

By using different rootstocks from the same species (homo grafting), as well as from different species (heterografting), such as eggplant (*Solanum melongena*), African eggplant (*Solanum macrocarpon* and *Solanum aethiopicum*), and wild species (*Solanum torvum* and *Solanum integrifolium*), researchers have been inspired by the Solanaceae family's wide genetic diversity to improve the performance of tomato plants (*Solanum lycopersicum*). To ensure a similar stem diameter at the time of grafting, seedlings of eggplant, African eggplant, and wild species are frequently sown a few days to a few weeks before sowing scions. Although seedling growth rates vary with temperature in nurseries where environmental factors are not adequately monitored, synchronization of seedlings is an important concern. Grafting eggplant rootstock onto commercial cultivars of tomato could increase their tolerance to biotic and abiotic stresses. However, there is limited information on the graft compatibility between eggplant rootstocks and tomato varieties cultivated in India. Therefore, the objective of this study was to evaluate the graft compatibility between tomato varieties and eggplant rootstocks and its wild relative species grown in India.

Materials and Methods

Experimental site

The experiment was conducted at the Defence Institute of Bio-Energy Research (DIBER), Defence Research & Development Organization (DRDO), Goraparao, Haldwani, Nainital, Uttarakhand, India, which is geographically situated between 29°21'N latitude and 79°51'E longitude at an elevation of 243 m above the mean sea level. The climate of this area is Sub-tropical humid during summer and mild dry during winter. The soil is sandy loam with a pH value of 6.7 to 7.5 with organic carbon (0.36%), Nitrogen (200 kg/ha), Phosphorus (25 kg/ha) and Potassium (140 kg/ha). The rainfall pattern in the study area was bimodal, with the short rains from November to February and the long rains from the last week of June to September. The average annual rainfall ranges between 300 mm to 350 mm.

Plant Materials and Growth Condition

Two-drought susceptible (EC 98 and DOrg) and one drought-tolerant (EC97) pure line of tomato as scion and six accessions of eggplant, including 03 drought tolerant (SM01, SM02, ST05) and 03 susceptible (SM03, SM04 SG06) were selected for this experiment. Detailed information about the accessions is given in Table 1. A grafting compatibility study was implemented by using a tomato as a scion (*Solanum lycopersicum* L.) grafted onto the eggplant rootstock (*Solanum melongena* L.) and its wild relatives. Defence Institute of Bio-Energy Research (DIBER), Defence Research & Development Organization (DRDO), Goraparao, Haldwani, Nainital, Uttarakhand, India during 2021-22 and 2022-23. The experimental design was laid out in a randomized complete block with 18 treatments and three replicates. Irrigation and nutrient management schedules were applied to provide a good growing condition. Weather data were recorded for daily (morning, afternoon and evening) maximum and minimum temperature and relative humidity during the experiment period.

Grafting Method and Sowing of Plant Material

The rootstock and scion seeds were sown in plastic trays with 50 cells at two different stages in order to have a synchronized stem diameter. The rootstock seedling was later transplanted into 15 polystyrene propagation trays. Scion seeds were sown one to two weeks later in order to synchronize the stem diameter. Scions at the 2 to 3 true leaves stage (25–30 days old) were grafted onto rootstock plants having 4 to 5 true leaves (40–45 days old) using the cleft grafting technique (Lee *et al.*, 2010). Grafted plants were placed in a closed healing chamber and were observed for temperature and relative humidity stability and misting of the grafting chamber was performed twice a day. The chamber was maintained with 80 to 95% relative humidity and 26 to 30°C temperature, and the light level was very

Table 1: A brief description about the accessions of tomato and brinjal and its source of collection

S. No.	Code	Original Code	Type of materials	Source of collection
Brinjal (Rootstocks)				
1.	SM01	Surya	Commercial variety	Kerala Agriculture University, Trissur, Kerala
2.	SM02	DIB-Sel-01	Commercial variety	DIBER, DRDO, Goraparao, Haldwani, Nainital Uttarakhand
3.	SM03	DIB-Sel-02	Commercial variety	DIBER, DRDO, Goraparao, Haldwani, Nainital Uttarakhand
4.	SM04	DIB-Sel-03	Commercial variety	DIBER, DRDO, Goraparao, Haldwani, Nainital Uttarakhand
5.	ST05	Solanum torvum	Wild relatives	DIBER, DRDO, Goraparao, Haldwani, Nainital Uttarakhand
6.	SG06	Solanum gilo	Wild relatives	DIBER, DRDO, Goraparao, Haldwani, Nainital Uttarakhand
Tomato (Scions)				
1.	EC97	EC-664597	Breeding line	Plant Gene Resource of Canada, Canada (maintained by DIBER)
2.	EC98	EC-664598	Breeding line	Plant Gene Resource of Canada, Canada (maintained by DIBER)
3.	DOrg	IC-0642490	Pure Line	DIBER, DRDO, Goraparao, Haldwani, Nainital Uttarakhand

low for 2 to 4 days. The lower the temperature and high relative humidity, the shorter the period required for the graft union healing. After seven days, the plants were removed from the chamber and placed in the greenhouse for hardening. About 20 days after grafting, the plant was ready and hardened, then transplanted to the field. The graft success was measured as the number of grafts that survived at 14 days after grafting and was recorded as 100 grafted seedlings

Graft Success

The number of grafts that survived at the end of a stay in each healing environment (dark, transparent healing chambers and nursery for hardening off) was recorded. Percentage grafting success was computed as shown below.

$$\text{Grafting success} = \frac{\text{number of successful graft} \times 100}{\text{Total number of grafts}}$$

Plant growth characteristics

Measurement of plant growth traits such as plant height, stem diameter, days to taken sprouting, number of sprouts per plant, number of leaves, root length, root fresh weight, root dry weight and success rate. The height of the plant was determined by cupping all the leaves each other, then measured from the crown to the highest end of the leaves by using a ruler. The number of leaves was calculated by counting the total leaves per plant from the appearance of the first leaf until the end of the research. The stem diameter was measured 5 cm above the ground level 30 days after grafting with the help of an electronic digital caliper. The root length of the plant was measured in terms of centimeters using a scale from collar to tip of the root in each plant. The root fresh weight was measured using an analytical balance and root dry weight was recorded by roots were dried at 65°C until a constant weight was reached and expressed in grams.

Data analysis

Data were analyzed using SPSS (statistical software ver. 24) and were performed with analysis of variance (two-way ANOVA). The Duncan Multiple Range Test was used to determine the mean separation between treatment groups (DMRT). Pearson's correlation analysis was used to define the results of the correlation analysis. Differences at $p \leq 0.05$ were determined significant.

Results and Discussion

Effect of Grafting Compatibility through Cleft Grafting on Growth and Development Characteristics of Graft Combinations

The results revealed that all the treatments were significantly different from other treatments and are presented in Table 2(a). The observation recorded on days taken for sprouting was statistically significant under all the treatments. Plant height varied from 20.18 cm in SM04x EC98 to 32.99 cm in SM01x DOrg. The highest plant height was recorded in SM01x DOrg (32.99 cm), followed by SG06 x DOrg (32.67 cm) and SM01 x EC98 (29.81 cm). whereas the lowest plant height was noticed 20.18 cm in SM04 x EC98 from the Table 2(a). Plant height, which is usually regarded as a measure of vigor, was also affected by grafting methods. Improved vigor due to rootstock grafting in SM01x DOrg, SG06 x DOrg, SM01 x EC98 and SM02 x EC98 was also evident in the values observed for plant height and number of branches, as a result of improved water uptake and greater capacity for assimilation, absorption and nutrient uptake (Musa *et al.*, 2020). The stem diameter varies from in graft combination SM01 x DOrg (0.45 cm) to treatment SG06 x EC97 (0.35 cm). The highest stem diameter is recorded in graft combination SM01 x DOrg (0.45 cm) followed by 0.42 cm in SM02 x EC98, 0.42 cm in SM01 x EC97 and SM02 x DOrg graft combination Table 2(a). In contrast, the lowest stem diameter was noticed

Table 2(a): Mean significant differences between plant height, stem diameter, days to take sprouts, number of sprouts per graft and number of leaves per plant under different treatments

S. No.	Treatment details	Plant height (cm)	Stem diameter (cm)	Days to taken sprouts (day)	No. of sprout/ graft	No. of leave/ graft
1.	SM01× EC97	23.41 ± 2.28 ^h	0.42 ± 0.05 ^{abc}	11.08 ± 0.87 ^{de}	4.45 ± 0.24 ^a	27.01 ± 2.67 ^a
2.	SM02× EC97	26.33 ± 2.71 ^{cdef}	0.42 ± 0.56 ^{bcde}	11.15 ± 1.00 ^{de}	4.31 ± 0.27 ^a	26.35 ± 2.79 ^{ab}
3.	SM03× EC97	21.06 ± 2.15 ⁱ	0.38 ± 0.41 ^{cdef}	11.52 ± 0.96 ^{cde}	3.96 ± 0.20 ^{ab}	20.11 ± 1.87 ^h
4.	SM04× EC97	23.25 ± 2.40 ^h	0.39 ± 0.47 ^{bcde}	13.05 ± 1.27 ^{abc}	3.81 ± 0.18 ^{abc}	23.71 ± 2.46 ^{cdef}
5.	ST05× EC97	26.55 ± 2.77 ^{cde}	0.36 ± 0.20 ^{ef}	13.32 ± 1.44 ^{ab}	3.36 ± 0.14 ^{bc}	24.15 ± 2.54 ^{bcde}
6.	SG06× EC97	24.67 ± 2.56 ^{efgh}	0.35 ± 0.16 ^f	14.10 ± 1.15 ^a	3.22 ± 0.24 ^f	22.32 ± 2.18 ^{efgh}
7.	SM01× EC98	29.81 ± 3.17 ^b	0.43 ± 0.25 ^{ab}	10.25 ± 0.93 ^e	4.25 ± 0.23 ^a	26.98 ± 2.92 ^{ab}
8.	SM02× EC98	27.59 ± 2.69 ^c	0.41 ± 0.45 ^{abcd}	11.08 ± 0.93 ^{cde}	3.94 ± 0.20 ^{ab}	26.12 ± 2.59 ^{abcd}
9.	SM03× EC98	23.81 ± 2.46 ^{gh}	0.37 ± 0.20 ^{def}	12.12 ± 1.13 ^{bcde}	2.45 ± 0.06 ^{ef}	23.16 ± 2.55 ^{bcde}
10.	SM04× EC98	20.18 ± 1.98 ⁱ	0.35 ± 0.19 ^{ef}	13.45 ± 1.37 ^{ab}	3.31 ± 0.12 ^{bcd}	21.22 ± 2.14 ^{fgh}
11.	ST05× EC98	26.84 ± 2.84 ^{cd}	0.41 ± 0.18 ^{abcd}	14.05 ± 1.37 ^a	3.09 ± 0.10 ^{cde}	25.41 ± 2.51 ^{abcd}
12.	SG06× EC98	25.47 ± 2.51 ^{defg}	0.38 ± 0.08 ^{cdef}	13.52 ± 1.32 ^{ab}	2.59 ± 0.04 ^{def}	22.05 ± 2.25 ^{efgh}
13.	SM01× DOrg	32.99 ± 3.43 ^a	0.45 ± 0.19 ^a	10.60 ± 0.87 ^e	3.92 ± 0.22 ^{ab}	27.12 ± 2.80 ^a
14.	SM02× DOrg	27.25 ± 2.84 ^{cd}	0.42 ± 0.05 ^{abc}	12.11 ± 1.15 ^{abcde}	3.36 ± 0.11 ^{bc}	26.57 ± 2.77 ^{abc}
15.	SM03× DOrg	23.05 ± 2.23 ^h	0.41 ± 0.14 ^{abcd}	13.15 ± 1.26 ^{abc}	2.53 ± 0.06 ^{ef}	22.13 ± 2.19 ^{efgh}
16.	SM04× DOrg	24.56 ± 2.45 ^{gh}	0.39 ± 0.08 ^{bcde}	12.61 ± 1.20 ^{abcd}	2.59 ± 0.05 ^{def}	20.96 ± 1.85 ^h
17.	ST05× DOrg	26.31 ± 2.69 ^{cdef}	0.42 ± 0.18 ^{abc}	11.51 ± 1.09 ^{bcde}	3.87 ± 0.18 ^{ab}	23.59 ± 2.29 ^{defg}
18.	SG06× DOrg	32.67 ± 3.46 ^a	0.35 ± 0.90 ^{ef}	13.33 ± 1.20 ^{ab}	3.32 ± 0.15 ^{bc}	21.05 ± 1.96 ^{gh}

The data presented are means ± standard error of three replicates (N=3). A two-way ANOVA analysis was carried out to assess the effect of compatibility of cleft grafting on growth and development traits of different graft combinations. Means with the same letter in same column are not significantly different at $p \leq 0.05$ with the DMRT test.

0.35 cm, in the SG06 x EC97 graft combination. The stem thickness prevents lodging and provides a good plant structure, which can be able to increase the number of primary branches, leaf area and growth of scion which is due to important changes in water and nutrient flow uptake. These findings occur with Khah (2011) who reported the same trend in both polyhouse and open-field eggplant/tomato graft combinations.

Results presented for days to take sprouts of grafted plants ranged from 10.25 to 14.10 days after grafting (Table 2 a). The minimum duration (10.25 days) was obtained in SM01 x EC98, followed by SM01 x DOrg (10.60 days). The highest days taken for sprouting (14.10 days) were observed in SG06 x EC97. The eggplant rootstock provides resistance against soil-borne pathogens and is also being used to provide water stress tolerance and greater nutrient and water uptake. A similar finding was reported by Fernandez *et al.* (2004) in eggplant. The results indicated that the number of sprouts per grafted plant was significantly different from each other except for the graft combinations SM01 x EC97, SM02 x EC97 and SM01 x EC98 were found non-significant. The number of sprouts per grafted plant varied from 2.45 to 4.45 in number. The highest number of sprouts per grafted plant was recorded (4.45) in SM01 x EC97 followed

by 4.31 in SM02 x EC97 and 4.25 in SM01 x EC98. The lowest number of sprouts was found in graft combination SM03 x EC98 (2.45) followed by treatments SM03 x DOrg, SG06 x EC98, SM04 x DOrg and ST05 x EC98 are 2.53, 2.59, 2.59 and 3.05 respectively in different graft combinations (Table 2 a). Cleft grafting techniques significantly influence the number of leaves. The number of leaves varied from 20.11 (SM03 x EC97) to 27.12 (SM01 x DOrg) (Table 2a). The highest number of leaves (27.12) was recorded in the graft combination SM01 x DOrg, followed by SM01 x EC97 (27.01). The rootstock and scion influence more efficient to uptake minerals, water and throughout the plant system. The findings are in accordance with those reported by Davis *et al.* (2008).

Effect of compatibility of Cleft Grafting on roots characteristics and success rate of different graft combinations

The data on root length was statistically significant from other treatments and root characters are presented in Table 2(b). The root length varied from 23.22 (ST05 x DOrg) to 14.25 cm (SM04x DOrg). The longest root was recorded in ST05 x DOrg (23.22 cm), followed by SM01 x EC97 (22.85 cm). Whereas, the lowest root length was noticed in SM04 x DOrg (14.25 cm). The higher percentage of rooting increases

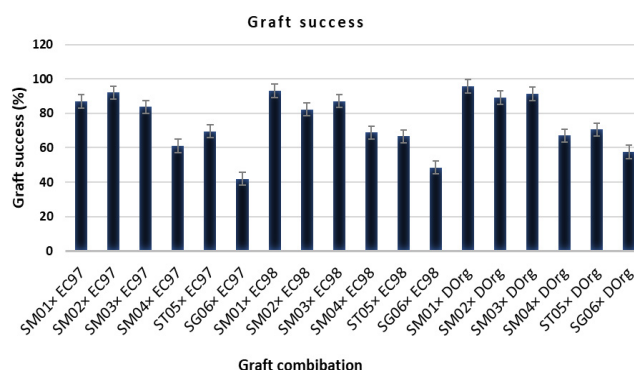
Table 2(b): Mean significant differences between root length, root fresh weight, root dry weight and success rate under different treatments

S. No.	Treatment details	Root length (cm)	Root fresh wt. (g)	Root dry wt. (g)	Success rate (%)
1.	SM01× EC97	22.85 ± 2.46 ^a	15.53 ± 1.57 ^{cde}	12.23 ± 1.14 ^{abcd}	87.02 ± 0.03 ^d
2.	SM02× EC97	17.86 ± 1.93 ^{def}	16.32 ± 1.87 ^{abcd}	13.33 ± 1.28 ^a	92.10 ± 0.08 ^b
3.	SM03× EC97	17.97 ± 1.85 ^{cdef}	17.01 ± 1.74 ^{abcd}	9.94 ± 0.86 ^{efg}	83.72 ± 1.42 ^e
4.	SM04× EC97	16.34 ± 1.69 ^{fg}	15.32 ± 1.48 ^{de}	9.98 ± 0.76 ^{efg}	61.02 ± 0.35 ^j
5.	ST05× EC97	22.05 ± 2.28 ^{ab}	18.39 ± 1.91 ^a	13.19 ± 1.18 ^{ab}	69.53 ± 0.20 ^{fg}
6.	SG06× EC97	19.72 ± 1.98 ^{bcde}	16.67 ± 1.57 ^{abcd}	9.87 ± 0.82 ^{efg}	41.87 ± 0.02 ^m
7.	SM01× EC98	20.32 ± 2.10 ^{abcd}	17.65 ± 1.81 ^{abc}	11.40 ± 1.08 ^{abcde}	93.01 ± 0.03 ^b
8.	SM02× EC98	21.33 ± 2.09 ^{ab}	18.05 ± 1.67 ^{ab}	10.58 ± 0.86 ^{cdef}	82.33 ± 0.26 ^e
9.	SM03× EC98	19.63 ± 2.07 ^{bcde}	17.41 ± 1.60 ^{abcd}	10.34 ± 0.95 ^{defg}	87.06 ± 0.01 ^d
10.	SM04× EC98	16.93 ± 1.72 ^{efg}	15.02 ± 1.50 ^{de}	9.99 ± 0.85 ^{efg}	68.74 ± 0.59 ^{gh}
11.	ST05× EC98	20.87 ± 2.20 ^{abc}	17.89 ± 1.68 ^{abc}	11.15 ± 1.02 ^{bcde}	66.58 ± 0.20 ^j
12.	SG06× EC98	17.33 ± 1.60 ^{ef}	15.52 ± 1.40 ^{cde}	8.99 ± 0.69 ^{fgh}	48.56 ± 0.77 ^l
13.	SM01× DOrg	21.59 ± 2.20 ^{ab}	16.23 ± 1.58 ^{abcd}	10.51 ± 0.86 ^{def}	95.71 ± 0.20 ^a
14.	SM02× DOrg	18.32 ± 1.90 ^{cdef}	15.01 ± 1.35 ^{de}	10.59 ± 1.04 ^{cdef}	89.11 ± 0.18 ^c
15.	SM03× DOrg	16.28 ± 1.42 ^{fg}	13.52 ± 1.37 ^e	8.31 ± 0.65 ^{gh}	91.25 ± 0.59 ^b
16.	SM04× DOrg	14.25 ± 1.47 ^g	15.12 ± 1.51 ^{de}	6.99 ± 0.48 ^h	67.01 ± 0.63 ^{hi}
17.	ST05× DOrg	23.22 ± 2.51 ^a	17.05 ± 1.73 ^{abcd}	12.69 ± 1.06 ^{abc}	70.54 ± 0.37 ^f
18.	SG06× DOrg	17.25 ± 1.56 ^{ef}	15.87 ± 1.42 ^{bcde}	9.52 ± 0.87 ^{efg}	57.47 ± 0.01 ^k

The data presented are means ± standard error of three replicates (N=3). A two-way ANOVA analysis was carried out to assess the effect of compatibility of cleft grafting on root characters and success rate of different graft combinations. Means with the same letter in same column are not significantly different at $p \leq 0.05$ with the DMRT test.

in length of roots in the grafted plants as a result of uptake of water and nutrients, as reported by Fernandez *et al.* (2004). The root fresh weight was found to be significantly different due to treatments, and it also varied from 18.39 g (ST05 x EC97) to 13.52 g (SM03 x DOrg). The highest fresh root weight was recorded in graft combination ST05 x EC97 (18.39 g), followed by SM02 x EC98 (18.05 g) and SM01 x EC98 (17.65 g).

Grafting influences the absorption and translocation of water and nutrients. Similar findings were found Petran and Hoover (2014) in eggplant wild relatives *Solanum torvum*, when used as a rootstock for tomatoes, that improved nutrient uptake in grafted seedlings and increased photosynthesis, which increased plant growth. Root dry weight also differed significantly for all the treatments. The root dry weight varied from 13.20g (SM02 x EC97) to 6.99 g (SM04 x DOrg). The maximum root dry weight was observed in SM02 x EC97 (13.20 g), followed by ST05 x DOrg (12.67 g) and SM01 x EC97 (12.23 g). The higher dry weight might be attributed to higher root length, which is accompanied by higher uptake of minerals and nutrients by rootstocks reported by Huang *et al.* (2015). The grafting success percentage was influenced significantly by grafting treatment. The success percentage varied from 95.76 to 43.56%. The highest success percentage (95.76%)

**Fig. 1:** Graft success (%) with cleft grafting techniques

was recorded in the treatment SM01 x DOrg, followed by SM01 x EC98 (93.03%) and SM03 x DOrg (91.66%), which was significantly higher than the rest of the treatments. The minimum success percentage was recorded as SG06 x EC97 (41.87%) in Table 2(b) and Fig. 1. The success of grafting is determined by graft combination, rootstock and scion compatibility, temperature, humidity and light (Gisbert *et al.*, 2011; Kawaguchi *et al.*, 2008). The results showed that the cleft grafting technique was highly successful, with more than 90% in the graft combinations SM01 x DOrg, SM01

x EC98, SM02x EC97 and SM03x DOrg. The results are in accordance with Musa *et al.* (2020), who reported significant graft success in MCV1, MCV2 and TCV scions grafted on wild eggplants using the cleft graft technique.

Conclusion

Based on the above findings, it may be concluded that the one tomato commercial variety and two breeding lines (EC97 and EC98) were grafted onto six eggplant rootstocks (SM01, SM02, SM03, SM04) and two wild relatives (ST05, SG06) were used for these experiments. In this research, among all the treatments, the six graft combinations, namely SM01x EC98, ST05x EC98, SM03x EC98, ST05x DOrg, SM01x EC97, ST05x EC97 and SM03x EC97 having more than 70% graft success rate. However, the method of cleft grafting is most suitable for the grafting solanaceous vegetable crops particularly tomato and eggplant and its wild relatives. The effect of rootstock-scion interactions pertaining to growth, attachment of graft union, and other morphological characters for graft compatibility are poorly understood. Further studies are required to understand the graft compatibility and rootstock scion interactions would aid more effective selection and use of rootstocks in the future.

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सारांश

सब्जियों में खासकर टमाटर में ग्राफ्टिंग जैविक और अजैविक तनावों को दूर करने के साथ-साथ पौधों के विकास और फल की गुणवत्ता में सुधार करने में कारगर साबित हुई है। हालाँकि, भारत में बैंगन रूटस्टॉक्स और टमाटर की किस्मों के बीच ग्राफ्ट संगतता का कम ही पता लगाया गया है। कुल 18 ग्राफ्टिंग संयोजन टमाटर की तीन अलग-अलग (दो प्रजनन लाइनों सहित) किस्मों को एक कलम के रूप में और बैंगन की दो जंगली प्रजातियों सहित किस्मों का उपयोग करके विकसित किए गए थे। प्रस्तुत अनुसंधान में 18 उपचार और 3 प्रतिकृति के साथ यादृच्छिक ब्लॉक डिजाइन (आरबीडी) प्रयोग किया गया और आँकड़ों का सांख्यिकीय रूप से विश्लेषण किया गया था। परिणामों से पता चला कि पौधे क्लेफ्ट ग्राफ्टिंग विधि के माध्यम से ग्राफ्टिंग के अनुकूल हैं, अर्थात् ग्राफ्ट संयोजन एस एम-01 x डी ऑर्ग के लिए, ग्राफ्ट सफलता दर (95.71%), अंकुरण में लगने वाले दिन (10.60 दिन), पत्तियों की संख्या (27.12), पौधे की ऊँचाई (32.99 सेमी), तने का व्यास (0.45 सेमी), जड़ की लंबाई (21.59 सेमी), जड़ का ताजा वजन (16.23 ग्राम) और जड़ का सूखा वजन (10.51 ग्राम) रहा। जड़ों के लिए सबसे अधिक ताजा वजन ग्राफ्ट संयोजन एस टी-05 x ई सी-97 (18.39 ग्राम) में दर्ज किया गया था उसके बाद एस एम -01 x ई सी -98 और एस टी-05 x डी ऑर्ग में (क्रमशः 17.65 और 17.05 ग्राम) दर्ज किया गया है, लेकिन जड़ों के लिए सूखे वजन को ग्राफ्ट संयोजनों एस टी-05 x डी ऑर्ग में अधिकतम देखा गया, जिसके बाद एस टी-05 x ई सी-98 और एस एम-01 x ई सी-97 क्रमशः 13.20, 12.59 और 12.23 ग्राम हैं। बेहतर ग्राफ्ट संगतता और पौधे की वृद्धि के लिए टमाटर की किस्मों के उपयुक्त चयन और उनके लिए लिए सबसे अच्छे रूटस्टॉक्स के चयन के अध्ययन की आवश्यकता है।