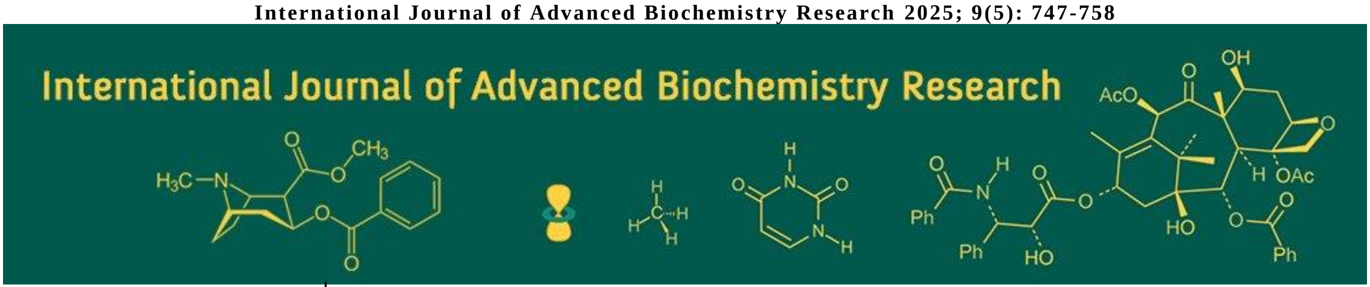


ISSN Print: 2617-4693
ISSN Online: 2617-4707
NAAS Rating: 5.29
IJABR 2025; 9(5): 747-758
www.biochemjournal.com
Received: 20-03-2025
Accepted: 26-04-2025

B Anuradha
Ph.D. Scholar, Department of Vegetable Science, College of Horticulture, SKLTGHU, Rajendranagar, Hyderabad, Telangana, India

A Kiran Kumar
Principal Scientist (Horti.) & Head, Horticultural Research Station, SKLTGHU, Nalgonda, Telangana, India

D Laxmi Narayana
Director of Research, SKLTGHU, Mulugu, Siddipet, Telangana, India

K Venkata Laxmi
Associate Dean, College of Horticulture, Malyal, Mahabubabad, Telangana, India

CH Raja Goud
Senior Scientist, Horticultural Research Station, SKLTGHU, Nalgonda, Telangana, India

R Purnima Mishra
Associate Professor, College of Horticulture, SKLTGHU, Mojerla, Wanaparthy, Telangana, India

Corresponding Author:
B Anuradha
Ph.D. Scholar, Department of Vegetable Science, College of Horticulture, SKLTGHU, Rajendranagar, Hyderabad, Telangana, India

Effect of identified root stocks on yield and quality of grafted tomato under Telangana conditions

B Anuradha, A Kiran Kumar, D Laxmi Narayana, K Venkata Laxmi, CH Raja Goud and R Purnima Mishra

DOI: https://www.doi.org/10.33545/26174693.2025.v9.i5i.4419

Abstract
The study was conducted at SKLTGHU, College of Horticulture, Rajendranagar, Hyderabad focused on three graft combinations, namely, T_1-Arka Vikas on *Solanum torvum*, T_2-Arka Vikas on Surya, and T_3-Arka Vikas on Arka Keshav, along with T_4-Arka Vikas seedling (scion ungrafted) to evaluate their impact on yield and quality under Telangana conditions. This was evaluated in a Randomized Block Design with five replications during *Rabi,* 2022. Among graft combinations, Arka Vikas grafted onto *Solanum torvum* provided the best results in terms of growth and yield (2.27 kg/plant), followed by Arka Vikas on Surya (2.04 kg/plant). High lycopene content (7.98 mg) and high ascorbic acid content (24.49 mg) were recorded in Arka Vikas on Arka Keshav. High TSS (4.73 ºBrix) and high beta-carotene content (2.42 mg) were recorded in the graft combination Arka Vikas on Surya, which can be used for processing.

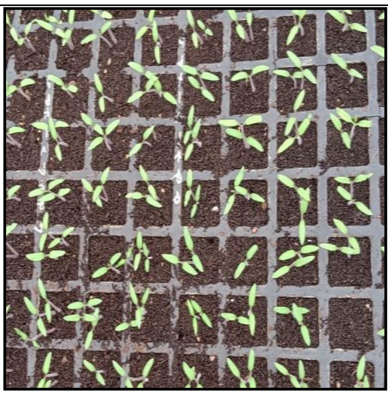
Keywords: Grafting, tomato, root stocks, yield, quality

Introduction
The tomato (*Solanum lycopersicum* L.), a member of the Solanaceae family and a native of Peru and Ecuador, is one of the most frequently grown commercial and culinary crops in the world due to its many uses as a vegetable. The fruit is a necessary component of daily nutrition, and whether eaten raw, cooked, or processed, it has a high nutritional value due to the presence of important nutrients such as carbohydrates, mineral salts, vitamins, and organic acids. Grafting is a simple propagation method in which preferred rootstocks are used to improve vigour, precocity, yield, quality, and survival under abiotic and biotic stress conditions (Pandey and Rai, 2003) [73]. Due to the utilization of vigorous root systems of the rootstocks, grafted plants usually show increased uptake of water and minerals compared to self-rooted plants. There are several other advantages of grafting, such as low and high temperature tolerance, salt tolerance, extended harvest period, earliness, and an increase of yield (Lee & Oda, 2003) [55]. Tomato is a major vegetable where grafting is important worldwide, although grafting is also often used in the case of watermelon, cucumber, melon, eggplant, and capsicum pepper (Lee, 2003) [54].
Tomato contains about 93-96% water. The total soluble solids range from 4% to 9% (Adams, 1986) [3]. The content of total soluble solids is inversely related to fruit yield (Stevens & Rudich, 1978) [103]. Sugars, mainly glucose and fructose, account for about half of the dry matter or 65% of the soluble solids of a ripe tomato fruit. Oda and co-workers (1996) [72] examined the effect of scarlet eggplant rootstock on the growth, yield, and sugar content of grafted tomato. Fruit yield on scarlet eggplant rootstock was lower than that on tomato rootstocks. Soluble solids and sugar contents in fruit were all higher in plants grafted on scarlet eggplant than those on tomato rootstocks. Chung and co-workers (1997) [18] examined the differences in marketable yield and fruit components between grafted and non-grafted tomato plants. Grafting increased the number of marketable fruits, although soluble solids, ascorbic acid, and total soluble sugar content were higher in ungrafted plants than in grafted ones.
Romano and Paratore (2001) [90] studied the consequences of grafting on fruit production and characteristics of tomato on three different rootstocks (one of them was the Beaufort that we also investigated).

The use of Beaufort enhanced the growth and production, but resulted in a minimum Brix°. In their trial Brix° of ungrafted fruits was the highest. Grafting provides a quicker way to improve crop tolerance to different stresses than traditional breeding methods, which may increase vegetable production in difficult situations. To optimise rootstock-scion combinations for particular crop requirements and growing environments, more research is necessary. According to Soe *et al.* (2018) [101], the greatest technique to use in organic farming is grafting. Further, the growth and eventual output of the plants are greatly impacted by the rootstock and scion combination (Voutsela *et al.*, 2012) [108]. Because the choice of rootstock may affect the chosen scion's fruit form, it is important to choose the right scion and rootstock. In this study, we investigated the effect of identified rootstocks on the yield and quality of grafted tomatoes under Telangana conditions.

Materials and Methods

The experimental material comprised of 3 root stocks of brinjal of which 1 is wild species (*Solanum torvum*) and the other 2 are cultivated varieties (Arka Keshav, Surya) and 1 Scion of tomato variety (Arka Vikas) which were obtained from COE, Jeedimetla, Hyderabad; IIHR, Bengaluru; KAU, Thrissur. The field experiment was laid out in a Randomized Block Design with 4 treatments, which were replicated five times. The treatments in each block were allotted randomly, and each germplasm line was grown in a plot of 1.8 × 3.15 m^2 (5.67 square meters) accommodating 21 plants per plot, 7 plants per row with a spacing of 60×45 cm^2 per replication. The data gathered in this study were analyzed using the appropriate procedure for the Randomized Block Design as explained by Panse and Sukhatme (1985) [74]. The critical difference at the 5 percent level of probability was used for comparing treatments.



1. Seed germination

2. Seedlings ready for grafting

3. Measuring rootstock and scion girth

4. Vertical slit is made to the rootstock by cutting it horizontally

5. A V-shape or wedge shape is given to the scion

6. Scion inserted into rootstock with the help of grafting paper

7. Grafted seedling

8. Hardened grafts ready for transplanting

Fig 1: Procedure for Vegetable Grafting

Results and Discussion
Rootstock and Scion parameters
Days taken for germination of rootstock and scion seeds
The data on number of days taken for germination showed significant differences among rootstock, scion and check variety (Table.1) (Fig. 1). The minimum number of days taken for seed germination was recorded in *Solanum torvum* (4.2 days) while Arka Keshav recorded maximum number of days taken for seed germination (5.2 days) which was on par with Surya (4.8 days). These findings were in agreement with the results of Johnson (1985) [35], Morejon (2013) [63].

Days taken to reach grafting stage
The results on days taken to reach grafting stage showed significant differences among the rootstock and scion (Table 2). The maximum number of days was recorded in Arka Keshav (50.60 days) while *Solanum torvum* (45.60 days) recorded minimum days to reach grafting stage which was on par with Surya (47.60 days). These findings were in agreement with the results of Oda *et al.* (2005) [71], Gisbert *et al.* (2011b) [26], Barrett *et al.* (2012) [11] and Johnson *et al.* (2011) [37], Bahadur *et al.* (2015) [10], Ramesh *et al.* (2016) [83], Kiran *et al.* (2018) [41].

Seedling girth at the stage of grafting
The results on seedling girth at the grafting stage showed significant differences among the rootstock and scion (Table 2). The maximum seedling girth at the grafting stage was observed in Surya (3.48 mm) which was on par with *Solanum toryum* (3.46 mm) and Arka Keshav (3.34 mm). Arka Vikas recorded minimum seedling girth at the grafting stage (3.22 mm). These findings were in agreement with the results of Bumgarner and Kleinhenz (2014) [17] and Rivard and Louws (2008) [89]], Nirmal (2017) [67] and Surve (2019) [105].

Observation of grafted plants
Per cent graft success
The data recorded on percent graft success at 7, 15 days after grafting (DAG) and 15 days after transplanting (DAT) showed significant differences among the different graft combinations (Table 3). At 7 days after grafting, graft combination T_1-Arka Vikas on *Solanum torvum* recorded maximum percent graft success (99.40%) which was on par with T_2-Arka Vikas on Surya (98.40%) and T_3-Arka Vikas on Arka Keshav (98.20%). At 15 days after grafting, maximum percent graft success was observed in graft combination T_1-Arka Vikas on *Solanum torvum* (98.60%) which was on par with T_2-Arka Vikas on Surya (97.20%) and T_3-Arka Vikas on Arka Keshav (96.63%). On the day of transplanting, concerning percent graft success, no difference was observed. At 15 days after transplanting, graft combination T_1-Arka Vikas on *Solanum torvum* (98.20%) recorded maximum percent graft success which was on par with T_2-Arka Vikas on Surya (96.65%) and T_3-Arka Vikas on Arka Keshav (95.45%).

Similar results were reported by Rajendra *et al.* (1975) [82], Ibrahim *et al.* (2001) [33], Rahman *et al.* (2002a) [80], Rashid *et al.* (2004) [86], Davis *et al.* (2008) [22], Gisbert *et al.* (2011) [25], Dhivya *et al.* (2014) [24], Petran and Hoover (2014) [76], Kumar *et al.* (2017b) [46], Rathod (2017) [87], Priyanka *et al.* (2019) [78] and Bharathi *et al.* (2021) [13].

Observation on growth parameters
Plant height
The data recorded for plant height showed significant differences among the different graft combinations (Table 4) (Fig.5). The maximum plant height (cm) was observed in T_1-Arka Vikas on *Solanum torvum* (92.36 cm) followed by T_2-Arka Vikas on Surya and T_3-Arka Vikas on Arka Keshav recorded (68.56 cm) which was on par with T_4-Arka Vikas (63.56 cm). These findings were in agreement with the results of Lee (1994) [53], Ioannou (2001) [34], Bletsos *et al.* (2003) [14], Khah (2005) [40], Khah *et al.* (2006) [39], Colla *et al.* (2008) [20], Mohammed *et al.* (2009) [61], Sherly (2011) [98], Yarshi (2011) [111], Nkansanh *et al.* (2013) [69], Johnson *et al.* (2014) [36], Sabatino *et al.* (2016) [91], Kumar *et al.* (2016a) [48], Kumar *et al.* (2016b) [50], Kumar *et al.* (2017a) [44], Kumar *et al.* (2017b) [46], Rathod (2017) [87], Abd El-Wasim mona *et al.* (2018) [1], Latifah *et al.* (2018) [52], Soe *et al.* (2018) [101], Hossain *et al.* (2019) [30], Priyanka *et al.* (2019) [78], Surve (2019) [105], Rinku *et al.* (2020) [88] and Bharathi *et al.*, (2021) [13].

Number of primary branches per plant
The data with respect to the number of primary branches per plant showed significant differences among the different graft combinations (Table 4). The maximum number of primary branches per plant was observed in T_1-Arka Vikas on *Solanum torvum* (8.88) followed by T_4-Arka Vikas (7.44) which was on par with T_2-Arka Vikas on Surya (7.28). While T_3-Arka Vikas on Arka Keshav (6.96) recorded minimum number of primary branches per plant. Similar results were reported by Salehi-Mohammadi *et al.* (2009) [94], Sherly (2011) [98], Davis *et al.* (2006) [23]

Days to first flowering
The data with respect to days to first flowering showed significant differences among different graft combinations (Table 5). T_2-Arka Vikas on Surya took minimum days (25.60 days) to first flowering which was on par with T_3-Arka Vikas on Arka Keshav (27.60 days) and T_1-Arka Vikas on *Solanum torvum* (28.84 days). While, the maximum number of days (29.16 days) to first flowering was recorded in T_4-Arka Vikas. Similar results were reported by Bharathi *et al.* (2021) [13], Kumar *et al.* (2016) [49].

Days to 50% flowering
The data pertaining to days to 50% flowering showed significant differences among different graft combinations (Table 5). T_2-Arka Vikas on Surya took minimum number of days (28.80 days) to 50% flowering which is on par with T_3-Arka Vikas on Arka Keshav (29.60 days) and T_1-Arka Vikas on *Solanum torvum* (32.80 days). While the maximum number of days (38.40 days) to 50% flowering was recorded in T_4-Arka Vikas. Similar results were reported by Nkansanh *et al.* (2013) [69], Rathod (2017) [87].

Days to fruit set
The data pertaining to days to fruit set was showed significant differences among different graft combinations (Table 5). T_2-Arka Vikas on Surya took minimum number of days (36.24 days) to fruit set which is on par with T_3-Arka Vikas on Arka Keshav (42.04 days) and T_1-Arka Vikas on *Solanum torvum* (42.44 days). While the maximum number of days (43.24 days) to fruit set was

recorded in T_4-Arka Vikas. Similar results were reported by Bharathi *et al.* (2021) [13].

Number of flowers per cluster

The data pertaining to number of flowers per cluster showed significant differences among different graft combinations (Table 5). T_1-Arka Vikas on *Solanum torvum* and T_4-Arka Vikas recorded maximum number of flowers per cluster (4.76) which was on par with T_2-Arka Vikas on Surya (4.52). While the minimum number of flowers per cluster (4.04) was recorded in T_3-Arka Vikas on Arka Keshav. Similar results were reported by Ramireddy *et al.* (2011) [84] and Nirmala *et al.* (2013) [68].

Days to first fruit harvest

The data pertaining to days to first fruit harvest showed significant differences among different graft combinations (Table 6). T_1-Arka Vikas on *Solanum torvum* took minimum number of days (68.29 days) to first fruit harvest which is on par with T_2-Arka Vikas on Surya (70.53 days) and T_4-Arka Vikas (73.73 days) while the maximum number of days (77.47 days) to first fruit harvest was recorded in graft combination T_3-Arka Vikas on Arka Keshav. Similar results were reported by Nkansanh *et al.* (2013) [69], Ibrahim *et al.* (2014) [32], Assinapol *et al.* (2017) [9], Soe *et al.* (2018) [101].

Days to last fruit harvest

The data pertaining to days to last fruit harvest showed significant differences among different graft combinations (Table 6). The maximum number of days to last fruit harvest (159.72) was recorded in T_1-Arka Vikas on *Solanum torvum*, which is on par with T_2-Arka Vikas on Surya (150.48 days) and T_3-Arka Vikas on Arka Keshav (146.80 days). While the minimum number of days to last fruit harvest (137.33) was recorded in T_4-Arka Vikas. Similar results were reported by Lugasi *et al.* (2005) [57].

Yield parameters

The data recorded with respect to number of fruits per plant, number of fruits per cluster, average fruit weight (g), fruit yield per plant (kg) and fruit yield per hectare (t) showed significant differences among the different graft combinations (Table 7) (Fig. 2 & 3).

Number of fruits per plant

The lowest number of fruits per plant (22.12) was recorded in T_4-Arka Vikas and the highest number of fruits per plant (34.80) was recorded in T_1-Arka Vikas on *Solanum torvum* which was on par with T_2-Arka Vikas on Surya (32.40) and T_3-Arka Vikas on Arka Keshav (30.92). These findings were in agreement with the results of Bletsos *et al.* (2003) [14], Yetisir and Sari (2003) [112], Nina and Joze (2004) [66], Khah (2005) [40], Colla *et al.* (2006) [19], Davis *et al.* (2006) [23], Leonardi and Giuffrida (2006) [56], Alexios *et al.* (2007) [7], Abdelmageed and Gruda (2009) [2], Gisbert *et al.* (2011) [25], Sherly (2011) [98], Turhan *et al.* (2011) [107], Hamed *et al.* (2012) [29], Mohamed *et al.* (2012) [60], Nkansanh *et al.* (2013) [69], Ibrahim (2014) [32], Petropoulos *et al.* (2014) [77], Rahmatian *et al.* (2014) [81], Kumar *et al.* (2016a) [48], Kumar *et al.* (2016b) [50], Sabatino *et al.* (2016) [91], Hoza *et al.* (2017) [31], Kumar *et al.* (2017b) [46], Rathod (2017) [87], Soe *et al.* (2018) [101], Kumar *et al.* (2019) [51], Sharma *et al.* (2019) [97], Rinku *et al.* (2020) [88] and Bharathi *et al.* (2021) [13].

Number of fruits per cluster

The lowest number of fruits per cluster (2.24) was recorded in T_2-Arka Vikas on Surya and the highest number of fruits per cluster (2.72) was recorded in T_1-Arka Vikas on *Solanum torvum* which was on par with T_3-Arka Vikas on Arka Keshav (2.56) and T_4-Arka Vikas (2.52). These findings were in agreement with the results of Mohammed *et al.* (2009) [61], Yarshi (2011) [111].

Average fruit weight (g)

The maximum average fruit weight (65.33 g) was recorded in T_1-Arka Vikas on *Solanum torvum* which was on par with T_2-Arka Vikas on Surya (63.00 g) and T_3-Arka Vikas on Arka Keshav (57.60 g) while the minimum average fruit weight (40.91 g) was recorded in T_4-Arka Vikas. These findings were in agreement with the results of Bletsos *et al.* (2003) [14], Khah *et al.* (2006) [39], Abdelmageed and Gruda (2009) [2], Sebahattin *et al.* (2009) [95], Turhan *et al.* (2011) [107], Yarshi (2011) [111], Mohamed *et al.* (2012) [60], Voutsela *et al.* (2012) [108], Alessandra *et al.* (2013) [6], Nkansanh *et al.* (2013) [69], Ahmed (2014) [4], Ibrahim *et al.* (2014) [32], Johnson *et al.* (2014) [36], Rahmatian *et al.* (2014) [81], Kumar *et al.* (2016a) [48], Kumar *et al.* (2016b) [50], Hoza *et al.* (2017) [31], Kumar *et al.* (2017b) [46], Rathod (2017) [87], Soe *et al.* (2018) [101], Hossain *et al.* (2019) [30], Sharma *et al.* (2019) [97], Singh *et al.* (2019) [100] and Bharathi *et al.* (2021) [13].

Fruit yield per plant (kg)

Maximum fruit yield per plant (2.27 kg) was recorded in T_1-Arka Vikas on *Solanum torvum* which was on par with T_2-Arka Vikas on Surya (2.04 kg) where as minimum fruit yield per plant (0.90 kg) was recorded in T_4-Arka Vikas.These findings were in agreement with the results of Matsuzoe *et al.* (1990) [58], Alam *et al.* (1995) [5], Granges *et al.* (1998) [27], Ibrahim *et al.* (2001) [33], Besri (2003) [12], Bletsos *et al.* (2003) [14], Khah, (2005) [40], Passam *et al.* (2005) [75], Khah *et al.* (2006) [39], Leonardi and Giuffrida (2006) [56], Wang *et al.* (2007) [110], Gisbert *et al.* (2011b) [26], Turhan *et al.* (2011) [107], Yarshi, (2011) [111], Mohamed *et al.* (2012) [60], Theodore, *et al.* (2012) [106], Voutsela *et al.* (2012) [108], Moncanda *et al.* (2013) [62], Ibrahim *et al.* (2014) [32], Johnson *et al.* (2014) [36], Rahmatian *et al.* (2014) [81], Bogoescu and Doltu (2015) [16], Kumar *et al.* (2016a) [48], Sabatino *et al.* (2016) [91], Hoza *et al.* (2017) [31], Kumar *et al.* (2017b) [46], Rathod (2017) [87], Abd El-Wasim mona *et al.* (2018) [1], Quamruzzaman *et al.* (2018) [79], Shipepe and Msogoya (2018) [99], Soe *et al.* (2018) [101], Semiz and Suarez (2019) [96], Sharma *et al.* (2019) [97] and Bharathi *et al.* (2021) [13].

Fruit yield per hectare (t)

T_4-Arka Vikas recorded the minimum fruit yield per hectare (33.48 t) and maximum fruit yield per hectare (84.18 t) was recorded in T_1-Arka Vikas on *Solanum torvum* which was on par with T_2-Arka Vikas on Surya (75.60 t). These findings were in agreement with the results of Rashid *et al.* (2004) [86], Nkansanh *et al.* (2013) [69], Kumar *et al.* (2016b) [50], Hossain *et al.* (2019) [30], Kumar *et al.* (2019) [51] and Sabatino *et al.* (2020) [92].

Fruit quality traits

Fruit quality traits like fruit length (cm), fruit width (cm), pericarp thickness (mm), number of locules per fruit, TSS (ºBrix), Ascorbic acid content (mg/100 g), lycopene content (mg/100 g) and beta-carotene content (mg/100 g) showed significant differences among the different graft combinations.

Fruit length (cm)

T_1-Arka Vikas on *Solanum torvum* recorded the maximum fruit length (4.39 cm), which was on par with T_3-Arka Vikas on Arka Keshav (4.30 cm), while T_2-Arka Vikas on Surya and T_4-Arka Vikas recorded the minimum fruit length (4.13 cm) (Table 8). These findings were in agreement with the results of Johnson *et al.* (2014) [36], Kumar *et al.* (2016b) [50], Kumar *et al.* (2016a) [48], Rathod (2017) [87], Kumar *et al.* (2017b) [46], Hossain *et al.* (2019) [30], Singh *et al.* (2019) [100], and Sabatino *et al.* (2020) [92].

Fruit width (cm)

The maximum fruit width (5.51 cm) was recorded in graft combination T_1-Arka Vikas on *Solanum torvum* which was on par with T_4-Arka Vikas(5.36cm) and T_3-Arka Vikas on Arka Keshav (5.01 cm). Minimum fruit width (4.96 cm) was recorded in graft combination T_2-Arka Vikas on Surya (Table 8). These findings were in agreement with the results of Johnson *et al.* (2014) [36], Kumar *et al.* (2016a) [48], Kumar *et al.* (2017b) [46], Rathod (2017) [87], Soe *et al.* (2018) [101], Hossain *et al.* (2019) [30], Kumar *et al.* (2019) [51] and Singh *et al.* (2019) [100].

Pericarp thickness (mm)

The minimum pericarp thickness (4.53) was recorded in T_2-Arka Vikas on Surya and the maximum pericarp thickness (4.71) was recorded in T_1-Arka Vikas on *Solanum torvum* which was on par with T_4-Arka Vikas (4.65) and T_3-Arka Vikas on Arka Keshav (4.55) (Table 9). These findings were in agreement with the results of Negi (2016) [64], Kumar *et al.* (2017) [43] and Sharma *et al.* (2019) [97].

Number of locules per fruit

The minimum number of locules per fruit (3.74) was recorded in T_1-Arka Vikas on *Solanum torvum* and the maximum number of locules per fruit (4.82) was recorded in T_4-Arka Vikas (Table 9) (Fig. 4). These findings were in agreement with the results of Kanneh *et al.* (2017) [38], Kumar and Rana (2017) [45] and Suresh kumara *et al.* (2017) [104].

T_1- Arka Vikas on *Solanum torvum*

T_2- Arka Vikas on Surya

T_3-Arka Vikas on Arka Keshav

T_4-Arka Vikas seedling (Scion ungrafted)

Fig 2: Fruits from different graft combinations

Fig 3: Fruits of grafted and ungrafted Arka Vikas

Fig 4: Number of locules from grafted and ungrafted Arka Vikas

T_1- Arka Vikas on *Solanum torvum*

T_2- Arka Vikas on Surya

T_3- Arka Vikas on Arka Keshav

T_4- Arka Vikas seedling (Scion ungrafted)

Fig 5: Arka Vikas on different graft combinations

Total Soluble Solids (ºBrix)

The highest TSS of the fruits (4.73 ºB) was recorded in graft combination T_2-Arka Vikas on Surya which was on par with T_1-Arka Vikas on *Solanum torvum* (4.60 ºB) and the lowest TSS of the fruits (4.39 ºB) was recorded in graft combination T_4-Arka Vikas (Table 10). These findings were in agreement with the results of Bletsos and Olympios (2008) [15], Turhan *et al.* (2011) [107] and Zhen Zhou *et al.* (2022) [113].

Ascorbic acid content (mg/100 g)

The highest ascorbic acid content of the fruits (24.49 mg/100 g) was recorded in graft combination T_3-Arka Vikas on Arka Keshav which was on par with T_2-Arka Vikas on Surya (20.07 mg/100 g) and the lowest ascorbic acid content of the fruits (17.97 mg/100 g) was recorded in graft combination T_1-Arka Vikas on *Solanum torvum* (Table 10). These findings were in agreement with the results of Wadano *et al.* (1999) [109], Arvanitoyannis *et al.* (2005) [8].

Lycopene content (mg/100 g)

The highest lycopene content of (7.98 mg/100 g) was recorded in T_3-Arka Vikas on Arka Keshav which was on par with T_2-Arka Vikas on Surya (7.80 mg/100 g). The lowest lycopene content of (5.37 mg/100 g) was recorded in T_1-Arka Vikas on *Solanum torvum* (Table 11). These findings were in agreement with the results of Salam *et al.* (2002) [93], Davis and Perkins-Veazie, (2005) [21], Nicoletto *et al.* (2012) [65], Kumar *et al.* (2015b) [47], Mini (2017) [59] and Ha *et al.* (2021) [28].

Beta carotene content (mg/100 g)

The highest Beta carotene content of (2.42 mg/100 g) was recorded in T_2-Arka Vikas on Surya which was on par with T_3-Arka Vikas on Arka Keshav (2.12 mg/100 g). The lowest Beta carotene content of (1.43 mg/100 g) was recorded in T_4-Arka Vikas (Table 11). These findings were in agreement with the results of Davis *et al.* (2008) [22] and Krumbein and Schwarz (2013) [42].

Table 1: Days taken for germination of rootstock and scion seeds

Treatments		Days taken for seed germination
Rootstock	*Solanum torvum*	4.2
Rootstock	Surya	4.8
Rootstock	Arka Keshav	5.2
C-Check and S-Scion	Arka Vikas	4.4
	S.Em±	0.047
	CD @ 5%	0.148

Table 2: Days taken to reach grafting stage and seedling girth at the stage of grafting

Treatments		Days taken to reach grafting stage	Seedling girth at the stage of grafting (mm)
Rootstock	*Solanum torvum*	45.60	3.46
Rootstock	Surya	47.60	3.48
Rootstock	Arka Keshav	50.60	3.34
S-Scion	Arka Vikas	31.20	3.22
	S.Em±	0.327	0.027
	CD @ 5%	1.017	0.085

Table 3: percent of graft success at 7, 15 days after grafting and 15 days after transplanting

Treatments	Per cent graft success		
	7 DAG	15 DAG	15 DAT
T_1-Arka Vikas on *Solanum torvum*	99.40	98.60	98.20
T_2-Arka Vikas on Surya	98.40	97.20	96.65
T_3-Arka Vikas on Arka Keshav	98.20	96.63	95.45
S.Em±	0.121	0.285	0.252
CD @ 5%	0.372	0.873	0.773

DAG-Days after grafting**, DAT**-Days after transplanting

Table 4: Interaction of scion and rootstocks on plant height and number of primary branches per plant of tomato

Treatments	Plant height (cm)	Number of primary branches per plant
T_1-Arka Vikas on *Solanum torvum*	92.36	8.88
T_2-Arka Vikas on Surya	68.56	7.28
T_3-Arka Vikas on Arka Keshav	68.56	6.96
T_4-Arka Vikas seedling (Scion un grafted)	63.56	7.44
SEm±	1.353	0.179
CD @ 5%	4.215	0.556

Table 5: Effect of scion and rootstocks on days to first flowering, days to 50% flowering, days to fruit set and number of flowers per cluster of tomato

Treatments	Days to first flowering	Days to 50% flowering	Days to fruit set	Number of flowers per cluster
T_1-Arka Vikas on *Solanum torvum*	28.84	32.80	42.44	4.76
T_2-Arka Vikas on Surya	25.60	28.80	36.24	4.52
T_3-Arka Vikas on Arka Keshav	27.60	29.60	42.04	4.04
T_4-Arka Vikas seedling (Scion ungrafted)	29.16	38.40	43.24	4.76
SEm±	0.219	0.231	0.473	0.036
CD @ 5%	0.682	0.719	1.473	0.112

Table 6: Effect of scion and rootstocks on days to first fruit harvest and days to last fruit harvest of tomato

Treatments	Days to first fruit harvest	Days to last fruit harvest
T_1-Arka Vikas on *Solanum torvum*	68.29	159.72
T_2-Arka Vikas on Surya	70.53	150.48
T_3-Arka Vikas on Arka Keshav	77.47	146.80
T_4-Arka Vikas seedling (Scion un grafted)	73.73	137.33
SEm±	0.258	0.727
CD @ 5%	0.802	2.265

Table 7: Interaction of scion and rootstocks on yield parameters of tomato

Treatments	Number of fruits per cluster	Number of fruits per plant	Average fruit weight (g)	Fruit yield per plant (kg)	Fruit yield per ha (t)
T_1-Arka Vikas on *Solanum torvum*	2.72	34.80	65.33	2.27	84.18
T_2-Arka Vikas on Surya	2.24	32.40	63.00	2.04	75.60
T_3-Arka Vikas on Arka Keshav	2.56	30.92	57.60	1.78	65.94
T_4-Arka Vikas seedling (Scion ungrafted)	2.52	22.12	40.91	0.90	33.48
SEm±	0.033	0.405	0.654	0.004	0.029
CD @ 5%	0.104	1.262	2.037	0.013	0.091

Table 8: Interaction of scion and rootstocks on fruit length and fruit width of tomato

Treatments	Fruit length (cm)	Fruit width (cm)
T_1-Arka Vikas on *Solanum torvum*	4.39	5.51
T_2-Arka Vikas on Surya	4.13	4.96
T_3-Arka Vikas on Arka Keshav	4.30	5.01
T_4-Arka Vikas seedling (Scion un grafted)	4.13	5.36
SEm±	0.018	0.035
CD @ 5%	0.056	0.110

Table 9: Interaction of scion and rootstocks on pericarp thickness and number of locules per fruit of tomato

Treatments	Pericarp thickness (mm)	Number of locules per fruit
T_1-Arka Vikas on *Solanum torvum*	4.71	3.74
T_2-Arka Vikas on Surya	4.53	4.13
T_3-Arka Vikas on Arka Keshav	4.55	4.10
T_4-Arka Vikas seedling (Scion un grafted)	4.65	4.82
SEm±	0.011	0.030
CD @ 5%	0.035	0.092

Table 10: Interaction of scion and rootstocks on TSS and Ascorbic acid content of tomato

Treatments	TSS (^{0}Brix)	Ascorbic acid content (mg/100 g)
T_1-Arka Vikas on *Solanum torvum*	4.60	17.97
T_2-Arka Vikas on Surya	4.73	20.07
T_3-Arka Vikas on Arka Keshav	4.48	24.49
T_4-Arka Vikas seedling (Scion un grafted)	4.39	18.21
SEm±	0.026	0.645
CD @ 5%	0.082	2.010

Table 11: Interaction of scion and rootstocks on lycopene content and beta-carotene content of tomato

Treatments	Lycopene content (mg/100 g)	Beta-carotene content (mg/100 g)
T_1-Arka Vikas on *Solanum torvum*	5.37	1.53
T_2-Arka Vikas on Surya	7.80	2.42
T_3-Arka Vikas on Arka Keshav	7.98	2.12
T_4-Arka Vikas seedling (Scion ungrafted)	5.92	1.43
SEm±	0.039	0.082
CD @ 5%	0.120	0.254

Conclusion

Grafted plants offer increased yield and consequently higher profits. Grafting can affect various quality aspects of vegetables. This study showed that T_1-Arka Vikas grafted on *Solanum torvum* gave the better results in terms of growth, yield followed by T_2-Arka Vikas on Surya. High lycopene content (7.98 mg) and high ascorbic acid content (24.49 mg) was recorded in T_3-Arka Vikas on Arka Keshav, High TSS (4.73 °Brix) and High beta-carotene content (2.42 mg) was recorded in graft combination T_2-Arka Vikas on Surya which can be utilized for processing purpose. Rootstock/scion combinations should be carefully selected for specific climatic and geographic conditions. Appropriate selection can help control soilborne diseases and also increase yield and improve fruit quality. Present study may be used in further improvement programme for increasing the yield potentiality by using the different scions of tomato. Multilocation trials may be under taken with promising treatments of present study.

Acknowledgments

I extend my heartfelt gratitude to the Ministry of Science and Technology, Department of Science and Technology, Government of India, New Delhi, for providing the Innovation in Science Pursuit for Inspired Research (INSPIRE) fellowship and to the SKLTGHU, College of Horticulture, Rajendranagar for providing the facilities to accomplish the present study.

References

1. Abd El-Wasim Mona M, Nour El Hound A, Reyad S, Sanad AS. Effect of grafting eggplant onto certain *Solanaceae* rootstock on growth and yield in relation to white mold and two spotted spider mite. Middle East Journal of Applied Sciences. 2018;8(3):755-776.

2. Abdelmageed A, Gruda N. The influence of grafting on growth, development and some physiological parameters of tomato under controlled heat stress conditions. European Journal of Horticultural Science. 2009;74(1):16-20.
3. Adams P. Mineral nutrition. In: Atherton JG, Rudich J, editors. The tomato crop. A scientific basis for improvement. London, New York: Chapman and Hall Ltd; 1986. p. 281-334.
4. Ahmed MA. Grafting as a tool to improve TYLCV-tolerance in tomato. Journal of Horticultural Science and Ornamental Plants. 2014;6(3):109-115.
5. Alam MZ, Hossain MM, Choudhury DAM, Uddin MJ, Haque NMM. Effect of grafting technology on suppression of whitefly (*Bemisia tabaci* Gennadius) disseminating virus diseases in tomato. Annals of Bangladesh Agriculture. 1995;5:91-98.
6. Alessandra M, Alesandro M, Filippo V, Valerio M, Digeo P, Anna FD. Effect of grafting on yield and quality of eggplant (*Solanum melongena* L.). Scientia Horticulturae. 2013;149:108-114.
7. Alexopoulos AA, Angelos K, Harold CP. Fruit yield and quality of watermelon in relation to grafting. Journal of Food, Agriculture and Environment. 2007;5(1):178-179.
8. Arvanitoyannis IS, Khah EM, Christakou EC, Bietsos FA. Effect of grafting and modified atmosphere packaging on eggplant quality parameters during storage. International Journal of Food Science and Technology. 2005;40:311-322.
9. Assinapol N, Praneetha S, Rajasree. Performance of grafted brinjal (*Solanum melongena* L.) under different spacing and fertigation levels. Journal of Pharmacognosy and Phytochemistry. 2017;6(2):307-311.
10. Bahadur A, Rai N, Kumar R, Tiwari SK, Singh AK, Rai AK, *et al.* Grafting tomato on eggplant as a potential tool to improve waterlogging tolerance in hybrid tomato. Vegetable Science. 2015;42(2):82-87.
11. Barrett CE, Zhao X, Hodges AW. Cost benefit analysis of using grafted transplants for root-knot nematode management in organic heirloom tomato production. HortTechnology. 2012;22:252-257.
12. Besri M. Tomato grafting as an alternative to methyl bromide in Morocco. Proceedings of the International Research Conference on Methyl Bromide Alternatives and Emission Reduction; 2003 Nov 3-6; San Diego, California. p. 12.
13. Bharathi S, Pugalendhi L, Swarna Priya R, Uma D, Tamilselvi NA. Grafting studies of tomato with wild *Solanum* rootstocks. Journal of Pharmacognosy and Phytochemistry. 2021;10(1):2210-2213.
14. Bletsos FA, Thanassoulopoulos C, Roupakias D. Effect of grafting on growth, yield and *Verticillium* wilt of eggplant. HortScience. 2003;38:183-186.
15. Bletsos FA, Olympios CM. Rootstocks and grafting of tomatoes, peppers and eggplants for soil-borne disease resistance, improved yield and quality. The European Journal of Plant Science and Biotechnology. 2008;2(1):62-73.
16. Bogoescu M, Doltu M. Effect of grafting eggplant (*Solanum melongena* L.) on its selected useful characters. Bulletin UASVM Horticulture. 2015;72(2):[full page range not provided].
17. Bumgarner N, Kleinhenz MD. Grafting guide: A pictorial guide to the cleft and splice graft methods as applied to tomato and pepper. Ohio State University; 2014. Bulletin-950.
18. Chung HD, Youn SJ, Choi YJ. Effects of rootstocks on yield, quality and components of tomato fruits. Journal of the Korean Society for Horticultural Science. 1997;38:603-607.
19. Colla G, Rouphael Y, Cadarelli M. Effect of salinity on yield, fruit quality, leaf gas exchange and mineral composition of grafted watermelon plants. HortScience. 2006;41(3):622-627.
20. Colla G, Rouphael Y, Cadarelli M, Temperini O, Rea E, Salerno A, *et al.* Influence of grafting on yield and fruit quality of pepper (*Capsicum annuum* L.) grown under greenhouse conditions. Acta Horticulturae. 2008;782:359-364.
21. Davis AR, Perkins-Veazie P, Hassell R, Levi A, King SR, Zhang XG. Grafting effects on vegetable grafting. HortScience. 2005;43(6):1670-1672.
22. Davis AR, Perkins-Veazie P, Hassell R, Levi A, King SR, Zhang XP. Grafting effects on vegetable quality. HortScience. 2008;43:1670-1672.
23. Davis AR, Webber CL, Perkins VP, Collins J. Impact of cultivar and production practices on yield and phytonutrient content of organically grown watermelon. Journal of Vegetable Science. 2006;12:83-91.
24. Dhivya R. Screening studies of wild rootstocks for biotic stresses and its performance on grafting in tomato (*Solanum lycopersicum* L.) [PhD thesis]. Coimbatore: Tamil Nadu Agricultural University; 2014.
25. Gisbert C, Prohens J, Nuez F. Performance of eggplant grafted onto cultivated, wild, and hybrid materials of eggplant and tomato. International Journal of Plant Production. 2011;5(4):367-380.
26. Gisbert C, Prohens J, Maria D, John RS, Fernando N. Eggplant relatives as sources of variation for developing new rootstocks: effect of grafting on eggplant yield and fruit apparent quality and composition. Science Horticulture. 2011;128:14-22.
27. Granges-A, Pucheu-Plante G, Leger A, Produit V. Greenhouse tomato cultivation: effect of soil steaming and grafted plants in soil infected with corky root. Revue Suisse de Viticulture, d'Arboriculture et d'Horticulture. 1998;30(4):233-236.
28. Ha HTN, Thuy NM. Effect of grafting and harvest stage on the quality of black cherry tomatoes (*Solanum lycopersicum* cv. OG) cultivated in Vietnam. Food Research. 2021;5(1):158-166.
29. Hamed HK, Ebrahim Z, Gholam S, Gholamabbas S. Evaluation of different rootstocks and grafting techniques on graft union percent, yield and yield components of watermelon cv. "Crimson Sweet". World Applied Sciences Journal. 2012;18(5):645-651.
30. Hossain MG, Arfan A, Rafija AR, Sabrina A, Shreef M. Influence of rootstocks on yield and quality of summer tomato cv. 'BARI-Tomato-4'. Earth Systems and Environment. 2019. (Page numbers not available.)
31. Hoza G, Doltu M, Dinu M, Becherescu AD, Apahidean AI, Bogoescu MI. Response of different grafted eggplants in protected culture. Notulae Botanicae Horti Agrobotanici Cluj-Napoca. 2017;45(2):473-480.
32. Ibrahim A, Wahb-Allah M, Abdel Razzak H, Alsadon A. Growth, yield, quality and water use deficiency of

grafted tomato plants grown in greenhouse under different irrigation levels. Life Science Journal. 2014;11(2):118-126.
33. Ibrahim M, Munira MK, Kabir MS, Islam AKMS, Miah MMU. Seed germination and graft compatibility of wild *Solanum* as rootstock of tomato. Asian Journal of Biological Sciences. 2001;1:701-703.
34. Ioannou N. Integrating soil solarization with grafting on resistant rootstocks for management of soilborne pathogens of eggplant. Journal of Horticultural Science and Biotechnology. 2001;76:396-401.
35. Johnson H. Eggplant. Cooperative Extension Leaflet. University of California, Berkeley; 1985.
36. Johnson S, Inglis D, Miles C. Grafting effects on eggplant growth, yield, and *Verticillium* wilt incidence. International Journal of Vegetable Science. 2014;20:3-20.
37. Johnson S, Kreider P, Miles C. Vegetable grafting: eggplants and tomatoes. Journal of the Korean Society for Horticultural Science. 2011;39:169-179.
38. Kanneh SM, Quee DD, Ngegba PM, Musa PD. Evaluation of tomato (*Solanum lycopersicum* L.) genotypes for horticultural characteristics on the upland in Southern Sierra Leone. Journal of Agricultural Science. 2017;9(6):213-220.
39. Khah EM, Kakava E, Mavromatis A, Chachalis D, Goulas C. Effect of grafting on growth and yield of tomato (*Lycopersicon esculentum* Mill.) in greenhouse and open-field. Journal of Applied Horticulture. 2006;8(1):3-7.
40. Khah EM. The effect of grafting on growth, performance and yield of aubergine (*Solanum melongena* L.) in the field and greenhouse. Journal of Food, Agriculture and Environment. 2005;3(4):92-94.
41. Kiran P, Samant PK, Naresh P, Acharya GC. Influence of organic and inorganic nutrients on nutrient accumulation in grafted tomato. The Pharma Innovation Journal. 2018;7(11):27-33.
42. Krumbein A, Schwarz D. Grafting: a possibility to enhance health-promoting and flavor compounds in tomato fruits of shaded plants. Scientia Horticulturae. 2013;149:97-107.
43. Kumar AB, Sanket K. Grafting of vegetable crops as a tool to improve yield and tolerance against diseases-a review. International Journal of Agriculture Sciences. 2017;9(13):4050-4056.
44. Kumar BA, Raja P, Pandey AK, Rabindro P. Evaluation of wilt resistance of wild *Solanum* species through grafting in brinjal. International Journal of Current Microbiology and Applied Sciences. 2017;6(9):3464-3469.
45. Kumar NM, Rana MK. Evaluation of tomato (*Solanum lycopersicum* L. var. *cerasiformae*). Trends in Biosciences. 2017;7(24):4304-4307.
46. Kumar P, Sharma P, Vats B. Effect of grafting tomato on different rootstocks under protected environment in mid hills of NW Himalayan region. Agricultural Science Digest. 2017;37(1):81-82.
47. Kumar P, Shivani R, Parveen S, Negi V. Vegetable grafting: a boon to vegetable growers to combat biotic and abiotic stresses. Himachal Journal of Agricultural Research. 2015;41(1):1-5.
48. Kumar P, Shivani R, Parveen S, Amar S, Upadhyay SK. Evaluation of chilli and brinjal rootstocks for growth, yield and quality of bell pepper (*Capsicum annuum* L. var. *grossum* Sendt.) under protected conditions. Agricultural Research Journal. 2016;53(2):180-183.
49. Kumar S, Patel NB, Saravaiya SN, Vashi JM. Performance of grafted brinjal cv. Surati Ravaiya onto *Solanum torvum* Swartz rootstock under excess moisture conditions of south Gujarat, India. International Journal of Tropical Agriculture. 2016;34(3):753-760.
50. Kumar S, Patel NB, Saravajya SN. Studies on *Solanum torvum* Swartz rootstock on cultivated eggplant under excess moisture stress. Bangladesh Journal of Botany. 2019;48(2):297-306.
51. Latifah E, Widaryanto E, Maghfoer MD, Arifin. Economic analysis, growth and yield of grafting tomato varieties for *Solanum torvum* as a rootstock. International Journal of Biological and Ecological Engineering. 2018;12(10).
52. Lee JM. Cultivation of grafted vegetables-I. Current status, grafting methods, and benefits. HortScience. 1994;29:235-239.
53. Lee JM. Advances in vegetable grafting. Chronica Horticulturae. 2003;43(2):13-19.
54. Lee JM, Oda M. Grafting of herbaceous vegetable and ornamental crops. Horticultural Reviews. 2003;28:61-124.
55. Leonardi C, Giuffrida F. Variation of plant growth and macronutrient uptake in grafted tomatoes and eggplants on three different rootstocks. European Journal of Horticultural Science. 2006;71(3):97-101.
56. Lugasi A, Pogony A, Pek Z, Helyes L. Effect of grafting on the tomatoes yield, quality and main fruit components in spring forcing. Acta Alimentaria. 2005;34(4):453-462.
57. Matsuzoe N, Ali M, Okubo H, Fujieda K. Growth behaviour of tomato plants grafted on wild relatives of *Solanum melongena*. Journal of the Japanese Society for Horticultural Science. 1990;59(2):358-359.
58. Mini ML. Influence of harvesting stage and storage temperature on nutritional quality of tomato (*Lycopersicon esculentum* Mill.) cv. PKM1. International Journal of Biochemistry Research and Review. 2017;16(4):1-8.
59. Mohamed H, Khalid E, El-Hamed A, Mohammed WM, Mennat-Allah NE. Impact of grafting on watermelon growth, fruit yield and quality. Vegetable Crops Research Bulletin. 2012;76:99-118.
60. Mohammed S, Humidan M, Boras M, Abdalla O. Effect of grafting tomato on different rootstocks on growth and productivity under glasshouse conditions. Asian Journal of Agricultural Research. 2009;3:47-54.
61. Moncanda A, Miceli A, Vetrano F, Mineo V, Planeta D, D'Anna F. Effect of grafting on yield and quality of eggplant (*Solanum melongena* L.). Scientia Horticulturae. 2013;149:108-114.
62. Morejon NH. Genetic and environmental factors affecting improvement of rootstocks for tomato [MSc thesis]. Ohio: Ohio State University; 2013.
63. Negi V, Kumar P, Sharma P, Raj D, Singh A, Vats B. Graft compatibility studies in interspecific tomato-potato grafts. Himachal Journal of Agricultural Research. 2016;42(1):29-31.

64. Nicoletto C, Tosini F, Sambo P. Effect of grafting and ripening conditions on some qualitative traits of 'Cuore di bue' tomato fruits. Journal of the Science of Food and Agriculture. 2012;93:1397-1403.
65. Nina KM, Joze O. The influence of grafting on yield of two tomato cultivars (*Lycopersicon esculentum* Mill.) grown in a plastic house. Acta Agriculturae Slovenica. 2004;83(2):243-249.
66. Nirmal OA. Comparative performance of different shade intensities on growth of vegetable seedlings under Konkan agro-climatic conditions [MSc thesis]. Dapoli: Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2017.
67. Nirmala N, Praneetha S, Manivannan N. *Per se* performance of cluster bearing, glossy purple brinjal (*Solanum melongena* L.) hybrids for economic traits. Electronic Journal of Plant Breeding. 2013;4(2):1188-1192.
68. Nkansanh GO, Ahwireng AK, Amoatey C, Ayarna AW. Grafting onto African eggplant enhances growth, yield and fruit quality of tomatoes in tropical forest ecozones. Journal of Applied Horticulture. 2013;15(1):16-20.
69. Oda M, Maruyama M, Mori G. Water transfer at graft union of tomato plants grafted on *Solanum torvum* rootstocks. Journal of the Japanese Society for Horticultural Science. 1999;74(6):458-463.
70. Oda M, Maruyama M, Mori G. Water transfer at graft union of tomato plants grafted on *Solanum torvum* rootstocks. Journal of the Japanese Society for Horticultural Science. 2005;74(6):458-463.
71. Oda M, Nagata M, Tsuji K, Sasaki H. Effects of scarlet eggplant rootstock on growth, yield and sugar content of grafted tomato fruits. Journal of the Japanese Society for Horticultural Science. 1996;65:531-536.
72. Pandey AK, Rai M. Prospects of grafting in vegetables: an appraisal. Vegetable Science. 2003;30(2):101-109.
73. Panse VG, Sukhatme PV. Statistical methods for agricultural workers. New Delhi: ICAR; 1985.
74. Passam HC, Stylianou M, Kotsiras A. Performance of eggplant grafted on tomato and eggplant rootstocks. European Journal of Horticultural Science. 2005;70:130-134.
75. Petran A, Hoover E. *Solanum torvum* as a compatible rootstock in interspecific tomato grafting. Journal of Horticulture. 2014;1(1):1-4.
76. Petropoulos SA, Olympios C, Ropokis A, Vlachou G, Ntatsi G, Paraskevopoulos A, *et al.* Fruit volatiles, quality and yield of watermelon as affected by grafting. Journal of Agricultural Science and Technology. 2014;16:873-885.
77. Priyanka A, Sujatha KB, Sivakumar T, Rajasree V. Morphological changes in the compatible grafts of tomato cv. PKM-1 with different solanaceous rootstocks. Journal of Pharmacognosy and Phytochemistry. 2019;8(3):2416-2419.
78. Quamruzzaman AKM, Islam F, Uddin MN, Halim GMA, Chowdhury MAZ, Saha S. Effect of grafting compatibility of different rootstock and scion on yield of eggplant in Bangladesh condition. Journal of Agriculture Science and Food Research. 2018;9:4.
79. Rahman MA, Rashid MA, Salam MA, Masad MAT, Masum ASMH, Hossain MM. Performance of some grafted eggplant genotypes on wild *Solanum* rootstocks against root knot nematode. Journal of Biological Science. 2002a;2(7):446-448.
80. Rahmatian A, Delshad M, Saheli R. Effect of grafting on growth, yield and fruit quality of single and double stemmed tomato plants grown hydroponically. Horticulture, Environment and Biotechnology. 2014;55(2):115-119.
81. Rajendra BR, Kelenjar AK, Shivashankar G. Grafting behaviour between *Lycopersicon esculentum* var. Marglobe and *Solanum* spp. (*S. torvum* and *S. melongena*). Current Science. 1975;44(3):105.
82. Ramesh R, Achari G, Asolkar T, Dsouza M, Singh NP. Management of bacterial wilt of brinjal using wild brinjal (*Solanum torvum*) as rootstock. Indian Phytopathology. 2016;69(3):260-265.
83. Rami Reddy SRKM, Lingaiah HB, Naresh P, Reddy PVK, Kuchi VS. Heterosis studies for yield and yield attributing characters in brinjal (*Solanum melongena* L.). Plant Archives. 2011;11(2):649-653.
84. Ranganna S. Handbook of analysis and quality control for fruit and vegetable products. 2nd ed. New Delhi: Tata McGraw Hill Co. Ltd.; 1986. p. 89-90.
85. Rashid MA, Rahman A, Ahmed B, Luther GC, Black L. Demonstration and pilot production of grafted eggplant and grafted tomato and training of farmers. 2004.
86. Rathod T. Evaluation of rootstock and scion in brinjal (*Solanum melongena* L.) for growth, yield and fruit quality [MSc thesis]. Andhra Pradesh: Dr. YSR Horticultural University; 2017.
87. Rinku MP, Sarat S, Borah P, Sibani D, Seema B, Ranjita B. Vegetable grafting for enhancing yield and combating biotic stress in *Bhut Jolokia* (*Capsicum chinensis*) under protected condition. International Journal of Current Microbiology and Applied Sciences. 2020;9(9):3051-3055.
88. Rivard C, Louws F. Grafting to manage soil borne diseases in heirloom tomato production. Horticultural Science. 2008;43:2104-2111.
89. Romano D, Paratore A. Effects of grafting on tomato and eggplant. Acta Horticulturae. 2001;559:149-153.
90. Sabatino L, Iapichino IG, Maggio A, D'Anna E, Bruno M, D'Anna F. Grafting affects yield and phenolic profile of *Solanum melongena* L. landraces. Journal of Integrative Agriculture. 2016;15(5):1017-1024.
91. Sabatino L, Iapichino G, Consentino BB, D'Anna F, Rouphael Y. Rootstock and arbuscular mycorrhiza combinatorial effects on eggplant crop performance and fruit quality under greenhouse conditions. Agronomy. 2020;10:693.
92. Salam MA, Masum ASMH, Chowdhury SS, Dhar M, Saddeque MA, Islam MR. Growth and yield of watermelon as influenced by grafting. Journal of Biological Science. 2002;2:298-299.
93. Salehi-Mohammadi R, Khasi A, Lee SG, Huh YC, Lee JM, Delshad M. Assessing survival and growth performance of Iranian melon to grafting onto *Cucurbita* rootstocks. Korean Journal of Horticultural Science and Technology. 2009;27(1):1-6.
94. Sebahattin C, Dasgan Y, Mansuroglu S, Kurt S, Mazmanoglu M, Antakli O, *et al.* Grafted eggplant yield, quality and growth in infested soil with *Verticillium dahliae* and *Meloidogyne incognita*.

Pesquisa Agropecuária Brasileira. 2009;44(12):1673-1681.

95. Semiz GB, Suarez PL. Impact of grafting, salinity, and irrigation water composition on eggplant fruit yield and ion relations. Scientific Reports. 2019;9:Article 14580.
96. Sharma V, Kumar P, Sharma P, Negi ND, Singh A, Sharma PK, *et al.* Rootstock and scion compatibility studies in tomato under protected condition. International Journal of Current Microbiology and Applied Sciences. 2019;8(5):1188-1197.
97. Sherly J. Studies on grafting of brinjal accessions (*Solanum melongena* L.) with wild *Solanum* rootstocks [PhD thesis]. Coimbatore: Tamil Nadu Agricultural University; 2011.
98. Shipepe BT, Msogoya TJ. Effect of grafting on yield and quality of hybrid tomato (*Solanum lycopersicum* Mill.) cultivars. Tanzania Journal of Agricultural Sciences. 2018;17(2):39-45.
99. Singh L, Singh P, Jyoti, Singh J. Grafting influence on physiochemical characters of tomato on brinjal rootstock. International Journal of Bio-resource and Stress Management. 2019;10(5):539-544.
100. Soe DW, Win ZZ, Thwe AA, Myint KH. Effects of different rootstocks on plant growth, development and yield of grafted tomato (*Lycopersicon esculentum* Mill.). J Agric Res. 2018;5(2):30-38.
101. Srivastava RP, Kumar S. Fruits and vegetable preservation: principles and practices. New Delhi: Bio-Green Books; 2002. p. 359-360.
102. Stevens MA, Rudich J. Genetic potential for overcoming physiological limitations on adaptability, yield, and quality in the tomato. Hort Sci. 1978;13:673-678.
103. Suresh Kumara B, Lingaiah HB, Shivapriya M, Parvithra HB. Evaluation of tomato genotypes for growth, yield and quality attributes under Eastern dry Zone of Karnataka, India. Int J Curr Microbiol Appl Sci. 2017;6(11):1922-1930.
104. Surve N. Studies on grafting techniques in brinjal (*Solanum melongena* L.) under Konkan agroclimatic conditions [MSc thesis]. Dapoli: Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth; 2019.
105. McAvoy T, Freeman JH, Rideout SL. Evaluation of grafting using hybrid rootstocks for management of bacterial wilt in field tomato production. HortScience. 2012;47(5):621-625.
106. Turhan A, Ozmen N, Serbeci MS, Seniz V. Effects of grafting on different rootstocks on tomato fruit yield and quality. Hort Sci. 2011;38(4):142-149.
107. Voutsela S, Yarsi G, Petropoulos SA, Khan EM. The effect of grafting of five different rootstocks on plant growth and yield of tomato plants cultivated outdoors and indoors under salinity stress. Afr J Agric Res. 2012;7(41):5553-5557.
108. Wadano A, Azeta M, Itotani S, Kanda A, Iwaki T, Taira T, *et al.* Change of ascorbic acid level after grafting of tomato seedlings. In: Proc. International Workshop held at Tata, Hungary. 1999;54:9-10.
109. Wang S, Yang R, Cheng J, Zhao J. Effect of rootstocks on the tolerance to high temperature of eggplants under solar greenhouse during summer season. Acta Hortic. 2007;761:357-360.
110. Yarshi G. Effects of grafted seedling use on yield, growth and quality parameters of tomato growing in greenhouse. In: Proc. XXVIIIth IHC-IS on micro and macro technologies for plant propagation. Fabbri A, Rugini E, editors. Acta Hortic. 2011;923: ISHS.
111. Yetisir H, Sari N. Effect of different rootstock on plant growth, yield and quality of watermelon. Aust J Exp Agric. 2003;43(10):1269-1274.
112. Zhou Z, Yuan Y, Wang K, Wang H, Huang J, Yu H, *et al.* Rootstock-scion interactions affect fruit flavor in grafted tomato. Sci Direct. 2022;8(4):499-510.