

**STANDARDIZATION OF GRAFTING OF
BRINJAL (*Solanum melongena* L.) USING
Solanum torvum AND CV. Konkan Prabha
AS ROOTSTOCK**

By

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A thesis submitted to the

Dr. BALASAHEB SAWANT KONKAN KRISHI VIDYAPEETH,
DAPOLI, (Agricultural University)
DIST. RATNAGIRI (Maharashtra), INDIA

In partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE (HORTICULTURE)

in

VEGETABLE SCIENCE

In

EDU. SCIENCE

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CERTIFICATE

This is to certify that, the thesis entitled “**Standardization of grafting of brinjal (*Solanum melongena* L.) using *Solanum torvum* and CV. Konkan Prabha as rootstock**’ submitted to the Faculty of Agriculture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, Dist. Ratnagiri, Maharashtra State in partial fulfillment of the requirement for the degree of **MASTER OF SCIENCE (HORTICULTURE)** in **VEGETABLE SCIENCE**, embodies the result of a piece of bona-fide and research carried out by **Mr. MUKUND MADHUKAR RAYKAR** under my guidance and supervision. No part of this thesis has been submitted for any other degree or diploma or published in other form. All the assistance and help received during this course of investigation and the sources of literature have been duly acknowledged by him.

Place: Dapoli
Date: / / 2020

(R. G. Khandekar)
Chairman,
Advisory Committee
And
Research Guide

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Date- / /2020

(Mukund Madhukar Raykar)

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COLLEGE OF HORTICULTURE, DAPOLI,

DIST. RATNAGIRI, (M.S.) 415 712

Title of Thesis : ‘Standardization of grafting of brinjal (*Solanum melongea* L.) using *Solanum torvum* and var. Konkan Prabha as rootstock.’

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ABSTRACT

The present investigation entitled “Standardization of grafting of brinjal (*Solanum melongea* L.) using *Solanum torvum* and var. Konkan prabha as rootstock.” was carried out in 2019-20 at 4 number nursery of College of Horticulture, Dapoli, in Randomized Block Design; consists of ten treatments namely T1: 25 days Bandhtiware local scion grafted on 70 days *Solanum torvum* rootstock , T2: 25 days Bandhtiware local scion grafted on 60 days old *Solanum torvum* rootstock , T3: 25 days Bandhtiware local scion grafted on 30 days Konkan prabha rootstock, T4: 25 days Bandhtiware local scion scion grafted on 25 days Konkan prabha rootstock, T5: 25 days Manjiri scion grafted on 70 days *Solanum torvum* rootstock, T6: 25 days Manjiri scion grafted on 60 days *Solanum torvum* rootstock, T7: 25 days Manjiri scion grafted on 30 days Konkan prabha rootstock, T8: 25 days Manjiri scion grafted

on 25 days Konkan prabha rootstock, T9: 25 days old Bandhtiware local seedling (control) and T10 25 days old Manjiri seedling (control) each was replicated thrice.

Data pertaining to characters *viz.* plant height (cm), number of leaves, length of main root (cm), number of adventitious roots, stem diameter (mm) above graft union, stem diameter (mm) at graft union, stem diameter (mm) below graft union, number of fruits, fruit yield per plant (kg), fruit yield per hectare (t) differed significantly among treatments.

Highest survival of grafts (82.25) was recorded in treatment T8 (25 days Manjiri scion grafted on 25 days Konkan prabha rootstock). Field survival of the grafts was 100 % in all the treatments except T10 (non- grafted). Highest plant height was recorded in T1 (145.53 cm) and lowest plant height was recorded in T10 (93.27 cm) at 120 DAT. Stem diameter above graft union was maximum in T1 (23.38 mm) and minimum in T8 (15.85 mm) at 120 DAT. Stem diameter at graft union was maximum in T1 (25.52 mm) and minimum in T8 (17.27 mm) at 120 DAT.

Minimum days required for first harvest (58.40 days) was observed in T5 and maximum days for last harvest (74.00) was recorded in T9, longest span of harvest observed in T1 (76.06 days). Physical parameters of fruits varied significantly. Maximum weight, and length of fruit was observed in T9 (control). Significantly maximum yield (2.35 kg) was recorded in T1 whereas minimum yield (1.31 kg) was noticed in T10. Yield per hectare varied significantly. The highest yield (60.93 t) was recorded in T1 whereas lowest yield (34.02 t) was found in T10. The percent survival of graft in T1 was (100%) with 114.93 leaves, 145.53 cm plant height, 57.54 cm tap-root length and 23.38 mm girth at collar

region was observed at 120 days after transplanting. The highest B:C ratio of 3.91 was recorded in treatment T1 and was significantly superior over control T9 (3.82). Similarly, the highest B:C ratio of 3.49 was recorded in treatment T5 and was significantly superior over control T10 (3.33).

उद्यानविद्या महाविद्यालय, दापोली

जि.रत्नागिरी (४१५ ७१२)

प्रबंधाचे शीर्षक	: सोलॅनम टोरवम व कोकण प्रभा वाण वापरून वांग्यामध्ये कलमाचे मानकिकरण करणे.
विद्यार्थ्याचे नाव	: कु. मुकुंद मधुकर रायकर
नोंदणी क्रमांक	: एचडीपीएम/१८/०१६७
मार्गदर्शकाचे नाव	: डॉ. राजन गोविंद.खांडेकर प्राध्यापक, उद्यानविद्या महाविद्यालय, दापोली डॉ.बा.सा.को.कृ.वि.दापोली
सादर वर्ष	: सप्टेंबर,२०२०

सारांश

हा प्रयोग उद्यानविद्या महाविद्यालय, दापोली अंतर्गत येणाऱ्या ४ नंबर नर्सरी प्रक्षेत्रावर २०१९-२० शैक्षणिक वर्षामध्ये घेण्यात आला. प्रयोगाचे मूळ उद्देश सोलॅनम टोरवम व कोकण प्रभा वाणाची मूळ काडी वापरून वांग्यामध्ये यशस्वीता व लागवडी पर्यंत कलम जगण्याचे प्रमाण आणि मुक्त प्रक्षेत्रावर त्याची कामगिरी चे मानकिकरण करणे.

हा प्रयोग यादृच्छिक खंड संकल्पनामध्ये करण्यात आला. यासाठी १० उपचार पद्धती वापरण्यात आल्या. टी_१ २० दिवस सोलॅनम टोरवम + २५ दिवस बांधतिवरे लोकल, टी_२ ६० दिवस सोलॅनम टोरवम + २५ दिवस बांधतिवरे लोकल, टी_३ ३० दिवस कोकण प्रभा + २५ दिवस बांधतिवरे लोकल, टी_४ २५ दिवस कोकण प्रभा + २५ दिवस बांधतिवरे लोकल, टी_५ ७० दिवस सोलॅनम टोरवम + २५ दिवस मंजिरी , टी_६ ६० दिवस सोलॅनम टोरवम+ २५ दिवस मंजिरी, टी_७ ३० दिवस कोकण प्रभा+ २५ दिवस मंजिरी, टी_८ २५ दिवस कोकण प्रभा+ २५ दिवस मंजिरी, टी_९ बांधतिवरे लोकल रोप, टी_{१०} मंजिरी रोप. या प्रत्येकांच्या हुबेहूब तीन प्रतिकृतींमध्ये लागवड करण्यात आली.

सदर प्रयोगाच्या नोंदिमध्ये कलमांची उंची , पानांची संख्या , कलम जोडणीला लागणारा कालावधी , कलम जगण्याचे प्रमाण, कलमाच्या मुळाची जाडी, बुंध्याजवळील जाडी, कलमाठिकाणची जाडी, फळ संख्या , प्रति झाड उत्पादन , प्रति हेक्टर उत्पादन , सर्वात जास्त कलम जगण्याचे प्रमाण उपचार टी_८ (२५ दिवस मंजिरी २५ दिवसाच्या कोकण प्रभा मूळकाडीवर बांधण्यात आलेले) मध्ये आढळून आले. मुक्त प्रक्षेत्रावर रोप जगण्याचे प्रमाण टी_{१०} (मंजिरी रोपे) वगळता उरलेल्या सर्व उपचारांमध्ये १००% आढळून आले. रोपाची सर्वाधिक उंची (१४५.५३ सेमी.) उपचार टी_१ मध्ये तर सर्वात कमी उंची (७८.१३ सेमी.) टी_{१०} या उपचारामध्ये नोंदविण्यात आली.

काढणीकरीता सर्वाधिक कमी कालावधी (५८.४०) उपचार टी_५ मध्ये तर सर्वाधिक कालावधी (७४ दिवस) उपचार टी_१ मध्ये नोंदविण्यात आला. सर्वाधिक काढणी कालावधी उपचार टी_१ मध्ये आढळला. फळाची सर्वाधिक लांबी व वजन टी_१ मध्ये नोंदविण्यात आले.

सर्वाधिक उत्पादन प्रति रोप उपचार टी_१ मध्ये (२.३५ किलो) तर सर्वात कमी टी_{१०} (१.३१किलो) तसेच सर्वाधिक उत्पादन प्रति हेक्टर सुद्धा उपचार टी_१ मध्ये (६०. ९३ टन) व सर्वात कमी हेक्टरी उत्पादन टी_{१०} मध्ये नोंदविण्यात आले.

कलम जगण्याची टक्केवारी उपचार टी_१ मध्ये १००% नोंदविण्यात आली. या उपचारामधील रोपाला सरासरी (११४. ९३) पाने, (१४५.५३) सेमी.उंची , (५७.५४ सेमी) मुळाची लांबी व बुंध्याजवळ (२३.९८ मिमी) जाडी लावणी पश्चात १२० दिवसांनंतर नोंदविण्यात आली.

सर्वाधिक खर्च लाभ प्रमाण ३:९१ उपचार टी_१ मध्ये नोंदविण्यात आले असून ते त्याच्या नियंत्रण उपचारापेक्षा लक्षणीय वरिष्ठ आढळून आले.

बागवानी महाविद्यालय, दापोली

जि. रत्नागिरी (४१५ ७१२)

प्रबंध का शीर्षक	: सोलॅनम टोरवम और कोंकण प्रभा मुलकांड लेके बैंगन मे कलम बांधता प्रमाणित करना।
छात्र का नाम	: कु. मुकुंद मधुकर रायकर
पंजीकरण क्र.	: एचडीपीएम/१८/०१६७
अनुसंधान के मार्गदर्शक	: डॉ. राजन गोविंद खांडेकर प्राध्यापक, बागवानी महाविद्यालय, दापोली डॉ. बा. सा. को. कृ. वि., दापोली

गोषवारा

यह प्रयोग बागवानी महाविद्यालय दापोली के अंतर्गत आने वाली ४ नंबर नर्सरी प्रक्षेत्र पे शैक्षणिक वर्ष २०१९ - २० मे किया गया। यह प्रयोग यादृच्छिक आवंला संकल्पना मे १० उपचार पद्धती लेके किया गया. टी_१ २५ दिन के बांधतिवरे लोकल तना कांड को ७० दिवस सोलॅनम टोरवम मुल कांड पर कलम बांधना। टी_२ २५ दिन के बांधतिवरे लोकल तना कांड को ६० दिवस सोलॅनम टोरवम मुल कांड पर कलम बांधना। टी_३ २५ दिन के बांधतिवरे लोकल तना कांड को ३० दिवस कोंकण प्रभा मुल कांड पर कलम बांधना। टी_४ २५ दिन के बांधतिवरे लोकल तना कांड को २५ दिवस कोंकण प्रभा मुल कांड पर कलम बांधना। टी_५ २५ दिन के मंजिरी तना कांड को ७० दिवस सोलॅनम टोरवम मुल कांड पर कलम बांधना। टी_६ २५ दिन के मंजिरी तना कांड को ६० दिवस सोलॅनम टोरवम मुल कांड पर कलम बांधना। टी_७ २५ दिन के मंजिरी तना कांड को ३० दिवस कोंकण प्रभा मुल कांड पर कलम बांधना। टी_८ २५ दिन के मंजिरी तना कांड को २५ दिवस कोंकण प्रभा मुल कांड पर कलम बांधना। टी_९ - बांधतिवरे लोकल साधारण पौधा। टी_{१०} - मंजिरी साधारण पौधा। इन प्रत्येक उपचारों को हूबहू तीन प्रतिकृतियों मे मुक्त क्षेत्र मे दोहराया गया।

प्रयोग के अवलोकन हेतु पौधे की ऊंचाई , पत्तों की संख्या , कलम बंधा के निधलो तन की मोटाई , उत्पादन प्रति पौधा , उत्पादन प्रति हेक्टर इ. आधार पर किया गया।

सर्वाधिक उत्तरजिवीका का दर उपचार टी₄ (२५ दिवस मंजिरी + २१दिवस कोंकण प्रभा) में पाया गया । मुक्त क्षेत्र में रोपण के बाद कलम उत्तरजिवीका का दर उपचार टी_{१०} को छोड़ कर बाकी सभी उपचारों में १०० फिस दी नपा गया.सबसे अधिक ऊंचाई (१४५.५३ सेंमी) उपचार टी_१ में और सबसे कम ऊंचाई (७८.१३ सेंमी) टी_{१०} इस उपचार में आंकी गयी।

प्रथम कटाई को सबसे कम अवधि (५८.४०५ दिन) उपचार टी_५ में पायी गयी और सबसे अधिक कालावधी (७४.०० दिन) उपचार टी_१ में पाया गया। सबसे अधिक फल की लम्बाई और वजन उपचार टी_१ में पाया गया ।

सर्वाधिक उत्पादन उपचार टी_१ में (२.३५ किलो) और सबसे कम उपचार टी_{१०} (१.३१ किलो) में पाया गया। सबसे अधिक प्रति हेक्टर उत्पादन टी_१ (६०.९० टन) और सबसे कम उपचार टी_{१०} में पाया गया ।

रोपण पश्चात कलम उत्तरजिवीका का पर उपचार टी_१ में १०० % प्रतिशत आंका गया । इस उपचार में औसतम पौधा ऊंचाई १४५.५३ सेंमी , पत्ते ११४. ९३ , जड़ की लम्बाई ५७.५४ सेंमी और कलम के निच के तने की मोटाई २३. ९८ एम एम पाई गयी ।

सर्वाधिक लागत लाभ अनुपास ३.९१ उपचार १ में पाया गया जो की नियंत्रण उपचार (३.८२) से काफी बेहतर हे ।

CHAPTER I

INTRODUCTION

Brinjal (*Solanum melongena* L.) belongs to relatives of Solanaceae. Native to some parts of India or Indo-China having chromosome number $2n=24$, Vavilov (1951). It is believed to have originated in Indo-Burma region. It is known by various names viz. eggplant, garden egg, badenakai, vangi, and aubergine etc. Brinjal display a wide range of fruit shapes and colours, ranging from oval or egg shaped to long club-shaped and from white, yellow, green through degrees of purple pigmentation to almost black (Anon., 2016).

Brinjal is a warm season crop and is very susceptible to frost. It is widely grown vegetable crop in Asian countries. In India, it is adapted to a wide range of climatic conditions from north to south and east to west. It is versatile crop adapted to different agro-climatic regions and can be grown throughout the year under mild agro climatic conditions.

Brinjal is weak tropical perennial but grown commercially as an annual crop. After potato, it ranks the second highest consumed vegetable in India, along with tomato and onion. It is extensively grown in China, India, Egypt, Turkey, Iran, Indonesia, Iraq, Japan, Italy, Philippines etc. (Anon., 2018 a).

In India, brinjal is well distributed in Orissa, Bihar, Karnataka, West Bengal, Andhra Pradesh, Maharashtra and Uttar Pradesh. Area under cultivation in India is 7.30 lakh ha and production is 12.8 MT with productivity of 18.53 t/ha. It contributes 5% of the total vegetable production of the country. Maharashtra is the 7th leading producer of brinjal in the country. In Maharashtra, area under brinjal crop is 22,480 ha with annual production of 4.29 lakh tonnes. (Anon., 2018 b).

The unripe fruit is primarily used as a cooked vegetable for the preparation of various dishes in different regions of the world. It has got much potential as raw material in pickle making and dehydration industries (Singh *et al.*, 1963). It is valued for its medicinal properties and has got anti-cholesterol property primarily due to its presence of poly-unsaturated fatty acid (Linoleic and linolenic) present in flesh and seed of fruit in higher amount (65.1%). Presence of magnesium and potassium salt in fruits also important in anti-cholesterol action. In native medicines, role of brinjal in treatment of liver diseases, cough due to allergy, rheumatism, colithiasis leucorrhoea and intestinal worms has been mentioned (Gopalkrishan, 2007).

Brinjal is important solanaceous crop grown under Konkan agro climatic conditions. It is grown all the year round due to mild climatic conditions. It has occupied prominent place in rice based cropping system. There are several commercial pockets cultivating brinjal during rabi season under irrigated situation. However, there are certain limitations in cultivating elite/improved/hybrid varieties due to the susceptibility of these varieties to incidence of bacterial wilt in lateritic soil of Konkan.

Grafting is an alternative approach used in vegetable production to fight against soil-borne diseases such as *Fusarium* wilt, bacterial wilt and nematodes since 1920s in Japan and Korea. Grafting as a technology for the commercial production was later on adopted by many countries in Europe, Middle East, Northern Africa, Central America and other parts of Asia. For the production of many fruit-bearing vegetables which include watermelon, cucumber, melon, tomato, eggplant and pepper, grafted seedlings were used. These seedlings besides providing resistance against biotic/abiotic stresses, increase the yield of the cultivars. This technique is considered eco-friendly for sustainable vegetable production because the resistant rootstock reduces dependence on agrochemicals. Grafting improves quality of the plant and is used to induce resistance against low and

high temperatures. Growth, yield and fruit quality of the scion is greatly influenced by the type of rootstock used. Due to high post graft mortality of seedlings, this technology is still in infancy in India. For its commercial application in India, sharpening of grafting skills and healing environment need to be standardized. The number of unnamed *Solanum* species were reported as graft well matched to cultivated eggplant genotypes (Bletsos *et al.*, 2003; Angela Devis *et al.*, 2008). Brinjal is widely cultivated in different climatic conditions round the world is suitable to grafting (King *et al.*, 2010).

Traditionally, grafting successful on woody perennials as a method to asexually propagated species that did not root well from vegetative cuttings. The grafting involves tying a member of two plant parts (a rootstock and scion) from exclusive plant parts to shape a single, dwelling plant. Grafting in vegetable crops is a simple method of propagation where preferred rootstocks are used to set increased vigour, precocity, more yield and excellent and better survival under wide range of abiotic and biotic stress situations. Grafting reduced the dependency on chemical residues required to treat the soil borne diseases and opened new vista in sustainable production of vegetables. Grafting enhances water and nutrient uptake and nutrient use efficiency (Santa-Cruz *et al.*, 2002), to extend the duration of harvest time and to improve fruit quality (Colla *et al.*, 2006; Fernandez *et al.*, 2004)

Commercialization of this technique will be advantageous in following ways:

- Increasing the yield potential of commercially accepted varieties
- Filling the yield gap under biotic and abiotic stress conditions
- Decreasing the use of chemical fertilizers and pesticides
- Increasing the efficiency of use of natural resources

Grafting methods vary greatly and considerably depending upon the kind of crops, farmers' experiences and preferences, facilities and machines available, numbers of grafting, and even by the purpose of grafting such as grafting for their own uses or for sales only by commercial growers.

In addition innovations are mechanized and robot grafting has given a flip to this novel eco-friendly method (Pandey and Rai, 2003). Semi-or fully automatic grafting robots have been invented with the aid of numerous agricultural industries inside the 1990's, but the models are restrained. The several commercial vegetable crops including eggplant tomato and watermelon are grafted to boom growth, yield, to induce resistance against biotic and abiotic stresses. In Japan hole insertion grafting is the most popular grafting method in watermelon. However, in cucumbers, tongue insertion grafting is most popular among the individual growers producing transplants for their own use. In contrast, the commercial growers prefer splice grafting. In eggplant, individual farmers prefer "splice grafting" whereas the commercial growers definitely prefer splice grafting.

The grafting technique has not been so far tried under Konkan agro-climatic conditions. Earlier the effect of rootstock and scion on success, survival and growth of brinjal grafts was studied by Nagma Surve (2019) under poly house and open field condition. In Konkan region most of framers are lacking facilities of poly house. Therefore it is utmost important to check the performance of grafted brinjal under open field conditions. Hence, experiment entitled 'Standardization of grafting of brinjal (*Solanum melongena* L.) using *Solanum torvum* and var. Konkan Prabha as rootstock' have been planned and executed with following objectives:

- i. To study the effect of age of rootstock and scion on success, survival and growth of brinjal grafts.
- ii. To study the comparative performance of grafted brinjal plants under field conditions.

CHAPTER II

REVIEW OF LITERATURE

In this chapter attempt has been made to review the literature regarding studies on 'Standardization of grafting of brinjal (*Solanum melongena* L.) using *Solanum torvum* and var. Konkan prabha as rootstock'.

2.1 Growth observations

2.1.1 Girth of rootstock and scion (cm) at collar region before grafting

Tremblay *et al.*, (2003) noticed that cleft grafting was mainly used for cucurbitaceae family because the diameter of seedlings stem was thicker than that of the solanaceae family plant.

Rivard (2006) explained that the method of hole grafting was used to graft tomato on eggplant, melon or cucumber, so that the scion diameter was less than the diameter of the rootstock used for grafting.

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success, survival and growth of brinjal grafts and found that highest girth at collar region was observed in 30 days scion and rootstock.

2.1.2 Number of leaves on scion and rootstock before grafting

Khah (2011) reported that aubergine seedlings were grafted by hand, applying the splice grafting method when the scion had 2 true leaves and the rootstock 2.5-3 true leaves.

Kumar *et al.*, (2015) followed that grafting on the rootstock at four to five leaf stage and scion used with 4 leaf stage.

Zeist (2017) reported that grafting was done 24 days after emergence of scion seedling when seedling had 3-4 leaves in tomato.

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success, survival and growth of brinjal grafts and found that maximum number of leaves was noticed in 30 days scion and rootstock.

2.2 After Grafting

2.2.1 Days required for graft union

De Ruiter (2006) suggested that the optimal temperature range for healing of grafted tomato is 21 to 22°C with a maximum temperature range of 28 to 29°C.

Oda (2007) suggested that a temperature range of 28 to 30°C is optimum to heal the grafts. Further, healing environment should be maintained between 85% and 100% RH for both tomato and cucurbit plants.

Onduso (2014) indicated that in tomato 80% of relative humidity ensured high graft success and took five days to heal the grafts.

Kumar *et. al.*, (2015) observed that healing is the most critical process of grafted seedling production. A temperature range of 25-30 °C, relative humidity of 85-90% and low light intensity are required for healing.

Tejaswini Rathod (2017) reported that there was no significant difference among the treatments for days taken to graft healing, however days taken for graft healing w 4 to 5 in brinjal crop.

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success, survival and growth of brinjal grafts and reported that minimum number of days in 20 days old scion and rootstock.

2.2.2 Grafting success (%)

Bletsos *et. al.*, (2003) reported that the percentage of graft success of cv. Tsakoniki on *Solanum torvum* was 84.4 % and 80.8 % in 1998 and 1999 respectively, while on *S. sisymbriifolium* graft success was 77.2 % and 74.8 % in brinjal.

Nina and Joze (2004) reported that the survival rate of tomato transplants grafted on 'Beaufort' and 'PG 3' rootstocks using the cleft grafting method was 100% with cv. 'Monroe' and 92 to 93% with cv. 'Belle' whereas, with the tube grafting method, the survival rate was 79 to 92 % with cv. 'Monroe' and 88 % with cv. 'Belle'.

Gisbert *et al.*, (2011) revealed that 98 %, 100 %, 90 %, 100 % and 100 % graft success were recorded in self-grafted cv. 'Black Beauty', 'Black Beauty' on *S. torvum*, Black Beauty on *S. macrocarpum*, 'Black Beauty' on *Solanum incanum* × *S. melongena* and 'Black Beauty' on *S. melongena* × *S. aethiopicum* respectively.

Nkansanh (2013) observed that tropimech tomato cultivar grafted on green eggplant cultivar recorded 96.07 % graft success.

Tejaswini Rathod (2017) observed that graft success was about 85 to 87 % which might be due to favorable condition provided in the graft chamber *i.e.*, relative humidity of 85-90 % and a temperature range of 21 to 32°C with 50 Lux light under the low tunnel or graft chamber.

Darli *et al.*, (2018) investigated that effect of different rootstock on plant growth, development and yield of grafted Tomato and reported that maximum grafting success (87.3) was recorded in tomato grafted on eggplant.

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success, survival and growth of brinjal grafts and noticed that highest grafting success was found in 25 days scion and rootstock at 5th, 10th, 15th, and 20th days after grafting.

2.2.3 Grafting survival (%)

Yetisir and Sari (2003) reported that survival rate was minimum (65 %) in cucurbita type rootstocks and maximum (95 %) in *Lagenaria* type rootstocks.

Mohamed *et al.*, (2012) opined that survival percent of grafts when cv. 'Aswan F₁' grafted on '6001 F₁', 'Strontosa F₁' and

'Tetsukabuto F₁' was 100 %, 100% and 83.3 % in 2010 and 100 % in all combination.

Hsiu-fung and Yung- fu (2013) reported that cucumber cv. 'Tainan No. 1' was grafted by approach grafting onto two different rootstocks. Survival rates when grafted on *Cucumis* and *Cucurbita* were 80 % and 78 %, respectively.

Bizhen *et al.*, (2014) found that graft survival exceeded 92 % in all eighteen tomato commercial rootstocks and five scion varieties with a study wide average of 97 %.

Rida Draie (2017) said that the tube grafting method gave the lowest survival percentage (85 %), it was exceeded by the method of hole grafting (90 %), while the method of cleft grafting was the superior (95 %) in tomato crop.

Kumar *et al.*, (2017) studied that maximum survival % in T₂ (67.35 %) *Solanum torvum* as rootstock and Pusa hybrid 6 as a scion in brinjal.

Darli wai soe *et al.*, (2018) studied the effect of different rootstock on plant growth, development and yield of grafted Tomato and reported that highest grafting survival rate (92.7%) was recorded in tomato grafted on eggplant.

Kumar *et al.*, (2019) investigated that higher survival percentage of grafted eggplant cv. 'Surati Ravaiya Pink' and 'Surati Ravaiya Purple' grafted on *Solanum torvum* 96.67 and 97.73 % respectively.

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success, survival and growth of brinjal grafts and found that highest (75.33%) survival of grafts was 25 days scion and rootstock.

Rana *et al.*, (2019) investigated the interaction effect of grafting techniques and scion-rootstock combinations of cucumber and reported that highest survival percentage (96%) was observed in

Cucumber cultivar Kalaam F₁ grafted onto bottle gourd by splice grafting.

Priyanka *et al.*, (2019) studied on morphological changes in the compatible graft of Tomato cv. PKM 1 with different solanaceous rootstocks and concluded that highest graft success (95%) was observed in T₂ in which PKM 1 grafted on *Solanum torvum*.

Ahmed *et al.*, (2019) among the various eggplant genotype high level of resistance were detected in *Solanum sisymbilifolium* and *Solanum torvum*.

2.3 After transplanting

2.3.1 Plant height (cm)

Bletsos *et al.*, (2003) reported that seedlings of eggplant cv. 'Tsakoniki' when grafted on *Solanum torvum* Swartz recorded a mean plant height of 124 cm and 116 cm during 1998 and 1999 respectively.

Khah (2005) concluded that height of plant was the highest (90.9cm) in 'Rima' grafted tomato rootstocks 'Primavera' whereas, the lowest plant height was recorded (72.6 cm) in control.

Davis *et al.*, (2006) reported that height of watermelon plant cv. 'SF800' when grafted on 'Gourd' was 430.8 cm, on 'Squash' was 418.5 cm and under control 430.8 cm.

Khah *et al.*, (2006) opined that in tomato cv. 'Big Red' grafted onto rootstock 'Primavera' recorded the highest plant height of 48.44 cm, 91.88 cm and 106.38 cm at 30, 60 and 96 DAT whereas, the lowest plant height (38.00 cm) was recorded in self-grafted cv. 'Big Red' at 30 DAT and in control (80.31 cm and 94.19 cm) at 60 DAT and 96 DAT respectively in greenhouse. Further, in open field cv. 'Big Red' grafted onto rootstock 'Heman' recorded the highest plant height of 53.75 cm, 67.7 cm and 75.13 cm whereas, the lowest plant height was recorded on rootstock 'Primavera' 46.44 cm, 62.50 cm and 69.13 cm at 34, 89 and 130 DAT respectively in open field.

Fotios *et al.*, (2008) observed that traditional greek eggplant cultivar 'Tsakoniki' grafted of *Solanum torvum* were taller and produces more secondary shoots than self- rooted plants

Bekhradi *et al.*, (2011) found that when watermelon cv. 'Charleston Gray' was grafted on 'Ferro' recorded the highest main stem length (4.98 m) whereas, the lowest plant height was recorded (3.40 m) in control.

Mohamed *et al.*, (2012) concluded the highest length of main stem (265.67 cm and 241.8 cm) in watermelon cv. 'Aswan F₁' grafted on rootstock '6001 F₁' and 'Aswan F₁' on 'Tetsukabuto F₁' in 2010 and 2011 respectively whereas, the lowest plant height was recorded in control (135.17 cm and 195.0 cm).

Petropoulos *et al.*, (2012) showed the highest plant height (15.7 cm and 14.2 cm) when 'Sugar Baby' grafted onto 'Rootstock 841 F₁' whereas, the lowest plant height was recorded in control (5.1 cm and 7.6 cm) at 34 days after grafting at 8 °C and 16 °C in watermelon respectively.

Nkansanh *et al.*, (2013) reported that maximum plant height observed in 'Remo' tomato cultivar grafted on 'Green' eggplant cultivar (49.80 cm) after 35 days after transplanting.

Johnson *et al.*, (2014) observed that the highest plant height (2467.95 mm) was recorded when eggplant cv. 'Epic' grafted on to 'Beaufort'.

Petropoulos *et al.*, (2014) recorded that the highest plant height (150.7 cm) was recorded when watermelon cv. 'Obla F₁' grafted on 'TZ 148' (*Cucurbita maxima* × *Cucurbita moschata*) whereas, the lowest plant height was recorded (108.5 cm) in self-rooted 'Obla F₁'.

Sayed *et al.*, (2014) reported that when cucumber cv. 'Hady' grafted on the rootstock 'Ferro' recorded average plant height of 69.33 cm, 67.67 cm and 196.50 cm in summer planting whereas, 51.00 cm,

118.30 and 163.0 cm in winter planting at 30, 60 and 90 days respectively.

Kumar *et al.*, (2016) observed the highest plant height of capsicum (160.44 cm) when grafted on 'chilli' rootstock (PI-201232) whereas, on 'brinjal' rootstock (VI-047335) plant height was recorded the lowest (110.35 cm) which was quite low as compared to chilli rootstocks.

Sabatino *et al.*, (2016) concluded that the highest plant height (62.80 cm) was recorded in brinjal 'Ecotype B₁' grafted on '*Solanum torvum* Swartz' and the lowest plant height was recorded (56.6 cm) in non-grafted 'B₃ ecotype' at 35 days, whereas, at 60 days of planting, plant height was highest (110.4 cm) in 'B₂' grafted on '*S. torvum* Swartz'. Further, the lowest plant height was recorded in non-grafted 'B₂'.

Kumar *et al.*, (2016) revealed that the maximum plant height (87.64 cm) was recorded in grafted 'Surati Ravaiya Pink' (84.12 cm) whereas, minimum plant height (77.71 cm) was recorded in control self-rooted 'Surati Ravaiya Purple'.

Kumar *et al.*, (2017) reported that maximum plant height (54.85cm) in T₁ *Solanum torvum* as rootstalk and Pusa Shyamla as a scion while minimum plant height observed in control in brinjal.

Tejaswini Rathod (2017) reported that plant height (91.47 cm) was maximum in grafted 'Mahyco-9'. Further, minimum plant height (70.80 cm) was observed in self-rooted 'Lalitha' in brinjal.

Abd El-Wasim mona M. *et al.*, (2018) studied on the effect of grafting eggplant onto certain solanaceous rootstocks and found that maximum plant height (1.77 m) in treatment where *Solanum torvum* used as rootstock while minimum (0.82 m) observed in treatment where *L. esculentum* (cv. Super strain-VFN) used as a rootstock.

Kumar *et al.*, (2019), observed that plant height was significantly higher in grafted plant of 'Surati Ravaiya Pink' and 'Surati Ravaiya

Purple' and showed gain of 8.11 and 5.64 % respectively compared to non-grafted brinjal plant.

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success, survival and growth of brinjal grafts and reported that at 120 days after transplanting highest (78.13 cm) plant height was found in 30 days scion and rootstock while lowest (56.58 cm) plant height was observed in control under open field condition.

2.3.2 Number of leaves

Yetisir and Sari (2003) observed that when watermelon cultivar 'Crimson Tide' was grafted on rootstock 'Gold Tosa' (GT) the highest average number of leaves per plant (287) was recorded whereas, the lowest number of leaves (109) was recorded in control at 50 days after transplanting.

Mohamed *et al.*, (2012) reported that the highest number of leaves (127.25 and 141.0) of cv. 'Aswan F₁' when grafted on rootstock '6001 F₁' and 'Aswan F₁' on 'Tetsukuto F₁' in 2010 and 2011 respectively and the lowest leaf number was recorded in control (135.17 and 195.0 respectively) in tomato.

Petropoulos *et al.*, (2012) found that the highest leaf number (4.3 and 5.2) was observed when 'Crimson Sweet' grafted on 'Rootstock Molina' (*Lagenaria siceraria* f. *clavata*) at 34 days after grafting at 8°C and 16°C respectively whereas, the lowest number of leaves were recorded under control (3.8 and 4.6) in watermelon.

Petropoulos *et al.*, (2012) concluded that the highest leaf number was recorded when 'Sugar Baby' grafted on 'Rootstock Molina' (*Lagenaria. siceraria* f. *clavata*) at 34 days after grafting at 8°C and 16°C was 4.5 and 5.6 in first year whereas, onto 'Rootstock 841 F₁' number of leaves was recorded about 7.1 and 6.3 respectively in second year. Further the lowest leaf number was observed under control 4.8 and 5.6 in first year whereas, 6.0 and 5.8 in second year at respective temperatures in watermelon.

Petropoulos *et al.*, (2014) recorded the highest leaf number when watermelon cv. 'Obla F₁' grafted on 'TZ 148' (32.3) and lowest number of leaves was observed in self-rooted 'Obla F₁' (25.0). In 1st order lateral stem leaf number was recorded the highest (53.0) when cv. 'Obla F₁' grafted on 'TZ 148' and recorded the lowest leaf number (41.5) in self-rooted 'Obla F₁'.

Sabatino *et al.*, (2016) opined the highest number of leaves (53) in brinjal 'ecotype B₄' grafted on '*Solanum torvum* Swartz' whereas, the lowest leaf number was observed in non-grafted 'B₂ ecotype' (29.4 leaves).

Tejaswini Rathod (2017) found that at 90 DAT 'Lalitha' recorded the highest number of leaves (371.00) as compared to other treatments followed by grafted brinjal 'Mahyco-9' (341.80) whereas in self-rooted 'Sharpovala' lowest number of leaves (206.13)

Nagma Surve (2019) studied on the effect of age of rootstock and scion on success and reported that at 120 days after transplanting maximum (121.93) number of leaves, while lowest (107.20) number of leaves was noticed in control under open field condition.

Kumar *et al.*, (2017) studied that maximum number of leaves (24) in T₁ *Solanum torvum* as rootstock and Pusa Shyamla as a scion while minimum plant height observed in control in brinjal.

Priyanka *et al.*, (2019) investigated the morphological changes in the compatible graft of Tomato cv. PKM 1 with different solanaceous rootstocks and observed that highest number of leaves in control (self-rooted PKM-1) after 30 days of grafting.

2.3.4 Length of main root (cm)

Kumar *et al.*, (2017) found that the largest root length of 56.50 cm was recorded when 'Pusa Shyamala' grafted on *Solanum torvum* and smallest root length of 22.50 cm for non-grafted plants of brinjal.

Nagma Surve (2019) stated that significantly longest length of main root (41.93 cm) was recorded in treatment T₆ (30 days scion and 25 days rootstock) whereas shortest length of main root (33.80 cm) was recorded in T₁₀ (control) in brinjal.

2.3.5 Number of secondary roots

Kumar *et al.*, (2017) revealed that the highest number of primary roots 14.75 were recorded when 'Pusa Hybrid-6' grafted on '*Solanum torvum*' and lowest number of primary roots 7.25 when 'Pusa Hybrid-6' grafted on '*Solanum xanthocarpum*' in brinjal .

Nagma Surve (2019) stated that significantly maximum number of secondary root (512.57) was recorded in treatment T₇ (20 days scion and 25 days rootstock) whereas lowest number of secondary root (402.97) was recorded in T₁₀ (control) in brinjal.

2.3.6 Stem diameter (mm)

Sebahattin *et al.*, (2009) found that average stem diameter of the grafted plants of both cultivars were found to be 53% greater than of the controls, and the highest and the lowest average stem diameters were obtained from grafted 'Pala' (40.15 mm) and un-grafted 'Faselis' (18.19 mm) plants, respectively.

Bletsos *et al.*, (2003) revealed that stem diameter increased in scions of certain eggplant varieties grafted onto '*S. torvum*'.

Leonardi & Giuffrida (2006) found that the stem diameter of self-grafted eggplants was equal to or lower than that of eggplant grafted onto different tomato rootstocks.

Al-Harbi *et al.*, (2013) observed that stem diameter of tomato grafts under different levels of water stress were 14.60 mm and 12.57 mm at 100% and 80% respectively.

Al-Harbi *et al.*, (2013) reported that maximum stem diameter 13.12 mm was found in grafted tomato compared to non- grafted tomato (12.61 mm).

Nagma Surve (2019) stated that at 120 days after transplanting maximum (23.09 mm) stem diameter of graft union was recorded in T₈ (25 days scion and 30 days rootstock) whereas minimum stem diameter at graft union (22.24 mm) was recorded in treatment T₁.

2.3.7 Number of branches

Davis *et al.*, (2006) reported that number of laterals of watermelon cv. 'SF800' when grafted on gourd was 18.3, on squash was 18 and under control it was recorded 16 laterals per vine.

Bekhradi *et al.*, (2011) concluded the effect of three cucurbit rootstocks on vegetative and yield of 'Charleston Gray' in watermelon and reported that cv. 'Charleston Gray' when grafted onto *Cucurbita pepo* recorded the highest number of laterals (10.96) and the lowest number of laterals (8.42) was recorded under control.

Mohamed *et al.*, (2012) recorded that the highest number of laterals (24.17) of watermelon cv. 'Aswan F₁' grafted on rootstock '6001 F₁' and on 'Tetsukabuto F₁' recorded about 23.00 laterals in 2010 and 2011 respectively.

Tejaswini Rathod (2017) opined that at 90 DAT grafted 'Lalitha' recorded the highest number of branches (13.07) followed by grafted 'Mahyco-9' (11.87) whereas, the lowest number of branches (8.20) was recorded in self-rooted 'Sharpova'.

Nagma Surve (2019) stated that at 120 days after transplanting maximum (15.13) number of branches was recorded in T₉ (30 days scion and rootstock) whereas minimum number of branches (8.40) was recorded in control.

2.3.8 Days required for initiation of flowering

Ndereyimana *et al.*, (2013) recorded lowest number of days to 50% flowering (31.50 and 16.50 days) in eggplant (*Solanum melongena* L.) grafts under different spacing and fertigation levels.

Kumar *et al.*, (2017) found that days required for initiation of flowering for grafted plants of brinjal were highest (46.37) than the non-grafted plants (34.62) because in grafted plants the formation of graft union between scion and rootstock necessary to translocate food material from root system to apical parts of plant and leads the delayed flowering in grafted plants.

Sabitano *et al.*, (2018) reported that brinjal grafted on *Solanum torvum* rootstock gave the shortest time of first flower emission (49.4 DAT).

Nagma Surve (2019) stated that under open field conditions, slightly delayed flowering was observed as compared to polyhouse conditions and was in range of 44.67 to 46.33 days with mean 45.43 days.

Kumar *et al.*, (2019) observed that grafted plant showed significantly earliest in flowering taking 38.60 day in brinjal cv. Surati ravaiya pink, than self-rooted Surati ravaiya pink.

2.3.9 Days required for 50 percent of flowering

Yetisir and Sari (2003) revealed that when watermelon cultivar 'Crimson Tide' was grafted onto rootstock *Cucurbita maxima* (CMA) resulted in early male (95.32 days) and female flowering (103.87 days) from sowing to first flowering whereas, control took 102.62 and 111.25 days from sowing to first flowering respectively.

Sharma (2006) observed that, the brinjal cultivar 'PPL' showed 100 per cent flowering after 35-45 days after planting.

Gunjeet *et al.*, (2008) investigated 622 landraces of brinjal and revealed that, the plants took on an average of 41 days after transplanting for 50 per cent flowering.

Madhur *et al.*, (2009) evaluated 30 genotypes of brinjal and reported that, the days required for 50 per cent flowering was 99 days after sowing and further reported that, the mean number of days required for complete flowering is 110 days after sowing.

Quamruzzaman *et al.*, (2009) analyzed the genetic divergence in 19 genotypes of eggplant and observed that, the number of days for 50 per cent flowering ranged from 78 days to 91.5 days.

Assinapol *et al.*, (2017) opined that the 75 and 100 per cent RDF were on par for early flowering (32.00 and 32.38 days in main crop; 16.88 and 17.00 days in ratoon crop) and the reason for which spacing did not affect significantly the days to first harvest could be that, at the initial stage up to the first harvest, there was no competition for space among different spacing levels.

Tejaswini Rathod (2017) evaluated that an average of 43 to 48 days were recorded for 50% flowering after transplanting whereas, 'Lalitha' grafted and own rooted took the lowest number of days (43.33) and 'Arka Anand' took the highest number of days (48.49).

2.3.10 Days required for first harvest

Assinapol *et al.*, (2017) concluded that early harvest was observed in main crop of brinjal grafts that is 44.38 and 45.44 days and the reason for which spacing did not affect significantly the days to first harvest could be that, at the initial stage up to the first harvest, there was no competition for space among different spacing levels.

Kekan (2018) opined that days required for first harvest in cultivar Bandhitiware local (seedlings) were 81.67 days.

Nagma Surve (2019) indicated that the days required for first harvest under open field conditions varied non-significantly in range of 75.67 to 78.33 with mean of 76.83 days.

Kumar *et al.*, (2019), concluded that the grafted brinjal plant showed an earliness more than five days in comparison to their analogous.

2.3.11 Days required for last harvest

Kekan (2018) observed that days required for last harvest in cultivar Bandhtiware local (seedlings used) were 138.40 days.

Nagma Surve (2019) observed that non-grafted brinjal plants record lowest days to last harvest than grafted brinjal plants.

Samruddhi Diwale (2019) reported that last harvest was in the range of 70-80 days in grafted capsicum.

2.3.12 Span of harvest

Haldavnekar (2015) reported that span of harvest was significantly varied between 29 progenies of brinjal under study and it was in range of 53.50 days to 74.50 days with the mean of 60.98 days.

Nagma Surve (2019) recorded that lowest span of harvest (60 days) in brinjal was observed in control while highest span (67 days) observed in T₉. (3 days old scion grafted on 30 days old rootstock).

2.3.13 Fruit length (cm)

Davis *et al.*, (2006) concluded that fruit length of cv. 'SF800' when grafted on gourd was 33.1cm, on squash was 31.3 cm and under control was recorded 31cm.

Bekhradi *et al.*, (2011) recorded that cv. 'Charleston gray' was grafted onto 'Ferro' gave fruit length of 39.33 cm and on '*Cucurbita pepo*' recorded the lowest fruit length of 36.58 cm.

Johnson *et al.*, (2014) opined that the highest fruit length was recorded when eggplant cv. 'Epic' grafted on to 'Beaufort' (20.29 cm) whereas, the lowest fruit length was recorded (18.22 cm) onto rootstock '*Solanum aethiopicum*'.

Sayed *et al.*, (2014) found that when cucumber cv. 'Hady' grafted onto the rootstock 'Ferro' recorded the highest average fruit length (15 cm, 14.17 cm and 15 cm) at 30th, 60th and 90th day respectively in summer planting whereas, in winter planting grafted cv. 'Hady' recorded the highest fruit length (15.17 cm, 15.0 cm and 15 cm).

Kumar *et al.*, (2016) revealed that the chilli rootstock 'AVPP0205' resulted in longer fruits (8.52 cm) whereas, brinjal rootstocks resulted in to fruit length of 7.74 cm to 7.66 cm in capsicum plants.

Kumar *et al.*, (2019) observed maximum fruit length in grafted 'Surati Ravaiya Pink' (8.1 cm) followed by self-rooted 'Surati Ravaiya Pink' 8.06 cm whereas, minimum fruit length (6.71 cm) was recorded in control self-rooted 'Surati Ravaiya Purple'.

Tejaswini Rathod (2017) reported that the highest fruit length was recorded (23.33 cm) by grafted 'Mahyco-9' followed by self-rooted 'Mahyco-9' (20.70 cm) and the lowest fruit length (8.17 cm) was recorded in Self rooted 'Lalitha'.

2.3.14 Fruit diameter (mm)

Turhan *et al.*, (2011) concluded the effects of grafting on different rootstocks on tomato fruit yield and quality and concluded that 'Swanson' on 'Beaufort' recorded a fruit index of 1.35.

Francisco *et al.*, (2014) recorded the influence of three rootstocks on yield and commercial quality of 'Italian sweet pepper' and reported that 'Palermo' onto 'Tresor' gave the highest values (50.19 mm) whereas, non-grafted 'Palermo' recorded the lowest values (49.87 mm).

Johnson *et al.*, (2014) opined that highest fruit diameter (9.7 cm) was recorded when eggplant cv. 'Epic' grafted on to 'Beaufort' whereas, the lowest fruit diameter (8.07 cm) was recorded onto rootstock '*Solanum aethiopicum*'.

Sayed *et al.*, (2014) found that when cucumber cv. 'Hady' grafted onto the rootstock 'Ferro' gave the highest average fruit diameter of 30.17 mm, 31.17 mm and 30.50 mm at 30, 60 and 90 days respectively in summer planting whereas, during winter planting an average fruit width of 25.67 mm, 25.67 mm and 27.33 mm was recorded at 30th, 60th and 90th day after planting.

Kumar *et al.*, (2016) revealed that 'Indra' grafted on to rootstock 'Pant C-1' gave maximum fruit width of 7.29 cm followed by 'Indra' on 'Surajmukhi' 7.31 cm.

Kumar *et al.*, (2019) observed maximum fruit diameter in grafted 'Surati Ravaiya Purple' (7.62 cm) followed by self-rooted 'Surati Ravaiya Purple' (7.56 cm) whereas, minimum fruit diameter (6.00 cm) was recorded in control (self-rooted 'Surati Ravaiya Purple').

Tejaswini Rathod (2017) reported that grafted 'Sharpova' recorded maximum fruit diameter of about 7.00 cm followed by self-rooted 'Sharpova' (5.33 cm) and minimum (3.27 cm) was recorded in self-rooted 'Arka Anand'.

2.3.15 Fruit weight (g)

Bletsos *et al.*, (2003) observed that the seedlings of 'Tsakoniki' when grafted on '*Solanum torvum* Swartz' recorded mean fruit weight of 137.7g and 226.5 g during 1998 and 1999 respectively.

Yetisir and Sari (2003) reported that when cultivar 'Crimson Tide' was grafted onto rootstock 'Skopje' (*Lagenaria* hybrid) recorded the highest fruit weight (8.80 kg) whereas, the lowest fruit weight (2.03 kg) was recorded onto rootstock '*Cucurbita moschata*' (CMO).

Colla *et al.*, (2006) concluded that highest mean weight (1.89 kg) fruit was observed when cv. 'Tex' grafted onto rootstock 'Ercole' (*Cucurbita maxima*) at salinity 2.0 dS/m² whereas, the lowest fruit weight was recorded (1.13 kg) in control at salinity 5.2 dS/m².

Khah *et al.*, (2006) opined that the cv. 'Big Red' grafted onto 'Heman' gave highest fruit weight of 7568.16 g and 2096.25 g while, lowest fruit weight was recorded in 4995.16 g and 1771.88 g in greenhouse and open field respectively.

Abdelmageed and Gruda (2009) found that the highest fruit weight was recorded at temperature of 37/27 and 26/20 °C in 'Summerset' self-rooted plants was 13.13 g and 284.00 g respectively in tomato.

Sebahattin *et al.*, (2009) observed that when eggplant 'Faselis' was grafted on '*S. torvum* Swartz', mean fruit weight increased by 20%.

Victoria and Francisco (2009) concluded an increase in average fruit weight in watermelon grafted plants compared to non-grafted plants varied from 13% to 28%.

Turhan *et al.*, (2011) compared the fruit characteristics of 'Yeni Talya' on 'Beaufort' were with those of non-grafted plants where the weight of fruit was (202.09 g/fruit) significantly influenced by grafting.

Alessandra *et al.*, (2013) recorded the average weight of fruits was significantly higher in all the grafted plants (274.2 g) especially for big sized cultivars. 'Birgah' characterized by big sized fruit and recorded the highest average fruit weight (321.8 g) whereas, Longo (lengthened shape fruit) produced fruits of 184.1g on average.

Johnson *et al.*, (2014) opined that the highest fruit weight was recorded when eggplant cv. 'Epic' grafted on to 'Beaufort' was 0.50 kg whereas the lowest fruit weight was recorded in self-grafted plants.

Petropoulos *et al.*, (2014) found highest fruit weight (6.4 kg) when cv. 'Obla F₁' grafted onto 'TZ 148' (*Cucurbita maxima* × *Cucurbita*

moschata) whereas the lowest fruit weight was (6.3 kg) in self-rooted 'Obla F₁'.

Sayed *et al.*, (2014) revealed that when cucumber cv. 'Hady' grafted onto the rootstock 'Ferro' recorded an average weight of fruits (70.67, 69.67 and 69 g) in summer planting whereas, average fruit weight (68.67, 68.67 and 69 g) in winter planting at 30, 60 and 90 days respectively.

Kumar *et al.*, (2016) observed the evaluation of chilli and brinjal rootstocks for growth, yield and quality of bell pepper (*Capsicum annuum* L. Var. Grossum Sendt.) under protected conditions and reported that the average weight of fruits per plant was 99.73 g in rootstock of capsicum 'PI-201232'.

Kumar *et al.*, (2019) reported the maximum fruit weight (73.43 g) was recorded in grafted 'Surati Ravaiya Pink' followed by self-rooted 'Surati Ravaiya Pink' (73.06 g) whereas, the minimum fruit weight (69.02 g) was recorded in self-rooted 'Surati Ravaiya Purple' (control).

Tejaswini Rathod (2017) concluded that grafted 'Sharpova' recorded the highest average fruit weight (260.00 g) per fruit followed by self-rooted 'Sharpova' (233.33 g) whereas, the lowest fruit weight was recorded in 'Arka Anand' (91.33 g).

Assinapol *et al.*, (2017) stated that the plants spaced by 1.5 m x 1.5 m recorded the highest fruit weight (67.44 and 63.71 g) and number of fruits plant-1 (243.30 and 126.32) in main and ratoon crops respectively.

Kumar *et al.*, (2017) reported that maximum weight of fruit observed in T₂ *Solanum torvum* as rootstalk and Pusa hybrid 6 as a scion while minimum fruit weight observed in control.

Bletsos *et al.*, (2003) opined that seedlings of 'Tsakoniki' when grafted on '*Solanum torvum* Swartz' recorded the fruit yield of 2867 g and 993 g during 1998 and 1999 respectively.

Nina and Joze (2004) used two cultivars as scion were 'Monroe' and 'Belle', and as rootstock 'PG 3' and 'Beaufort'. Two grafting methods were applied: cleft grafting and tube grafting. Results showed that cv. 'Monroe' under cleft grafting recorded yield of 4718.0 g/plant and under tube grafting about 3091.0 g/plant whereas in cv. 'Belle' under cleft grafting yields 3004.0 g/plant and under tube grafting yield was recorded about 3591.3 g/plant.

Khah (2005) revealed the yield per plant was recorded the highest (15.3 kg/plant) when 'Rima' grafted tomato rootstocks 'Primavera' whereas, the lowest yield was recorded in control (9.5 kg/plant).

Colla *et al.*, (2006) reported the highest mean yield of fruits (11.1 kg per plant) when cv. 'Tex' grafted onto rootstock 'Ercole' (*Cucurbita maxima*) at salinity 2.0 dS/m² whereas, the lowest yield was recorded in control (4.9 kg per plant) at salinity 5.2 dS/m².

Gisbert *et al.*, (2011) observed the highest yield per plant (6.9 kg) in 'Black Beauty' on rootstock *Solanum incanum* × *S. melongena* and the lowest yield (3.4 kg) was recorded in was 'Black Beauty' on '*S. macrocarpum*'.

Turhan *et al.*, (2011) opined the effects of grafting on different rootstocks on tomato fruit yield and quality and concluded that the fruit yield of 'Yeni Talya' on 'Beaufort' was 6.77 kg per plant and stated that the fruit index (diameter/length), number of fruits/truss and fruit weight were significantly influenced by grafting.

Kumar *et al.*, (2016) evaluated chilli and brinjal rootstocks for growth, yield and quality of bell pepper (*Capsicum annuum* L. Var. Grossum sendt.) under protected conditions and reported that the highest fruit yield per plant (2.47 kg) was recorded with the chilli rootstock PI-201232, followed by VI-037556 (1.97 kg) and AVPP0205 (1.91 kg) which were statistically at par.

Sabatino *et al.*, (2016) concluded that the highest yield per plant was recorded in 'ecotype' B1 grafted on '*Solanum torvum* Swartz' about

4.38 kg and the lowest yield was recorded in non-grafted 'B4 ecotype' about 1.82 kg.

2.3.17 Fruit yield per ha (t)

Yetisir and Sari (2003) observed that when cultivar 'Crimson Tide' was grafted onto rootstock 'Skopje' (*Lagenaria* hybrid) recorded the highest fruit yield of 13.26 kg/m² whereas, the lowest yield was recorded onto rootstock 'P360' (*Cucurbita* hybrid) about 1.89 kg/m².

Besri (2008) recorded the average yield of melon and watermelon plants grafted on different *Cucurbita* hybrids (*C. maxima* x *C. moschata*) as rootstocks were much higher than the yields of the non-grafted plants. The yield increase was 44 % and 84 % for melon and watermelon respectively.

Petropoulos *et al.*, (2014) opined the highest yield (88008 kg/ha) when cv. 'Obla F₁' grafted onto 'TZ 148' (*Cucurbita maxima* x *Cucurbita moschata*) whereas the lowest yield (50233 kg/ha) was recorded in self-rooted 'Obla F₁'.

Sayed *et al.*, (2014) revealed that when cucumber cv. 'Hady' grafted onto the rootstock 'Ferro' in summer planting recorded the highest early fruit yield of 2.668 kg/m² and total yield of 11.668 kg/m² whereas, in winter planting early yield of 3.583 kg/m² and total yield of 14.750 kg/m² was recorded.

Kumar *et al.*, (2016) concluded the highest fruit yield in grafted 'Surati Ravaiya Purple' (44.46 t/ha) followed by self-rooted 'Surati Ravaiya Purple' (31.67 t/ha) whereas, lowest yield was recorded in control self-rooted 'Surati Ravaiya Pink' (17.60 t/ ha).

Kumar *et al.*, (2017) stated that maximum yield per plant observed in T₂ *Solanum torvum* as rootstalk and Pusa hybrid 6 as a scion while minimum yield per plant observed in control .

Abd El-Wasim mona M. *et al.*, (2018) studied on the effect of grafting eggplant onto certain solanaceace rootstocks and found that

maximum yield (3.860 kg/plant) in treatment where *Solanum torvum* used as rootstock while minimum (1.010) observed in treatment where *L. esculentum* (cv. Super strain-VFN) used as a rootstock.

Nagma Surve (2019) recorded maximum yield (1.59 kg) was in T₄ while minimum yield recorded in T₁₀ which is self-rooted plant.

Semiz *et al.*, (2019) reported that higher fruit yield observed in 'Maxifort' an eggplant cultivar grafted on *Solanum torvum* relative to non-grafted plants in all salinity treatments.

CHAPTER III

MATERIAL AND METHODS

The information pertaining to the materials used and methodology followed as per the experiment details during the present investigation entitled, 'Standardization of grafting of brinjal (*Solanum melongena* L.) using *Solanum torvum* and var. Konkan Prabha as rootstock' are presented in this chapter.

2.1 Experimental Site

The field experiment was conducted at the Hi-tech Unit and 4-number nursery, College of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli Dist. Ratnagiri (M.S.) India 415 712 during year 2019-20 in rabi season.

2.2 Place and Weather Conditions

The Konkan region lies in the west coast of Maharashtra at 17° 45' N latitude and 73° 12' E longitude. Dapoli presents more or less tropical climate having average humidity 78% throughout the year. The average minimum and maximum temperature is 14.85° C and 32.57° C, respectively with an average annual precipitation 3938 mm which is generally received from June to October. It is situated at 240 meter from mean sea level. (Weather data is given in Appendix 2).

2.3 Details of Experiment

2.3.1 Treatment Details

The experiment comprises of ten treatments with three replications laid out in Randomized Block Design (Figure 1).

Rootstock: 1 *Solanum melongena* L. cv. 'Konkan prabha' 30 days

2. *Solanum melongena* L. cv. 'Konkan prabha' 25 days

3. *Solanum torvum* 70 days

4. *Solanum torvum* 60 days

- Scion:**
1. *Solanum melongena* L. cv. 'Manjiri'
 2. *Solanum melongena* L. cv. Bandhware local

Treatment details:

T₁	:	70 days <i>Solanum torvum</i> rootstock +25 days Bandhware local scion
T₂	:	60 days <i>Solanum torvum</i> rootstock +25 days Bandhware local scion
T₃	:	30 days Konkan prabha rootstock + 25 days Bandhware local scion
T₄	:	25 days Konkan prabha rootstock + 25 days Bandhware local scion
T₅	:	70 days <i>Solanum torvum</i> rootstock +25 days Manjiri scion
T₆	:	60 days <i>Solanum torvum</i> rootstock +25 days Manjiri scion
T₇	:	30 days Konkan prabha rootstock +25 days Manjiri scion
T₈	:	25 days Konkan prabha rootstock +25 days Manjiri scion
T₉	:	Seedling of Bandhware local
T₁₀	:	Seedling of Manjiri

2.3.2 Sowing:

Seeds of both rootstock and scion were sown in protrays containing cocopeat and vermicompost in 3:1 ratio as per the treatments.

2.3.3 Seedling raising

Seedlings of various age treatment wise were exposed to sunshine for 5-6 hours in a day after germination.

2.3.4 Method of grafting grafting:

Splice grafting was carried out when scion and rootstock seedlings attained their respective age according to the treatments. 1.6 mm silicon grafting clips were used for grafting.

The grafts were placed in the healing chambers to ensure high grafting success. They were kept in the chambers with a relative humidity of 85-95 % and 28-32⁰c temperature for seven to ten days to allow the graft union to heal, then light was gradually increased and relative humidity was decreased (Plate 2).

After eight days grafts were transferred to hardening chamber.

2.4 Collection of Data:

Five plants per treatment per replication were selected randomly for recording observation.

2.4.1 Before grafting:

2.4.1.1 Girth of rootstock at collar (mm)

The replication wise girth of rootstock at collar region was measured by digital Vernier Caliper Scale.

2.4.1.2 Girth of scion at collar (mm)

The replication wise girth of scion at collar region was measured by digital Vernier Caliper Scale.

2.4.1.3 Number of leaves on rootstock

Number of leaves on rootstock seedling replication wise was recorded before grafting.

2.4.1.4 Number of leaves on scion

Number of leaves on scion seedling replication wise was recorded before grafting.



Seedling



Grafting



Grafts in Heeling Chamber



Grafts in Hardening Chamber



Grafts ready for transplanting

Plate 2: Grafting procedure

2.4.2 After grafting:

2.4.2.1 Days required for graft union

The observation of number of days required to heal the graft union was recorded by removing the silicon grafting clip.

2.4.2.2. Grafting success (%)

The observation was recorded at 7th, 14th and 21th days after grafting. It was calculated by number of plants alive to the total number of plants grafted multiplied by hundred and expressed in percentage.

2.4.2.3. Grafting survival (%)

The mortality of the grafts was recorded and survival percentage was calculated by number of plants survived to the total number of plants grafted multiplied by hundred and expressed in percentage.

2.4.2.4. Girth at collar region (mm)

The girth of scion at collar region was measured by digital vernier caliper scale.

2.4.2.5. Girth at graft union (mm)

The girth of graft at graft union was measured by digital vernier caliper scale.

2.5 Transplanting

The grafts were ready for transplanting treatment wise under open field conditions. The grafts were transplanted 1 month after grafting and regular cultivation practices were followed as per standard package of practices (Plate 1).



Plate 1: General view of experimental plot of brinjal grafts under field condition

2.6 Aftercares

2.6.1 Application of manures and fertilizers

Fertilizer was applied at rate of 100:50:50 kg/ha in the form of urea and sulphala along with basal dose of F.Y.M.

2.6.2 Other cultural practices

Hand weeding was done as and when necessary during the cropping period. Irrigation was given depending on the soil moisture conditions. Timely plant protection measures were taken to protect crop from pests and disease infection.

2.7 Biometric observations

2.7.1 Growth parameters:

The growth parameters of transplanted grafts as per treatment details were recorded replication wise of the observation plant.

2.7.1.1 Survival of plants after transplanting

The observation was recorded after transplanting in field conditions. It was calculated by number of plants survived to the total number of plants transplanted multiplied by hundred and expressed in percentage.

2.7.1.2 Plant height (cm)

Plant height was recorded by measuring the length from base to the tip of apical top most leaf. The readings were taken from the 5 tagged plants and average was worked out and expressed in centimeters.

2.7.1.3 Number of leaves

Number of leaves was recorded by counting each leaf at 15 days interval. The readings were taken from 5 tagged plants and average was worked out and expressed in numbers.

2.7.1.4 Length of main root (cm)

Length of tap root from five selected grafts/seedling from each replication of all treatment combinations was recorded four months after transplanting with the help of measuring scale and average tap root length is expressed in centimeter.

2.7.1.5 Number of secondary roots

Number of secondary roots from five selected grafts /seedlings replication wise were recorded and average was calculated and expressed in numbers.

2.7.1.6 Stem diameter above graft union (mm)

The stem diameter of graft at above graft union was measured by digital Vernier Caliper Scale.

2.7.1.7 Stem diameter at graft union (mm)

The stem diameter of graft at graft union was measured by digital Vernier Caliper Scale.

2.7.1.8 Number of branches

Number of branches was recorded by counting total branches at 15 days interval and average was worked out and expressed in numbers.

2.7.1.9 Days required for initiation of flowering

Days required for initiation of flowering was recorded by counting the number of days required for flower initiation after transplanting.

2.7.1.10 Days required for 50% flowering

Days required for 50% flowering was recorded by counting the number of days required by 50% of plant population to flower from the date of transplanting.

2.7.2 Yield attributes

2.7.2.1 Days required for first harvesting

Number of days required for first harvesting from the date of transplanting was recorded in each treatment.

2.7.2.2 Days required for last harvesting

Number of days required for last harvesting from date of transplanting was recorded in each treatment.

2.7.2.3 Span of harvest

The span in days from first harvest to last harvest was worked out and recorded as span of harvest.

2.7.2.4 Number of fruit per plant

2.7.2.5 Fruit yield (kg/plant)

The weight of harvested fruits of five tagged plants at each harvesting was measured by using electronic weighing balance. Then after calculating total yield of observational plants and average was calculated and recorded as fruit yield per plant in kg.

2.7.2.6 Fruit yield (t/ha)

The yield obtained per plot from each treatment was converted into yield per hectare by multiplication factor and expressed in t/ha.

2.7.3 Physical parameters of the fruit

Randomly selected fruits were taken from each treatment replication wise and used for recording different physical parameters of fruits and replication wise mean values were worked out.

2.7.3.1 Fruit length (cm)

The linear distance between the peduncle and pistillate end of randomly selected fruits was measured with the help of Vernier Caliper and average was scaled and recorded as a length of fruit in centimeter.

2.7.3.2 Fruit diameter (mm)

The girth of randomly selected fruits was measured at middle portion of fruit by Vernier Caliper and their average was recorded as girth of fruit in centimeter.

2.7.3.3 Fruit weight (g)

Weight of fruit of randomly selected fruits was recorded on electronic top balance and average was worked out.

2.8 Statistical analysis

The data obtained in the present study was analyzed as per the method suggested by Panse and Sukhatme (1995). The critical difference at 5 per cent level of probability was used for comparing treatments.

CHAPTER IV

RESULTS AND DISCUSSION

The results during the investigation on “Standardization of grafting in brinjal (*Solanum melongena* L.) using *Solanum torvum* and cv. Konkan prabha as rootstock” are presented here under appropriate headings and discussed in the light of the relevant literature reviewed on the topic.

4.1. Growth parameters before grafting

4.1.1 Girth of rootstock and scion at collar (mm) before grafting

Girth of rootstock and scion at collar region is an important parameter deciding health of seedling and further growth of graft in field. The girth of rootstock and scion at collar region before grafting in descending order is given as follows

Girth of rootstock before grafting : $T_5 > T_1 > T_2 > T_3 > T_7 > T_4 > T_8 > T_6$

Girth of scion before grafting : $T_3 > T_8 > T_{10} > T_1 > T_7 > T_9 > T_2 > T_4 > T_6 > T_5$

The data presented in Table 1 revealed that girth of rootstock at collar region was in range of 1.02 mm to 1.43 mm whereas girth of scion at collar region was in range 1.11 mm to 1.21 mm. Significantly maximum girth of rootstock (1.43 mm) was observed in T_5 whereas scion T_3 and T_8 recorded maximum girth of scion (1.21 mm). The minimum girth of rootstock was recorded in T_6 (1.02 mm), whereas minimum girth scion was recorded in T_5 (1.11 mm) at collar region in brinjal before grafting.

It was further observed that girth of 70 and 60 days old rootstock of *Solanum torvum* was higher than girth of 25 and 30 days old rootstock of Konkan prabha. It might be due to increase in age of seedlings the girth of seedlings also increased. Nirmal *et al.*, (2017) reported that girth of 21 days old seedlings was 2.04 mm and 25 days old seedlings was 3.02 mm

Table 1: **Girth of rootstock and scion (mm) at collar region in brinjal at grafting**

Treatment	Girth of rootstock (mm)	Girth of scion (mm)
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	1.36	1.19
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	1.33	1.17
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	1.23	1.21
T₄: Konkan prabha 25 days + Bandhtiware local 25 days	1.22	1.17
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	1.43	1.11
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	1.02	1.12
T₇: Konkan prabha 30 days + Manjiri 25 days	1.23	1.19
T₈: Konkan prabha 25 days + Manjiri 25 days	1.22	1.21
T₉ Bandhtiware local seedling	*	1.18
T₁₀: Manjiri seedling	*	1.20
Range	1.02-1.43	1.11-1.21
Mean	1.25	1.18
Result	Sig	Sig
S.E.m ±	0.15	0.01
CD@5%	0.32	0.01

in brinjal. Nagma Surve (2019) indicated that girth of rootstock was 1.46 mm to 3.15 mm at 30 days after germination in brinjal.

4.1.2 Number of leaves on scion and rootstock before grafting

Number of leaves on rootstock and scion before grafting in descending order is given as follows

Number of leaves on rootstock : $T_1 > T_8 > T_2 > T_6 > T_7 > T_4 > T_3 > T_5$.

Number of leaves on scion : $T_6 > T_{10} > T_1 > T_5 > T_8 > T_4 > T_2 > T_7 > T_3 > T_9$

The data regarding number of leaves on scion and rootstock at grafting presented in Table 2 indicate that number of leaves on both scion and rootstock varied significantly. Number of leaves on scion seedlings used for grafting was in range of 3.07-3.37, whereas number of leaves on rootstock used for grafting was in range of 3.10-3.43. Significantly maximum number of leaves on scion (3.37) was recorded in T_5 which was at par with T_{10} (3.33), T_6 (3.30) T_7 (3.30), T_8 (3.27), T_9 (3.17), and whereas maximum number of leaves on rootstock (3.43) was recorded in T_1 in brinjal before grafting. Significantly minimum number of leaves on scion (3.07) was observed in T_3 and T_4 while, minimum number of leaves (3.10) on rootstock was recorded in T_4 and T_6 before grafting.

It was observed that number of leaves of rootstock were more on 70 days old *Solanum torvum* seedling than 60 days old *Solanum torvum* seedling. Similarly more number of leaves were observed on 30 days old seedlings of 'Konkan prabha' than 25 days old seedlings of 'Konkan prabha'. It could be due to increase in age of seedlings the number of leaves also increased as the growth advances.

Zeist *et al.*, (2017) reported that grafting was done at 24 days after emergence of (scion) seedling when seedling had 3-4 leaves in tomato.

Table 2: Number of leaves on rootstock and scion at grafting in brinjal

Treatment (Rootstock + scion)	Number of leaves on rootstock	Number of leaves on Scion
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	3.43	3.09
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	3.27	3.09
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	3.17	3.07
T₄: : Konkan prabha 25 days + Bandhtiware local 25 days	3.10	3.07
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	3.27	3.37
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	3.10	3.30
T₇: Konkan prabha 30 days + Manjiri 25 days	3.37	3.30
T₈: : Konkan prabha 25 days + Manjiri 25 days	3.20	3.27
T₉ Bandhtiware local seedling	*	3.17
T₁₀: Manjiri seedling	*	3.33
Range	3.10-3.43	3.07-3.37
Mean	3.23	3.21
Result	Sig	Sig
S.E.m ±	0.11	0.08
CD@5%	0.33	0.25

Kumar *et al.*, (2015) used four to five leaf stage rootstock and four leaf stage scion for brinjal grafting. Nagma Surve (2019) concluded that number of leaves on both rootstock and scion were more on 30 days old seedlings than 20 and 25 days old seedlings and maximum number of leaves on scion (6.53) and rootstock (6.87) in T₉ (30 days old scion grafted on 30 days old rootstock) was recorded in brinjal before grafting.

4.2. Growth parameters after grafting

4.2.1 Days required for graft union

Days required for graft union in brinjal grafts in ascending order is given as follows

$$\underline{\mathbf{T_5 < T_7 < T_2 < T_3 < T_6 < T_8 < T_1 < T_4}}$$

The data pertaining to days required for graft union of brinjal presented in Table 3 and depicted in Fig.2 showed that there was significant difference among the treatments to days required for graft union of brinjal and was in range of 8.07 to 8.53 days. Lowest number of days (8.07) was required for graft union in T₅ which was at par with T₇ (8.13), T₂ (8.20), T₃ (8.20) and T₆ (8.20), whereas highest number of days (8.53) was required for graft union in T₄.

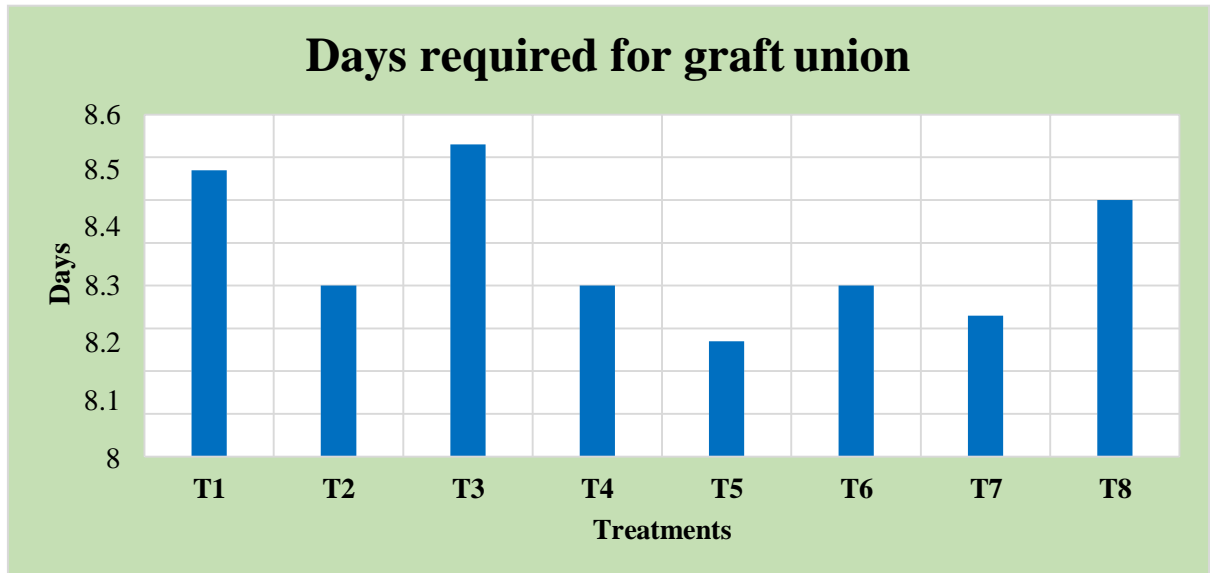
Less number of days (8.07) was required for graft union in T₅ where 25 days old scion (Manjiri) was grafted on 70 days old rootstock (*Solanum torvum*) whereas highest number of days (8.53) was required for graft union in T₄ in which 25 days old scion (Bandhitiware local) was grafted on 25 days old rootstock (Konkan prabha). This might be due to better union of vascular tissues at the graft union. Days required for graft union depends on stage of rootstock and scion as well as prevailing atmospheric conditions.

Similar findings investigated by Onduso (2014) who reported that it took five days to heal the tomato grafts. Tejaswini Rathod (2017)

Table 3: **Effect of age of rootstock and scion on days required for graft union in brinjal grafts**

Treatment (Rootstock + scion)	Days required for graft union
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	8.47
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	8.20
T₃: Konkan prabha 30 days + Bandhware local 25 days	8.20
T₄: Konkan prabha 25 days + Bandhware local 25 days	8.53
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	8.07
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	8.20
T₇: Konkan prabha 30 days + Manjiri 25 days	8.13
T₈: Konkan prabha 25 days + Manjiri 25 days	8.40
T₉ Bandhware local seedling	*
T₁₀: Manjiri seedling	*
Range	8.07-8.53
Mean	8.27
Result	Sig
S.E.m ±	0.10
CD@5%	0.29

Figure 2: Effect of age of rootstock and scion on days required for graft union in brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhtiware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhtiware local 25 days
- T₃** : Konkan prabha 30 days + Bandhtiware local 25 days
- T₄** : Konkan prabha 25 days + Bandhtiware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum torvum* 60 days + Manjiri 25 days
- T₇** : Konkan prabha 30 days + Manjiri 25 days
- T₈** : Konkan prabha 25 days + Manjiri 25 days

reported that days taken for graft healing was 4 to 5 days and there was no significant difference among the treatments for days required for graft healing in brinjal. Nagma Surve (2019) observed minimum number of days (7.60) required for graft union in T₁ (20 days old scion grafted on 20 days old rootstock).

4.2.2 Grafting success in brinjal grafts

Grafting success in brinjal grafts in descending order is given as follows

$$\mathbf{T_3 > T_4 > T_5 > T_1 > T_6 > T_8 > T_2 > T_7}$$

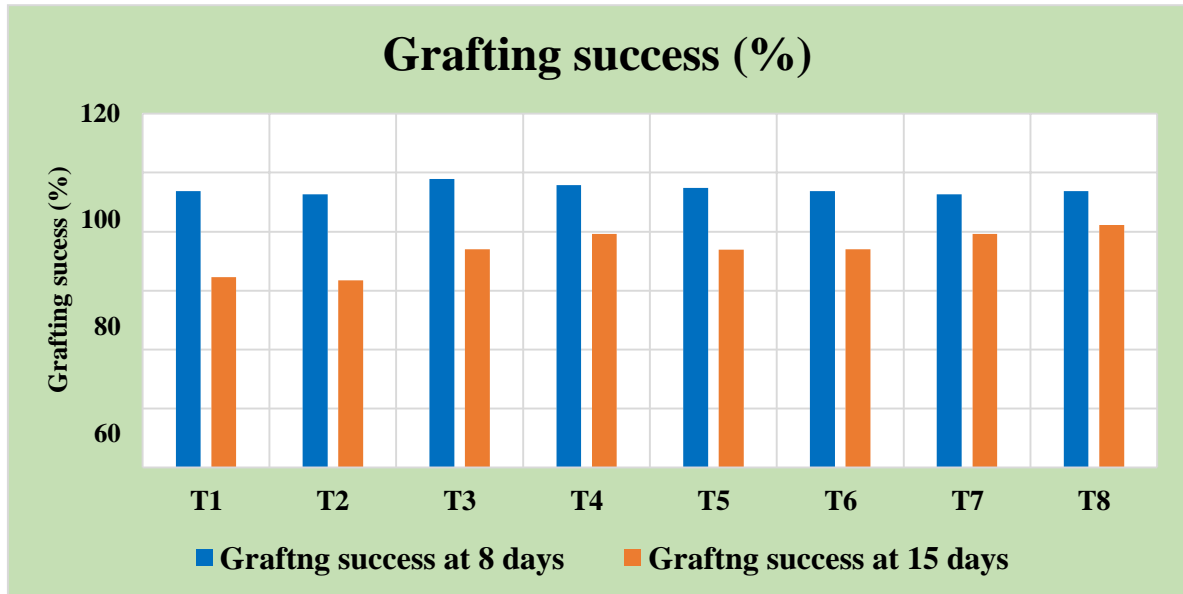
The data presented in Table 4 and depicted in Fig. 3 revealed the grafting success of brinjal grafts. The critical perusal of data showed that there was significant difference between the grafting success and it was in range of 92.67 to 97.92 % on 8th day after grafting. Highest grafting success (97.92 %) was observed in treatment T₃ followed by treatment T₄ (95.83 %) which was at par with treatment T₅ (94.83 %). The minimum grafting success (92.67 %) was noted in treatment T₂ and T₇ and it was at par with treatment T₁ and T₆ (93.75 %).

Significantly highest grafting success at 8th day after grafting was observed in treatment T₃ (25 days old Bandhware local grafted on 30 days old Konkan prabha). This might be due to better graft union and favorable conditions provided in the healing chamber. The above results are in confirmation with Tejaswini Rathod (2017) who observed that graft success was about 85 to 87 % in brinjal. Darli *et al.*, (2018) stated that maximum grafting success (87.3) was recorded in tomato which was grafted on eggplant. Nagma Surve (2019) noticed that highest grafting success was found in 25 days scion and rootstock at 5th, 10th, 15th, and 20th days after grafting in brinjal.

Table 4: **Effect of age of rootstock and scion on grafting success and survival of brinjal grafts.**

Treatment (Rootstock + scion)	Grafting success %	Grafting percent at transplanting
	(8 days)	(15 days)
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	93.75 (75.52)	64.58 (53.48)
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	92.67 (74.29)	63.50 (52.83)
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	97.92 (81.71)	74.00 (59.34)
T₄: Konkan prabha 25 days + Bandhtiware local 25 days	95.83 (78.22)	79.17 (62.85)
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	94.83 (76.86)	73.92 (59.29)
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	93.75 (75.52)	74.00 (59.34)
T₇: Konkan prabha 30 days + Manjiri 25 days	92.67 (74.29)	79.17 (62.85)
T₈: Konkan prabha 25 days + Manjiri 25 days	93.75 (75.52)	82.25 (65.08)
T₉ Bandhtiware local seedling	*	*
T₁₀: Manjiri seedling	*	*
Range	92.67-97.92	63.50-82.25
Mean	94.39	73.82
Result	Sig	Sig
S.E.m ±	0.47	0.44
CD@5%	1.39	1.32

Figure 3: Effect of age of rootstock and scion on grafting success (%) of brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhware local 25 days
- T₃** : Konkani prabha 30 days + Bandhware local 25 days
- T₄** : Konkani prabha 25 days + Bandhware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum torvum* 60 days + Manjiri 25 days
- T₇** : Konkani prabha 30 days + Manjiri 25 days
- T₈** : Konkani prabha 25 days + Manjiri 25 days

4.2.3 Survival percentage (%) at transplanting

Grafting survival percentage in brinjal grafts at transplanting in descending order is given as follows

$$T_8 > T_4 > T_7 > T_3 > T_6 > T_5 > \underline{T_1} > T_2$$

The data pertaining to the survival percentage at transplanting of brinjal grafts are presented in Table 4. Survival percentage at transplanting of brinjal grafts were recorded at the time of transplanting. The data revealed that there was significant difference between the survival percentage of grafts at 15th day after grafting and it was in range of 63.50 % to 82.25 %. Significantly maximum survival percentage of brinjal grafts at transplanting was recorded in treatment T₈ (82.25 %) and it was followed by treatment T₇ and T₄ (79.17 %) whereas minimum survival percentage was found in treatment T₂ (63.50 %) which was at par with treatment T₁ (64.58 %).

The maximum survival percentage of brinjal grafts at transplanting was recorded in treatment T₈ (25 days Manjiri grafted on 25 days old Konkan prabha) this may be due to better compatibility within age of scion (Manjiri) and rootstock (Konkan prabha) and favourable climatic conditions provided to the grafts. The results were in conformity with Bizhen *et al.*, (2014) who found that graft survival exceeded 92 % in all eighteen tomato commercial rootstocks and five scion varieties with average of 97 %. Kumar *et al.*, (2017) studied that maximum survival percentage (67.35 %) observed in T₂ (*Solanum torvum* as rootstock and Pusa hybrid 6 as scion) in brinjal. Nagma Surve (2019) found that highest survival (75.33%) was registered for grafts of 25 days old scion grafted on 25 days old rootstock.

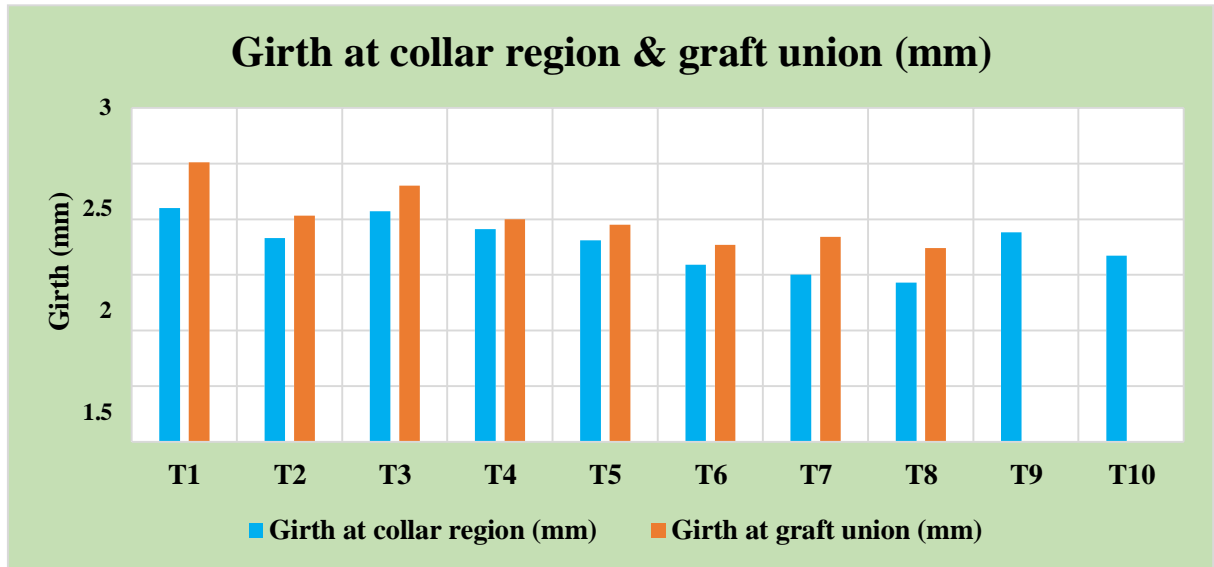
4.2.4 Girth at collar region (mm) and graft union at transplanting

Girth at collar region and graft union in brinjal grafts at transplanting in descending order is given as follows

Table 5: **Effect of age of rootstock and scion on girth at collar region and girth at graft union in brinjal grafts at transplanting**

Treatment (Rootstock + scion)	girth at collar region (mm)	girth at graft union (mm)
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	2.10	2.51
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	1.83	2.03
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	2.07	2.30
T₄ : Konkan prabha 25 days + Bandhtiware local 25 days	1.91	2.00
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	1.81	1.95
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	1.59	1.77
T₇: Konkan prabha 30 days + Manjiri 25 days	1.50	1.84
T₈ : Konkan prabha 25 days + Manjiri 25 days	1.43	1.74
T₉ Bandhtiware local seedling	1.88	*
T₁₀: Manjiri seedling	1.67	*
Range	1.43-2.10	1.74-2.51
Mean	1.78	2.01
Result	Sig	sig
S.E.m ±	0.08	0.22
CD@5%	0.23	0.64

Fig: 4 Effect of age of rootstock and scion on girth at collar region and girth of graft union in brinjal grafts before transplanting



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhtiware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhtiware local 25 days
- T₃** : Konkani prabha 30 days + Bandhtiware local 25 days
- T₄** : Konkani prabha 25 days + Bandhtiware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum torvum* 60 days + Manjiri 25 days
- T₇** : Konkani prabha 30 days + Manjiri 25 days
- T₈** : Konkani prabha 25 days + Manjiri 25 days
- T₉** : Bandhtiware local seedling
- T₁₀** : Manjiri local seedling

Girth at collar region : $\underline{T_1 > T_3 > T_4 > T_9 > T_2}$ $T_5 > T_{10}$ $\underline{T_6 > T_7 > T_8}$

Girth at graft union : $\underline{T_1 > T_3 > T_2 > T_4 > T_5 > T_7}$ $> T_6 > T_8$

The data regarding the girth at collar region and graft union of brinjal grafts are presented in Table 5 and depicted in Fig. 4. Girth at collar region was in range of 1.43-2.10 mm, whereas girth at graft union was in range of 1.74-2.51 mm. The maximum girth at collar region was recorded in treatment T₁ (2.10 mm) which was at par with treatment T₃ (2.07 mm), T₄ (1.91 mm) and T₉ (1.88 mm), while the minimum girth at collar region was found in treatment T₈ (1.43 mm) and it was at par with treatment T₇ (1.50 mm) and T₆ (1.59 mm). In case of girth at graft union the maximum girth was registered in treatment T₁ (2.51 mm) which was at par with treatment T₃ (2.30 mm), T₂ (2.03 mm), T₄ (2.00 mm) and T₅ (1.95 mm). The minimum girth at graft union was found in treatment T₈ (1.74 mm).

Hence, the maximum girth at collar region and graft union was observed in Bandhtiwari local 25 days grafted on *Solanum torvum* 70 days which could be due to the higher age of rootstock as compared to other treatments. The similar findings were also in accordance with Nagma Surve (2019) in brinjal where 25 days old scion grafted on 30 days old rootstock.

4.3. Growth parameters after transplanting

4.3.1 Field survival (%)

Field survival in brinjal grafts after transplanting in descending order is given as follows

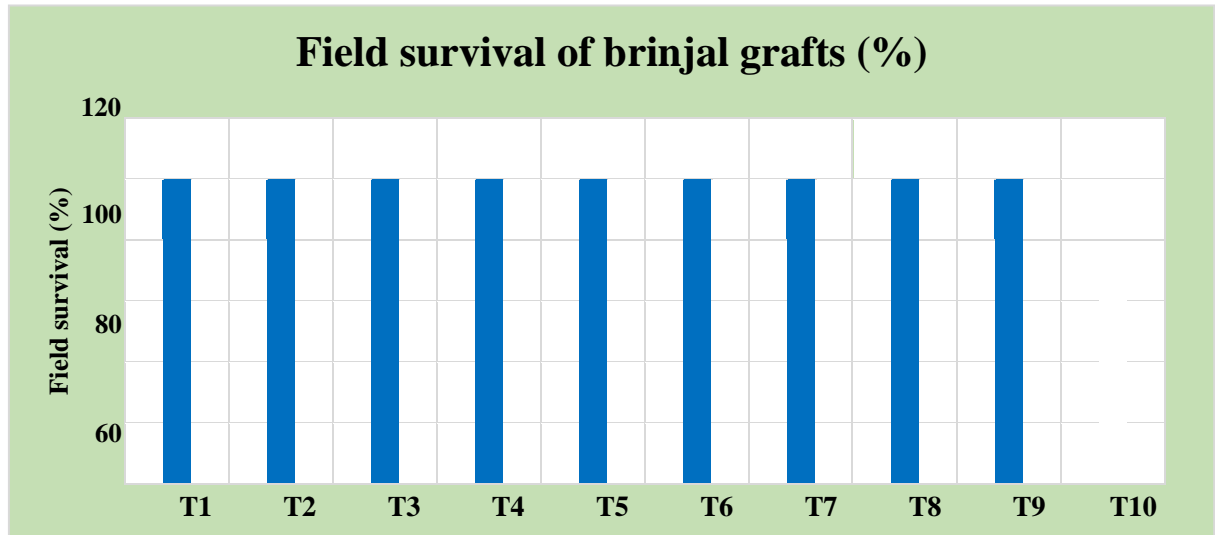
$$T_1 > T_2 > T_3 > T_4 > T_5 > T_6 > T_7 > T_8 > T_9 > T_{10}$$

The data on the survival percentage of brinjal grafts under field conditions are presented in Table 6 and depicted in Fig. 5. Survival of brinjal grafts. It was in range 66.67-100 %. 100 % field survival was

Table 6: **Effect of age of rootstock and scion on field survival in brinjal grafts**

Treatment (Rootstock + scion)	Field survival of brinjal grafts (%)
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	100.00 (90.00)
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	100.00 (90.00)
T₃: Konkan Prabha 30 days + Bandhware local 25 days	100.00 (90.00)
T₄ : Konkan Prabha 25 days + Bandhware local 25 days	100.00 (90.00)
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	100.00 (90.00)
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	100.00 (90.00)
T₇: Konkan prabha 30 days + Manjiri 25 days	100.00 (90.00)
T₈ : Konkan prabha 25 days + Manjiri 25 days	100.00 (90.00)
T₉ Bandhware local seedling	100.00 (90.00)
T₁₀: Manjiri seedling	66.67 (54.74)
Range	66.67-100
Mean	96.67
Result	Sig
S.E.m ±	2.64
CD@5%	7.82

Fig: 5 Effect of age of rootstock and scion on field survival in brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhware local 25 days
- T₃** : Konkan prabha 30 days + Bandhware local 25 days
- T₄** : Konkan prabha 25 days + Bandhware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum torvum* 60 days + Manjiri 25 days
- T₇** : Konkan prabha 30 days + Manjiri 25 days
- T₈** : Konkan prabha 25 days + Manjiri 25 days
- T₉** : Bandhware local seedling
- T₁₀** : Manjiri local seedling

observed in treatment T₁ to T₉ whereas 66.67 % field survival was noted in treatment T₁₀.

The incidence of bacterial wilt is an important aspect in commercial cultivation of brinjal in Konkan region. Most of the released varieties in different parts of the country showed the incidence of bacterial wilt, when they are grown under the Konkan agro-climatic conditions. Manjiri used as scion is susceptible to bacterial wilt and Konkan prabha and *Solanum torvum* used as rootstock are bacterial wilt resistant. High mortality was found in T₁₀ (control) where seedlings were used for transplanting that might be due to incidence of bacterial wilt.

High mortality observed in seedlings (T₁₀) might be due to more susceptibility of seedlings to field pathogens than grafts. Nagma Surve (2019) found minimum field survival in self-rooted brinjal cv. Kali rawai in comparison to the grafts transplanted in open field condition.

4.3.1 Plant height (cm)

Plant height is one of the important growth parameter and is a central part of plant architecture. It decides the overall structure of the plant and shows extent of growth vigor in plant and influences the yield of any crop. It is strongly correlated with life span, maturity as well as yield. The yield of any crop is influenced by vigor of plant and the plant height plays an important role in deciding plant vigor.

Plant height in brinjal grafts **15 DAT** in descending order is given as follows

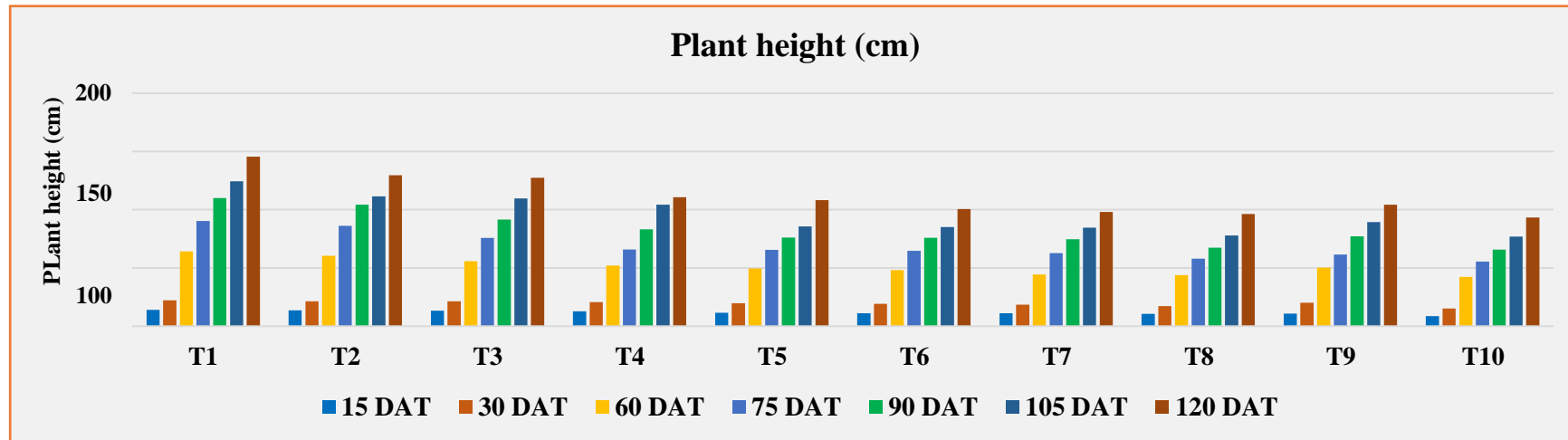
$$\underline{\mathbf{T_1 > T_2 > T_3 > T_4}} > \mathbf{T_5 > T_6 > T_7 > T_9 > T_8 > T_{10}}$$

The data in relation to plant height are presented in Table 7 and illustrated in Fig. 6. Plant height showed significant differences at all intervals. At **15 DAT** plant height was in the range of 8.53 cm to 14.10 cm with mean of 11.68 cm. Highest plant height was recorded

Table 7: Effect of age of rootstock and scion on plant height in brinjal grafts

Treatment (Rootstock + scion)	Plant height (cm)							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	14.10	22.20	41.00	64.10	90.40	110.00	124.33	145.53
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	13.50	21.47	35.37	60.50	86.00	104.27	111.57	129.60
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	13.23	21.33	34.83	55.83	75.73	91.47	109.73	127.27
T₄: Konkan prabha 25 days + Bandhtiware local 25 days	12.70	20.73	34.67	51.93	65.63	83.17	104.27	110.70
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	11.43	19.67	32.33	49.63	65.33	76.17	85.67	108.17
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	11.00	19.27	29.47	48.17	64.70	75.90	84.97	100.50
T₇: Konkan prabha 30 days + Manjiri 25 days	10.97	18.37	29.17	44.33	62.70	74.57	84.57	98.03
T₈: Konkan prabha 25 days + Manjiri 25 days	10.60	17.33	29.10	43.77	57.97	67.43	77.97	96.33
T₉: Bandhtiware local seedling	10.77	20.10	32.80	50.33	61.50	77.07	89.40	104.17
T₁₀: Manjiri seedling	8.53	15.33	23.50	42.30	55.40	65.67	76.87	93.27
Range	8.53- 14.10	15.33- 22.20	23.50- 41.00	42.30- 64.10	55.40- 90.40	65.67- 110	76.87- 124.33	93.27- 145.53
Mean	11.68	19.58	32.22	51.09	68.54	82.57	94.93	111.36
Result	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
S.E.m ±	0.41	0.90	1.97	2.55	2.02	3.85	5.28	2.62
CD@5%	1.23	2.66	5.87	7.58	5.99	11.43	15.70	7.80

Fig: 6 Effect of age of rootstock and scion on plant height (cm) in brinjal grafts.



- | | |
|--|--|
| T ₁ : <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days | T ₆ : <i>Solanum torvum</i> 60 days + Manjiri 25 days |
| T ₂ : <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days | T ₇ : Konkan prabha 30 days + Manjiri 25 days |
| T ₃ : Konkan prabha 30 days + Bandhtiware Local 25 days | T ₈ : Konkan prabha 25 days + Manjiri 25 days |
| T ₄ : Konkan prabha 25 days + Bandhtiware Local 25 days | T ₉ : Bandhtiware local seedling |
| T ₅ : <i>Solanum torvum</i> 70 days + Manjiri 25 days | T ₁₀ : Manjiri local seedling |

in treatment T₁(14.10 cm) was at par with T₂ (13.50 cm) and T₃ (13.23 cm) whereas the treatment T₁₀ (control) recorded the significantly lowest plant height (8.53cm).

Plant height in brinjal grafts **30 DAT** in descending order is given as follows

$$\underline{T_1 > T_2 > T_3 > T_4} > T_9 > T_5 > T_6 > T_7 \quad \underline{T_8 > T_{10}}$$

At **30 DAT** plant height was in the range of 15.33 cm to 22.20cm with mean of 19.58 cm. Highest plant height was observed in treatment T₁ (22.20 cm) which was at par with treatment T₂ (21.47 cm) and T₃ (21.33cm) T₄ (20.73) T₉ (20.10) T₅ (19.67) whereas lowest plant height (15.33 cm) was noted in T₁₀ (control) which was at par with T₈ (17.33 cm).

Plant height in brinjal grafts **45 DAT** in descending order is given as follows

$$\underline{T_1 > T_2 > T_3 > T_4} > T_9 > T_5 > T_6 > T_7 \quad \underline{T_8 > T_{10}}$$

At **45 DAT** plant height was in the range of 23.50 cm to 41.00 cm with mean of 32.22 cm. Highest plant height was recorded in treatment T₁ (41.00 cm) which was at par with T₂ (35.37 cm) whereas the treatment T₁₀ (control) recorded the lowest plant height (23.50cm) was at par with T₈ (29.10 cm) and T₇ (29.17 cm).

Plant height in brinjal grafts **60 DAT** in descending order is given as follows

$$\underline{T_1 > T_2 > T_3 > T_4} > T_9 > T_5 > T_6 > T_7 \quad \underline{T_8 > T_{10}}$$

At **60 DAT** plant height was in the range of 42.30 cm to 64.10 cm with mean of 51.09 cm. highest plant height was registered in treatment T₁ (64.10 cm) which was at par with T₂ (60.50 cm) whereas the treatment T₁₀ (control) recorded the lowest plant height (42.30 cm) was at par with T₈ (43.77 cm), T₇ (44.33cm), T₆ (48.17) and T₅ (49.63).

Plant height in brinjal grafts 75 DAT in descending order is given as follows.

$$\underline{\mathbf{T_1 > T_2}} > \mathbf{T_3 > T_4} > \mathbf{T_5} > \mathbf{T_6} > \mathbf{T_7} > \mathbf{T_9} > \mathbf{T_8} > \mathbf{T_{10}}$$

At 75 DAT plant height was in the range of 55.40 cm to 90.40 cm with mean of 68.54 cm. The highest plant height (90.40 cm) was recorded in treatment T₁ and it was at par with treatment T₂ (86.00 cm) whereas the treatment T₁₀ (control) recorded the lowest plant height (55.40 cm).

Plant height in brinjal grafts 90 DAT in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2}} > \mathbf{T_3 > T_4} > \underline{\mathbf{T_9 > T_5}} > \mathbf{T_6} > \mathbf{T_7} > \mathbf{T_8} > \mathbf{T_{10}}$$

At 90 DAT plant height was in the range of 65.67 cm to 110.00 cm with mean of 82.57 cm. The highest plant height (110.00 cm) was recorded in treatment T₁ and was at par with T₂ (104.27 cm) whereas the treatment T₁₀ (control) recorded the lowest plant height (65.67 cm) which was at par with T₈ (67.43cm), T₇ (74.57cm), T₆ (75.90 cm), T₅ (76.17 cm) T₉ (77.07 cm).

Plant height in brinjal grafts 105 DAT in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2}} > \mathbf{T_3 > T_4} > \underline{\mathbf{T_9 > T_5}} > \mathbf{T_6} > \mathbf{T_7} > \mathbf{T_8} > \mathbf{T_{10}}$$

At 105 DAT plant height was in the range of 76.87 cm to 124.33 cm with mean of 94.93 cm. The highest plant height (124.33 cm) was recorded in treatment T₁ and was at par with T₂ (111.57 cm) and T₃ (109.73 cm) whereas the treatment T₁₀ (control) recorded the lowest plant height (76.87 cm) and was at par with T₈ (77.97cm), T₇ (84.57cm), T₆ (84.97 cm), T₅ (85.67 cm) T₉ (89.40 cm).

Plant height in brinjal grafts **120 DAT** in descending order is given as follows



T₅



T₆



T₇

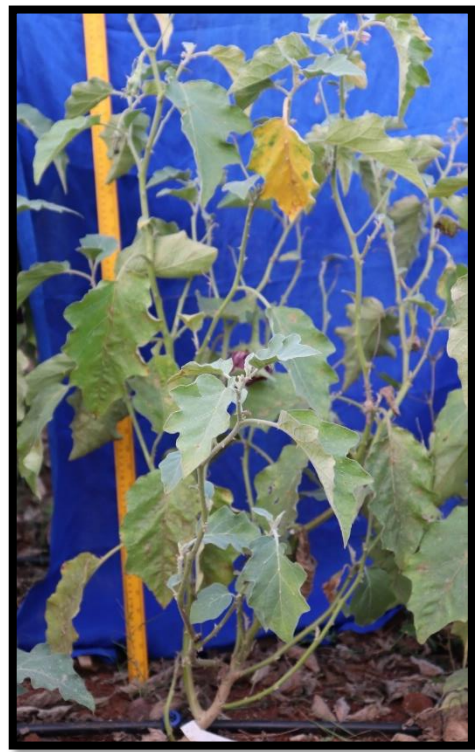


T₈

Plate 3B: Performance of brinjal grafts



T₉



T₁₀

Plate 3C: Performance of brinjal seedlings

$$T_1 > T_2 > T_3 > T_4 > T_5 > T_9 > T_6 > T_7 > T_8 > T_{10}$$

At **120 DAT** plant height was in the range of 93.27 cm to 145.53 cm with mean of 111.36 cm. Significantly highest plant height (145.53cm) was recorded in treatment T_1 whereas the treatment T_{10} (control) recorded the lowest plant height (93.27 cm) and was at par with T_8 (96.33cm), T_7 (98.03cm), T_6 (100.50 cm).

These findings were analogous to the above findings recorded by Lee (1994) and Ioannou (2001) who found that grafted plants were taller and more vigorous than self-rooted ones. Nagma Surve (2019) studied grafting techniques in brinjal (*Solanum melongena* L.) under poly house and open field conditions and observed that 30 days old scion grafted on 30 days old rootstock recorded highest plant height (78.13 cm) at 120 days after transplanting. (Plate 3A, 3B and 3C).

The grafted brinjal plants vigorous root system might be often capable of absorbing water and nutrients more efficiently than scion own roots (seedlings) and serves as a good supplier of endogenous plant hormones (Lee,1994). Cytokinins are the major plant hormones known to be synthesized principally in roots. Brinjal showed significant amount of xylem sap when the plant was cut off after considerable growth. This xylem sap, which is greatly influenced by rootstock even in the same scion cultivars, is known to contain fairly high concentration of minerals, organic substances and plant hormones such as cytokinins and gibberellins which influence the rootstock to absorb the water and nutrients from the soil.

4.3.2 Number of leaves

Leaves play an important role in the production of carbohydrates through process of photosynthesis and thus they increase vigour of the plant, which ultimately influences the output of the plant. Number of leaves produced by the plant is generally dependent on vigour of the plant and period taken by the plant for flowering.

Number of leaves in brinjal grafts **15 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_5 > T_3 > T_6 > T_4 > T_9 > T_7 > T_8 > T_{10}}$$

The data pertaining to number of leaves are presented in Table 8 and depicted in Fig. 7. Number of leaves varied significantly at all intervals. At 15 DAT number of leaves was in the range of 3.13 with mean of 5.93. Significantly maximum number of leaves was recorded in treatment T₁ (5.93) and was at par with T₂ (5.87), T₃ (5.20), T₄ (5.00), T₅ (5.40), T₆ (5.07) and T₉ (4.93) whereas the treatment T₁₀ recorded the minimum number of leaves (3.13) which was at par with T₈ (4.27) and T₇ (4.33).

Number of leaves in brinjal grafts **30 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_5 > T_6 > T_4 > T_7 > T_8 > T_9 > T_{10}}$$

At **30 DAT** number of leaves was in the range of 7.53 to 15.67 with mean of 10.23. Significantly maximum number of leaves was recorded in treatment T₁ (15.67), whereas the treatment T₁₀ recorded minimum number of leaves (7.53) and was at par with T₉ (7.60) T₈ (8.00) T₇ (8.53) and T₄ (09.07).

Number of leaves in brinjal grafts **45 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_5 > T_6 > T_7 > T_9 > T_8 > T_{10}}$$

At **45 DAT** number of leaves was in the range of 13.73 to 25.27 with mean of 18.46. Maximum number of leaves was recorded in treatment T₁ (25.27) which was at par with T₂ (22.20) whereas the treatment T₁₀ recorded the minimum number of leaves (13.73) and was at par with T₈ (14.80) T₉ (16.73) T₇ (17.73).

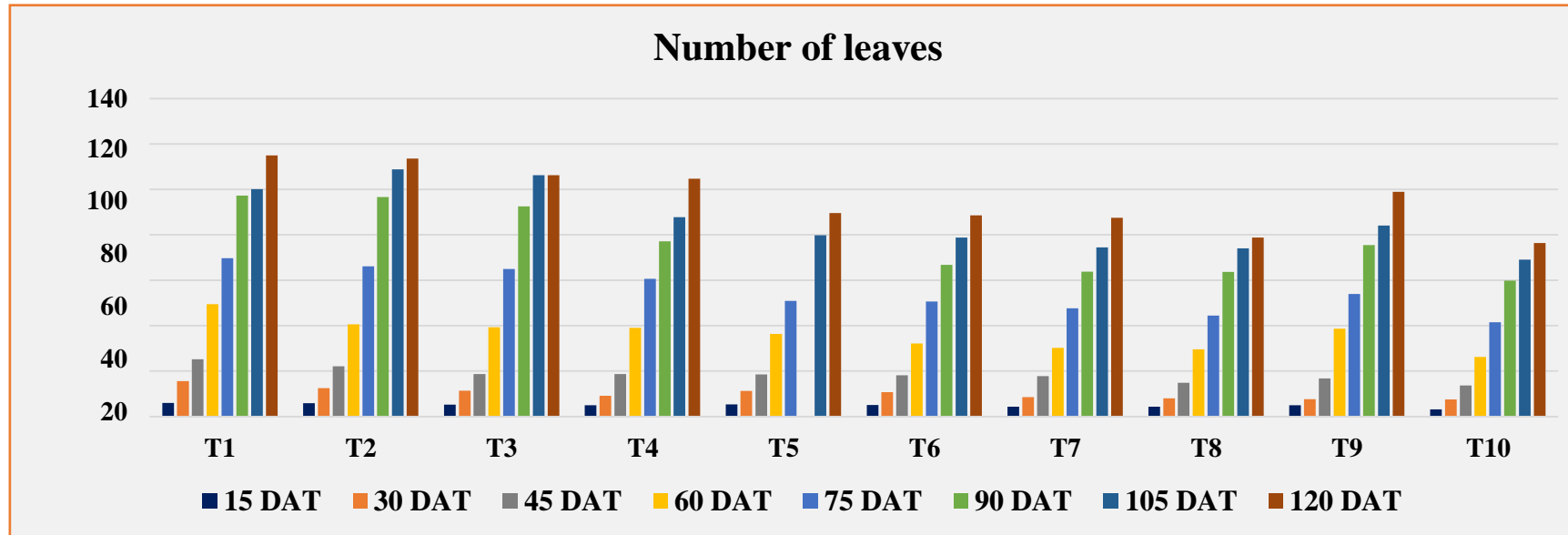
Number of leaves in brinjal grafts **60 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}}$$

Table 8: Effect of age of rootstock and scion on number of leaves in brinjal grafts

Treatment (Rootstock + scion)	Number of leaves							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	5.93	15.67	25.27	49.40	69.73	97.27	108.77	114.93
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	5.87	12.47	22.20	40.67	66.07	96.60	106.20	113.60
T₃: Konkan prabha 30 days + Bandhware local 25 days	5.20	11.40	18.73	39.33	64.97	92.47	100.10	106.20
T₄: Konkan prabha 25 days + Bandhware local 25 days	5.00	9.07	18.67	39.13	60.67	77.13	87.83	104.77
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	5.40	11.20	18.60	36.33	50.90	69.67	79.87	89.53
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	5.07	10.80	18.13	32.20	50.60	66.80	78.77	88.50
T₇: Konkan prabha 30 days + Manjiri 25 days	4.33	8.53	17.73	30.20	47.67	63.80	74.47	87.57
T₈: Konkan prabha 25 days + Manjiri 25 days	4.27	8.00	14.80	29.53	44.47	63.73	74.10	78.83
T₉: Bandhware local seedling	4.93	7.60	16.73	38.67	54.00	75.53	84.07	99.00
T₁₀: Manjiri seedling	3.13	7.53	13.73	26.20	41.47	59.87	69.07	76.43
Range	3.13- 5.93	7.53- 15.67	13.73- 25.27	26.20- 49.40	41.47- 69.73	59.87- 97.27	69.07- 108.77	76.43- 114.93
Mean	4.91	10.23	18.46	36.17	55.05	76.29	86.32	95.94
Result	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
S.E.m ±	0.66	0.90	1.40	2.57	2.14	1.68	4.41	4.54
CD@5%	1.36	2.66	4.16	7.65	6.36	4.98	13.11	13.50

Fig: 7 Effect of age of rootstock and scion on number of leaves in brinjal grafts.



- | | |
|--|--|
| T₁ : <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days | T₆ : <i>Solanum torvum</i> 60 days + Manjiri 25 days |
| T₂ : <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days | T₇ : Konkan prabha 30 days + Manjiri 25 days |
| T₃ : Konkan prabha 30 days + Bandhtiware Local 25 days | T₈ : Konkan prabha 25 days + Manjiri 25 days |
| T₄ : Konkan prabha 25 days + Bandhtiware Local 25 days | T₉ : Bandhtiware local seedling |
| T₅ : <i>Solanum torvum</i> 70 days + Manjiri 25 days | T₁₀ : Manjiri local seedling |

At **60 DAT** number of leaves was in the range of 26.20 to 49.40 with mean of 36.17. Significantly maximum number of leaves was recorded in treatment T₁ (49.40), whereas the treatment T₁₀ (control) recorded the minimum number of leaves (26.20) was at par with T₈ (29.53), T₇ (30.20), T₆ (32.20).

Number of leaves in brinjal grafts **75 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}}$$

At **75 DAT** number of leaves was in the range of 41.47 to 69.73 with mean of 55.05. Significantly maximum number of leaves was recorded in treatment T₁ (69.73) and was at par with T₂ (66.07), T₃ (64.97). Whereas treatment T₁₀ (control) recorded the minimum number of leaves (41.47) was at par with T₈ (44.47), T₇ (47.67).

Number of leaves in brinjal grafts **90 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}}$$

At **90 DAT** number of leaves was in the range of 59.87 to 97.27 with mean of 76.29. Maximum number of leaves was recorded in treatment T₁ (97.27) and was at par with T₂ (96.60) and T₃ (92.47), whereas treatment T₁₀ (control) recorded minimum number of leaves (59.87) was at par with T₈ (63.73), T₇ (63.80), and T₆ (66.80).

Number of leaves in brinjal grafts **105 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}}$$

At **105 DAT** number of leaves was in the range of 69.07 to 108.77 with mean of 86.32. Maximum number of leaves was recorded in treatment T₁ (108.77) and was at par with T₂ (106.20), T₃ (100.10) while treatment T₁₀ (control) recorded minimum number of leaves (69.07) was at par with T₈ (74.10), T₇ (74.47), T₆ (78.77) and T₅ (79.87).

Number of leaves in brinjal grafts **120 DAT** in descending order

is given as follows.

$$\underline{\mathbf{T}_1 > \mathbf{T}_2 > \mathbf{T}_3 > \mathbf{T}_4} > \mathbf{T}_9 > \mathbf{T}_5 > \underline{\mathbf{T}_6 > \mathbf{T}_7} > \mathbf{T}_8 > \mathbf{T}_{10}$$

At **120 DAT** number of leaves was in the range of 76.43 to 114.93 with mean of 95.94. Maximum number of leaves was recorded in treatment T_1 (114.93) and was at par with T_2 (113.60) and T_3 (106.20), T_4 (104.77) whereas treatment T_{10} (control) recorded minimum number of leaves (76.43) T_8 (78.83), T_7 (87.57), T_6 (88.50) and T_5 (89.53).

Sabatino *et al.*, (2016) also gave the similar results of maximum number of leaves in brinjal ‘ecotype B4’ grafted on ‘*Solanum torvum* Swartz’ whereas, the minimum number of leaves in non-grafted ‘B2 ecotype’.

4.3.3 Length of main root (cm)

Roots play role of absorption of water and inorganic nutrients, anchoring of the plant body to the ground and supporting it, storage of food and nutrients and vegetative reproduction and competition with other plants. Length of roots in brinjal grafts **120 DAT** in descending order is given as follows

$$\mathbf{T}_1 > \mathbf{T}_5 > \mathbf{T}_2 > \mathbf{T}_6 > \mathbf{T}_9 > \mathbf{T}_3 > \mathbf{T}_4 > \mathbf{T}_7 > \underline{\mathbf{T}_8} > \mathbf{T}_{10}$$

The data presented in Table 9 and depicted in Fig 8 revealed the length of main root varied significantly among treatments. Length of root was in range of 34.11cm to 57.54cm with mean of 43.71 cm. Significantly longest length of main root (57.54 cm) was recorded in treatment T_1 , whereas shortest length of main root (34.11 cm) was recorded in T_{10} (control) which was at par with T_8 (34.39 cm). It was observed that non-grafted brinjal plants recorded the shortest length of main root as compared to grafted brinjal. Results in the line of the above findings were also reported by Kumar *et al.*, (2017). Nagma Surve (2019) indicated that length of main root of brinjal plant in the range of 33.80 to 41.93 cm.

Table 9: **Effect of age of rootstock and scion on root parameters in brinjal grafts**

Treatment (Rootstock + scion)	Length of tap root (cm)	Number of adventitious roots
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	57.54	499.67
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	51.38	496.17
T₃: Konkan prabha 30 days + Bandhware local 25 days	38.30	407.07
T₄: Konkan prabha 25 days + Bandhware local 25 days	37.78	395.05
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	54.02	454.50
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	51.22	443.16
T₇: Konkan prabha 30 days + Manjiri 25 days	36.44	372.55
T₈: Konkan prabha 25 days + Manjiri 25 days	34.39	371.42
T₉ Bandhware local seedling	41.96	337.72
T₁₀: Manjiri seedling	34.11	334.47
Range	34.11- 57.54	334.47- 499.67
Mean	43.71	411.18
Result	Sig	Sig
S.E.m ±	0.64	3.04
CD@5%	1.91	9.03

Fig: 8 Effect of age of rootstock and scion on length of tap root (cm) in brinjal grafts.

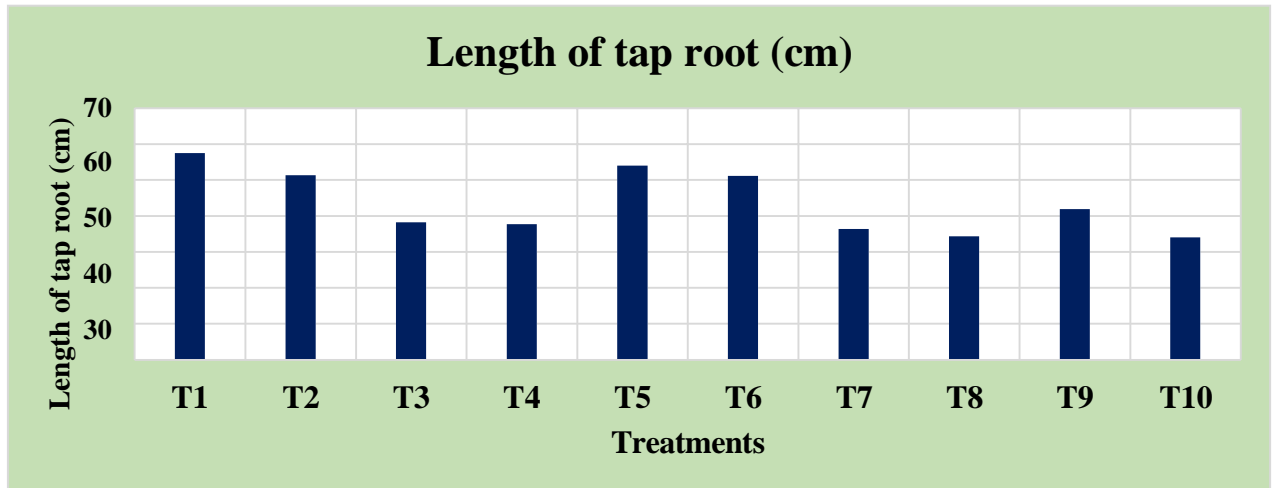
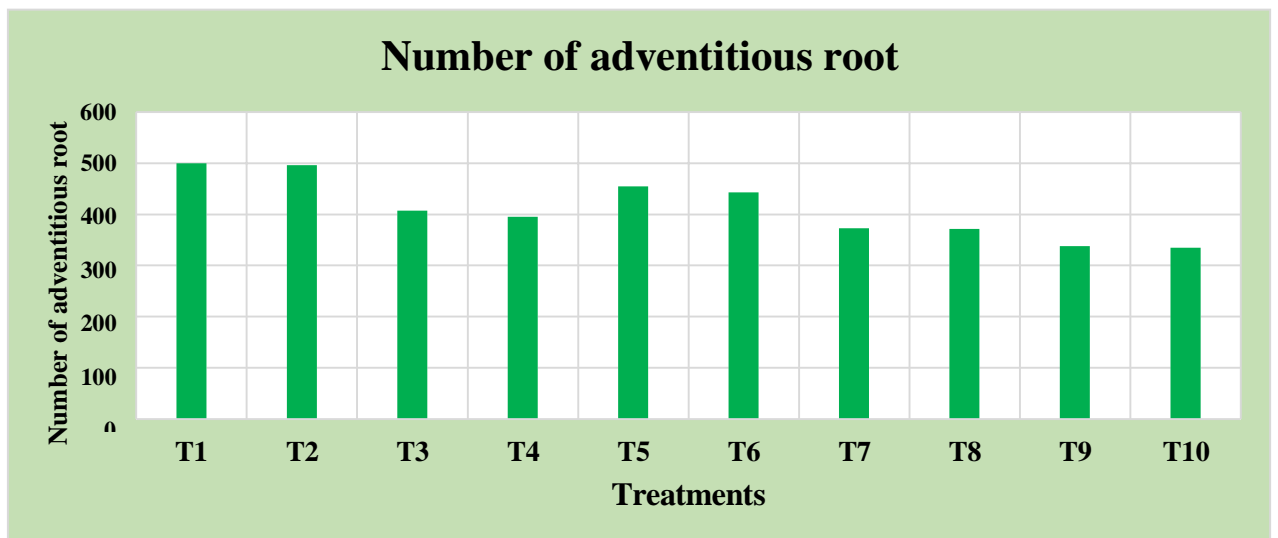


Fig: 9 Effect of age of rootstock and scion on number of adventitious root in brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhtiware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhtiware local 25 days
- T₃** : Konkan prabha 30 days + Bandhtiware local 25 days
- T₄** : Konkan prabha 25 days + Bandhtiware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum tovumr* 60 days + Manjiri 25 days
- T₇** : Konkan prabha 30 days + Manjiri 25 days
- T₈** : Konkan prabha 25 days + Manjiri 25 days
- T₉** : Bandhtiware local seedling
- T₁₀** : Manjiri local seedling

4.3.4 Number of adventitious root (cm)

The data given in Table 9 and depicted in Fig. 9 showed that, number of adventitious roots varied significantly among all the treatments. Number of adventitious roots in brinjal grafts **120 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > T_5 > T_6 > T_3 > T_4 > T_7 > T_8 > T_9 > \underline{T_{10}}$$

Number of secondary roots were in range of 334.72 to 499.67 with mean of 411.18. Maximum number of secondary roots (499.67) were recorded in treatment T₁ which was at par with T₂ (496.17). However, minimum number of secondary roots (334.47) were recorded in T₁₀ (control) which as at par with T₉ (337.72).

It was observed that non-grafted brinjal plants recorded the lesser number of secondary roots as compared to grafted brinjal plants. Kumar *et al.*, (2017) revealed that the highest number of primary roots were recorded when 'Pusa Hybrid-6' grafted on '*Solanum torvum*' and lowest number of primary roots were recorded when 'Pusa Hybrid-6' grafted on '*Solanum xanthocarpum*'. Nagma Surve (2019) reported number of secondary roots of brinjal plant in the range of 402.97 to 512.57.

4.3.5 Stem diameter (cm) above graft union

Stem diameter above graft union in brinjal grafts **15 DAT** in descending order is given as follows

$$\underline{T_1 > T_5} > T_2 > T_6 > T_7 > T_8 > T_3 > T_4$$

Stem diameter above graft union are presented in Table 10. Stem diameter above graft union varied significantly. At **15 DAT** the stem diameter was in range of 4.11 to 5.33 mm with mean of 4.63 mm. Maximum stem diameter above graft union (5.33mm) was recorded in treatment T₁ and was at par with T₅ (4.94 mm) T₂ (4.82 mm) T₆ (4.63 mm) T₇ (4.61 mm) T₈ (4.33 mm) and T₃ (4.28 mm) whereas minimum stem diameter above graft union (4.11 mm) was recorded in treatment

T₄.

Stem diameter above graft union in brinjal grafts **30 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2 > T_5 > T_6 > T_3 > T_7 > T_4 > T_8}}$$

At **30 DAT** the stem diameter was in range of 5.47 to 7.92 mm with mean of 6.40 mm. maximum stem diameter above graft union (7.92 mm) was observed in treatment T₁ and was at par with T₂ (7.23 mm) and T₅ (6.71 mm) whereas minimum stem diameter above graft union (5.47 mm) was recorded in treatment T₈, which was at par with T₄ (5.60), T₇ (5.90), T₃ (5.95) and T₆ (6.44). Stem diameter above graft union in brinjal grafts **45 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2 > T_5 > T_6 > T_3 > T_4 > T_7 > T_8}}$$

At **45 DAT** the stem diameter was in range of 7.53 to 9.56 mm with mean of 8.64 mm. Maximum stem diameter above graft union (9.56mm) was recorded in treatment T₁ and was at par with T₂ (9.42 mm) T₅ (9.21 mm) T₆ (8.95 mm), T₃ (8.57 mm), T₄ (8.06 mm) whereas minimum stem diameter above graft union (7.53 mm) was recorded in treatment T₈.

Stem diameter above graft union in brinjal grafts **60 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2 > T_5 > T_6 > T_3 > T_4 > T_7 > T_8}}$$

At **60 DAT** the stem diameter was in range of 9.28 to 12.48 mm with mean of 11.15 mm. Maximum stem diameter above graft union (12.48 mm) was observed in treatment T₁ and was at par with T₂ (11.94 mm) T₅ (11.49 mm) T₆ (11.48 mm) T₃ (11.31 mm) whereas minimum stem diameter above graft union (9.28 mm) was recorded in treatment T₈ which was at par with T₇ (10.59 mm) and T₄ (10.65 mm).

Table10: Effect of age of rootstock and scion on stem diameter above graft union (mm) in brinjal grafts

Treatment (Rootstock + scion)	Stem diameter above graft union (mm)							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	5.33	7.92	9.56	12.48	16.37	20.54	21.27	23.38
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	4.82	7.23	9.42	11.94	14.12	17.95	19.75	21.06
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	4.28	5.95	8.57	11.31	13.28	16.01	17.96	18.86
T₄: Konkan prabha 25 days + Bandhtiware local 25 days	4.11	5.60	8.06	10.65	13.20	15.21	17.17	18.29
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	4.94	6.71	9.21	11.49	14.09	17.06	17.50	18.40
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	4.63	6.44	8.95	11.48	13.42	16.08	17.09	18.24
T₇: Konkan prabha 30 days + Manjiri 25 days	4.61	5.90	7.79	10.59	12.82	14.81	16.51	17.52
T₈: Konkan prabha 25 days + Manjiri 25 days	4.33	5.47	7.53	9.28	11.90	13.98	14.80	15.85
T₉: Bandhtiware local seedling	*	*	*	*	*	*	*	*
T₁₀: Manjiri seedling	*	*	*	*	*	*	*	*
Range	4.11- 5.33	5.47- 7.92	7.53- 9.56	9.28- 12.48	11.90- 16.37	13.98- 20.54	14.80- 21.27	15.85- 23.38
Mean	4.63	6.40	8.64	11.15	13.65	16.46	17.76	18.95
Result	Sig	Sig	Sig	Sig	Sig	Sig	Sig	Sig
S.E.m ±	0.40	0.44	0.56	0.54	0.69	0.92	0.21	0.51
CD@5%	1.18	1.30	1.68	1.59	2.04	2.733	0.64	1.51

Stem diameter above graft union in brinjal grafts **75 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_5 > T_6 > T_3 > T_4 > T_7 > T_8}$$

At **75 DAT** the stem diameter was in range of 11.90 to 16.37 mm with mean of 13.65 mm. Significantly maximum stem diameter above graft union (16.37 mm) was recorded in treatment T_1 , whereas minimum stem diameter above graft union (11.90 mm) was recorded in treatment T_8 which was at par with T_7 (12.82 mm), T_4 (13.20 mm), T_3 (13.28 mm), and T_6 (13.42 mm).

Stem diameter above graft union in brinjal grafts **90 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_5 > T_6 > T_3 > T_4 > T_7 > T_8}$$

At **90 DAT** the stem diameter was in range of 13.98 to 20.54 mm with mean of 16.46 mm. Maximum stem diameter above graft union (20.54 mm) was observed in treatment T_1 and was at par with T_2 (17.95mm), whereas minimum stem diameter above graft union (13.98 mm) was recorded in treatment T_8 was at par with T_7 (14.81 mm), T_4 (15.21 mm), T_3 (16.01 mm), T_6 (16.08 mm).

Stem diameter above graft union in brinjal grafts **105 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_3 > T_5 > T_4 > T_6 > T_7 > T_8}$$

At **105 DAT** the stem diameter was in range of 14.80 to 21.27 mm with mean of 17.76 mm. significantly maximum stem diameter above graft union (21.27mm) was recorded in treatment T_1 . Whereas significantly minimum stem diameter above graft union (14.80 mm) was recorded in treatment T_8 .

Stem diameter above graft union in brinjal grafts **120 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_3 > T_5 > T_4 > T_6 > T_7 > T_8}$$

At **120 DAT** the stem diameter was in range of 15.85 to 23.38 mm with mean of 18.95 mm. Significantly maximum stem diameter above graft union (23.38 mm) was observed in treatment T₁, whereas significantly minimum stem diameter above graft union (15.85 mm) was recorded in treatment T₈.

From the data it was observed that stem diameter above graft union of Bandhtiware local 25 days grafted on *Solanum torvum* 70 days was comparatively greater than the stem diameter of T₁₀ (control) where Manjiri seedlings were used. This might be due because of better nutrients supply resulting in good growth of grafted plants than seedling.

Bletsos *et al.*, (2003) revealed that stem diameter increased in scions of certain eggplant varieties grafted onto '*S. torvum*'. Sebahattin *et al.*, (2009) found that average stem diameter of the grafted plants of both cultivars were found to be 53% greater than of the controls, and the maximum and the minimum average stem diameters were obtained from grafted 'Pala' (40.15 mm) and ungrafted 'Faselis' (18.19 mm) plants, respectively. Nagma Surve (2019) indicated that stem diameter above graft union of brinjal plant was in the range of 18.63 to 19.23 mm.

4.3.6 Stem diameter (cm) at graft union

Stem diameter at graft union in brinjal grafts **15 DAT** in descending order is given as follows

$$\underline{T_1 > T_5 > T_2 > T_6 > T_3 > T_4 > T_7 > T_8}$$

Data related to stem diameter at graft union are presented in Table 11. Stem diameter at graft union varied significantly. At **15 DAT** the stem diameter was in range of 4.30 to 5.88 mm. Maximum stem diameter at graft union (5.88 mm) was recorded in treatment T₁ and was at par with T₅ (5.21mm) T₂ (5.08 mm) T₆ (5.05 mm) T₃ (4.93 mm) T₄ (4.66 mm) whereas minimum stem diameter at graft union (4.30) was recorded in treatment T₈.

Stem diameter at graft union in brinjal grafts **30 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > \underline{T_5 > T_6} > T_3 > T_7 > T_4 > T_8$$

At **30 DAT** the stem diameter was in range of 5.81 to 8.43 mm. Maximum stem diameter at graft union (8.43 mm) was observed in treatment T_1 and was at par with T_2 (7.74 mm) and T_5 (7.20 mm) whereas minimum stem diameter at graft union (5.81 mm) was recorded in treatment T_8 and was at par with T_4 (5.86 mm), T_7 (6.23 mm) T_3 (6.25 mm) T_6 (6.81 mm).

Stem diameter at graft union in brinjal grafts **45 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > \underline{T_5 > T_6} > T_7 > T_3 > T_4 > T_8$$

At **45 DAT** the stem diameter was in range of 8.09 to 11.07 mm. Maximum stem diameter at graft union (11.07 mm) was recorded in treatment T_1 and was at par with T_2 (10.78 mm) T_5 (9.64 mm) whereas minimum stem diameter at graft union (8.09 mm) was recorded in treatment T_8 .

Stem diameter at graft union in brinjal grafts **60 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > \underline{T_5 > T_6} > T_7 > \underline{T_3 > T_4} > T_8$$

At **60 DAT** the stem diameter was in range of 9.66 to 14.83 mm. Maximum stem diameter at graft union (14.83 mm) was observed in treatment T_1 and was at par with T_2 (13.54 mm). Whereas minimum stem diameter at graft union (9.66 mm) was recorded in treatment T_8 which was at par with T_4 (11.27 mm) and T_3 (11.33 mm).

Stem diameter at graft union in brinjal grafts **75 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > \underline{T_3 > T_7} > T_5 > T_4 > \underline{T_6 > T_8}$$

Table 11: Effect of age of rootstock and scion on stem diameter at graft union (mm) in brinjal grafts

Treatment (Rootstock + scion)	Stem diameter at graft union (mm)							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	5.88	8.43	11.07	14.83	18.26	22.67	23.76	25.52
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	5.08	7.74	10.78	13.54	16.31	20.04	21.12	23.47
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	4.93	6.25	8.45	11.33	14.52	18.39	19.46	20.34
T₄: Konkan prabha 25 days + Bandhtiware local 25 days	4.66	5.86	8.31	11.27	13.63	16.64	18.09	19.37
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	5.21	7.20	9.64	11.80	13.94	17.23	17.98	19.29
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	5.05	6.81	9.47	11.73	13.41	16.78	17.67	18.77
T₇: Konkan prabha 30 days + Manjiri 25 days	4.50	6.23	8.86	11.61	14.19	16.83	17.49	18.63
T₈: Konkan prabha 25 days + Manjiri 25 days	4.30	5.81	8.09	9.66	12.37	15.21	15.93	17.27
T₉: Bandhtiware local seedling	*	*	*	*	*	*	*	*
T₁₀: Manjiri seedling	*	*	*	*	*	*	*	*
Range	4.30- 5.88	5.81- 8.43	8.09- 11.07	9.66- 14.83	12.37- 18.26	15.21- 22.67	15.93- 23.76	17.27- 25.52
Mean	4.95	6.79	9.33	11.97	14.57	17.97	18.93	20.33
Result	Sig	Sig	Sig	Sig	Sig	Sig	sig	Sig
S.E.m ±	0.45	0.44	0.53	0.59	0.79	0.67	0.77	0.60
CD@5%	1.37	1.33	1.59	1.76	2.36	2.67	2.29	1.71

At **75 DAT** the stem diameter was in range of 12.37 to 18.26 mm. Maximum stem diameter at graft union (18.26 mm) was recorded in treatment T₁ and was at par with T₂ (16.31 mm). Whereas minimum stem diameter at graft union (12.37mm) was recorded in treatment T₈ which was at par with T₄ (13.63 mm), T₆ (13.41 mm), T₅ (13.94), T₇ (14.19 mm), T₃ (14.52 mm).

Stem diameter at graft union in brinjal grafts **90 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2}} > \mathbf{T_3 > T_5 > T_7} > \mathbf{T_6} > \mathbf{T_4 > T_8}$$

At **90 DAT** the stem diameter was in range of 15.21 to 22.67 mm. Significantly maximum stem diameter at graft union (22.67mm) was observed in treatment T₁ and was at par with T₂ (20.04 mm) whereas minimum stem diameter at graft union (15.21 mm) was recorded in treatment T₈ was at par with T₄ (16.64 mm) T₆ (16.78 mm) T₇ (16.83 mm) T₅ (17.23 mm).

Stem diameter at graft union in brinjal grafts **105 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2} > \mathbf{T_3 > T_4 > T_5} > \mathbf{T_6} > \mathbf{T_7 > T_8}$$

At **105 DAT** the stem diameter was in range of 15.93 to 23.76 mm. maximum stem diameter at graft union (23.76 mm) was recorded in treatment T₁ and was at par with T₂ (21.12 mm) whereas minimum stem diameter at graft union (15.93 mm) was recorded in treatment T₈ was at par with T₇ (17.49 mm) T₆ (17.67 mm) T₅ (17.98 mm) T₄ (18.09 mm).

Stem diameter at graft union in brinjal grafts **120 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2} > \mathbf{T_3 > T_4 > T_5} > \underline{\mathbf{T_6}} > \mathbf{T_7 > T_8}$$

At **120 DAT** the stem diameter was in range of 17.27 to 25.52. Significantly maximum stem diameter at graft union (25.52 mm) was observed in treatment T₁ whereas minimum stem diameter at graft

union (17.27 mm) was recorded in treatment T₈ was at par with T₇ (18.63 mm) T₆ (18.77 mm).

Nagma Surve (2019) indicated that significantly maximum stem diameter at graft union (23.09 mm) was observed in treatment T₈ (25 days old scion grafted on 30 days old rootstock) in brinjal.

4.3.7 Stem diameter (mm) at collar region (below graft union)

Stem diameter at collar region in brinjal grafts **15 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2}} > \mathbf{T_5 > T_3 > T_6 > T_4 > T_7 > T_8}$$

The data related to stem diameter below graft union under open field condition are presented in Table 12. Stem diameter at collar region varied significantly. At **15 DAT** the stem diameter was in range of 2.82 to 3.92 mm with mean of 3.38 mm. maximum stem diameter at collar region (3.92 mm) was recorded in treatment T₁ and was at par with T₂ (3.90 mm). Whereas minimum stem diameter below graft union (2.82 mm) was recorded in treatment T₈.

Stem diameter at collar region in brinjal grafts **30 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2 > T_5 > T_3 > T_6 > T_4 > T_7 > T_8}}$$

At **30 DAT** the stem diameter was in range of 5.07 to 7.38 mm with mean of 5.94 mm. maximum stem diameter at collar region (7.38 mm) was observed in treatment T₁ and was at par with T₂ (7.13 mm), T₅ (6.89mm) T₃ (5.85 mm), T₆ (5.85 mm), T₄ (5.75 mm) T₇ (5.66mm) whereas minimum stem diameter below graft union (5.07 mm) was recorded in treatment T₈.

Stem diameter at collar region in brinjal grafts **45 DAT** in descending order is given as follows

$$\underline{\mathbf{T_1 > T_2}} > \underline{\mathbf{T_5 > T_6 > T_3 > T_4 > T_7 > T_8}}$$

Table 12: Effect of age of rootstock and scion on stem diameter (mm) at collar region (below graft union) in brinjal grafts

Treatment (Rootstock + scion)	Stem diameter (mm) at collar region (below graft union)							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	3.92	7.38	10.53	13.79	17.02	21.48	22.64	23.98
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	3.90	7.13	9.76	13.09	16.50	20.29	22.05	22.46
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	3.41	5.85	8.06	10.58	12.87	16.25	21.47	20.71
T₄: Konkan prabha 25 days + Bandhtiware local 25 days	3.25	5.75	7.75	10.13	12.85	16.09	18.68	20.53
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	3.72	6.89	8.54	11.14	14.21	18.26	18.33	20.16
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	3.33	5.85	8.46	11.11	13.14	16.29	17.62	19.51
T₇: Konkan prabha 30 days + Manjiri 25 days	2.96	5.66	7.63	10.07	12.60	16.06	16.63	17.95
T₈: Konkan prabha 25 days + Manjiri 25 days	2.82	5.07	7.40	9.93	12.45	15.85	16.40	17.92
T₉: Bandhtiware local seedling	*	*	*	*	*	*	*	*
T₁₀: Manjiri seedling	*	*	*	*	*	*	*	*
Range	2.82- 3.92	5.07- 7.38	7.40-9- 10.53	9.93- 13.79	12.45- 17.02	15.85- 21.48	16.40- 22.64	17.92- 23.58
Mean	3.38	5.94	8.25	10.85	13.55	17.04	18.75	19.81
Result	Sig	Sig	Sig	Sig	Sig	Sig	sig	Sig
S.E.m ±	0.02	0.36	0.48	0.63	0.86	1.14	0.53	0.51
CD@5%	0.06	1.8	1.42	1.87	2.56	3.40	1.58	1.52

At **45 DAT** the stem diameter was in range of 7.40 to 10.53 mm. maximum stem diameter at collar region (10.53 mm) was recorded in treatment T₁ and was at par with T₂ (9.76mm) whereas minimum stem diameter below graft union (7.40 mm) was recorded in treatment T₈ was at par with T₇ (7.63 mm), T₄ (7.75 mm), T₃ (8.06 mm) T₆ (8.46 mm) T₅ (8.54 mm).

Stem diameter at collar region in brinjal grafts **60 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > T_5 > T_6 > \underline{T_3 > T_4} > T_7 > T_8$$

At **60 DAT** the stem diameter was in range of 9.93 to 13.79 mm. maximum stem diameter at collar region (13.79 mm) was observed in treatment T₁ and was par with T₂ (13.09mm). Whereas minimum stem diameter at collar region (9.93 mm) was recorded in treatment T₈ was at par with T₇ (10.07 mm), T₄ (10.13 mm), T₃ (10.58 mm).

Stem diameter at collar region in brinjal grafts **75 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > \underline{T_5 > T_6} > \underline{T_3 > T_4} > T_7 > T_8$$

At **75 DAT** the stem diameter was in range of 12.45 to 17.02 mm. maximum stem diameter at collar region (17.02 mm) was recorded in treatment T₁ and was at par with T₂ (16.50mm).Whereas minimum stem diameter below graft union (12.45 mm) was recorded in treatment T₈ was at par with T₇ (12.60 mm), T₄ (12.85 mm), T₅ (12.87 mm) T₆ (13.14 mm).

Stem diameter at collar region in brinjal grafts **90 DAT** in descending order is given as follows

$$\underline{T_1 > T_2} > T_5 > \underline{T_6 > T_3 > T_4} > T_7 > T_8$$

At **90 DAT** the stem diameter was in range of 15.85 to 21.48 mm. Maximum stem at collar region (21.48mm) was observed in treatment T₁ and was at par with T₂ (20.29 mm) whereas minimum

stem diameter below graft union (15.85 mm) was recorded in treatment T₈ was at par with T₇ (16.06 mm), T₄ (16.09 mm), T₃ (16.25 mm), T₆ (16.29 mm).

Stem diameter at collar region in brinjal grafts **105 DAT** in descending order is given as follows

$$\underline{T_1} > \underline{T_2} > T_3 > T_4 > T_5 > T_6 > \underline{T_7} > \underline{T_8}$$

At **105 DAT** the stem diameter was in range of 16.40 to 22.64 mm. Maximum stem diameter at collar region (22.64 mm) was recorded in treatment T₁ and was at par with T₂ (22.05 mm) whereas minimum stem diameter below graft union (16.40 mm) was recorded in treatment T₈ which was at par with T₇ (16.63 mm).

Stem diameter at collar region in brinjal grafts **120 DAT** in descending order is given as follows

$$\underline{T_1} > \underline{T_2} > T_3 > T_4 > T_5 > T_6 > \underline{T_7} > \underline{T_8}$$

At **120 DAT** the stem diameter was in range of 17.92 to 23.58 mm. maximum stem diameter at collar region (23.58 mm) was observed in treatment T₁ and was at par with T₂ (22.46 mm) whereas minimum stem diameter below graft union (17.92 mm) was recorded in treatment T₈ which was at par with T₇ (17.95 mm).

From the data regarding stem diameter at collar region *viz.*, collar region of the brinjal plants it was observed that stem diameter of the brinjal grafts was comparatively greater than the stem diameter of T₁₀ (control) where seedlings were used.

Bletsos *et al.*, (2003) revealed that stem diameter increased in scions of certain eggplant varieties grafted onto '*S. torvum*'. Sebahattin *et al.*, (2009) found that average stem diameter of the grafted plants of both cultivars were found to be 53% greater than of the controls, and the maximum and the minimum average stem diameters were obtained from grafted 'Pala' (40.15 mm) and ungrafted 'Faselis' (18.19 mm) plants, respectively. Nagma Surve (2019) indicated that stem

diameter (mm) below graft union of brinjal plants was 25.85 to 27.21 mm.

4.3.8 Number of branches

Number of branches per plant is an important character having indirect relation with the plant spread and further determination of plant spacing along with other parameters which is considered for crop management to maximize the fruit yield.

Number of branches in brinjal grafts **15 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_{10} > T_9 > T_7 > T_5 > T_3 > T_4 > T_6 > T_8}$$

The critical perusal of data presented in Table 13 and depicted in Fig. 10 revealed that the number of primary branches varied significantly. At **15 DAT** primary branches was in the range of 2.27-2.87 with mean of 2.46 branches. Significantly maximum number of branches (2.87) was found in T₁. While minimum number of branches (2.27) recorded in T₃, T₄, T₆ and T₈.

Number of branches in brinjal grafts **30 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_5 > T_3 > T_4 > T_6 > T_7 > T_8 > T_9 > T_{10}}$$

At **30 DAT** primary branches were in the range of 6 to 7.13 with mean of 6.50 branches. Significantly maximum number of branches (7.13) was found in T₁. While minimum number of branches (6.00) recorded in T₁₀. Number of branches in brinjal grafts **45 DAT** in descending order is given as follows

$$\mathbf{T_1 > T_2 > T_5 > T_6 > T_3 > T_7 > T_4 \quad T_8 > T_9 > T_{10}}$$

At **45 DAT** primary branches in the range of 9.40 to 10.53 with mean of 9.89 branches. Maximum number of branches (10.53) was found in T₁ was at par with T₂ (10.13) and T₅ (10.13). While minimum number of branches (9.40) recorded in T₁₀. was at par with T₉ (9.53), T₈ (9.60), and T₄ (9.73).

Number of branches in brinjal grafts **60 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_5 > T_6 > T_7 > T_3 > T_4 > T_9 > T_8 > T_{10}}$$

At **60 DAT** primary branches in the range of 14.27 to 15.73 with mean of 14.57 branches. Maximum number of branches (15.73) was found in T_1 was at par with T_2 (15.40). While minimum number of branches (13.47) recorded in T_{10} . was at par with T_8 (13.67).

Number of branches in brinjal grafts **75 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}}$$

At **75 DAT** primary branches varied significantly in the range of 18.13 to 21.80 with mean of 19.09 branches. Significantly maximum number of branches (21.80) were recorded in T_1 and whereas minimum number of branches (18.13) were recorded in T_{10} and T_8 which was at par T_7 (18.40), T_6 (18.47), and T_5 (18.53).

Number of branches in brinjal grafts **90 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_5 > T_6 > T_9 > T_7 > T_8 > T_{10}}$$

At **90 DAT** primary branches were in the range of 23.27 to 28.13 with mean of 24.92 branches. Significantly maximum number of branches (28.13) were recorded in T_1 and whereas minimum number of branches (23.27) were recorded in T_{10} which was at par T_8 (23.47), and T_7 (23.60).

Number of branches in brinjal grafts **105 DAT** in descending order is given as follows.

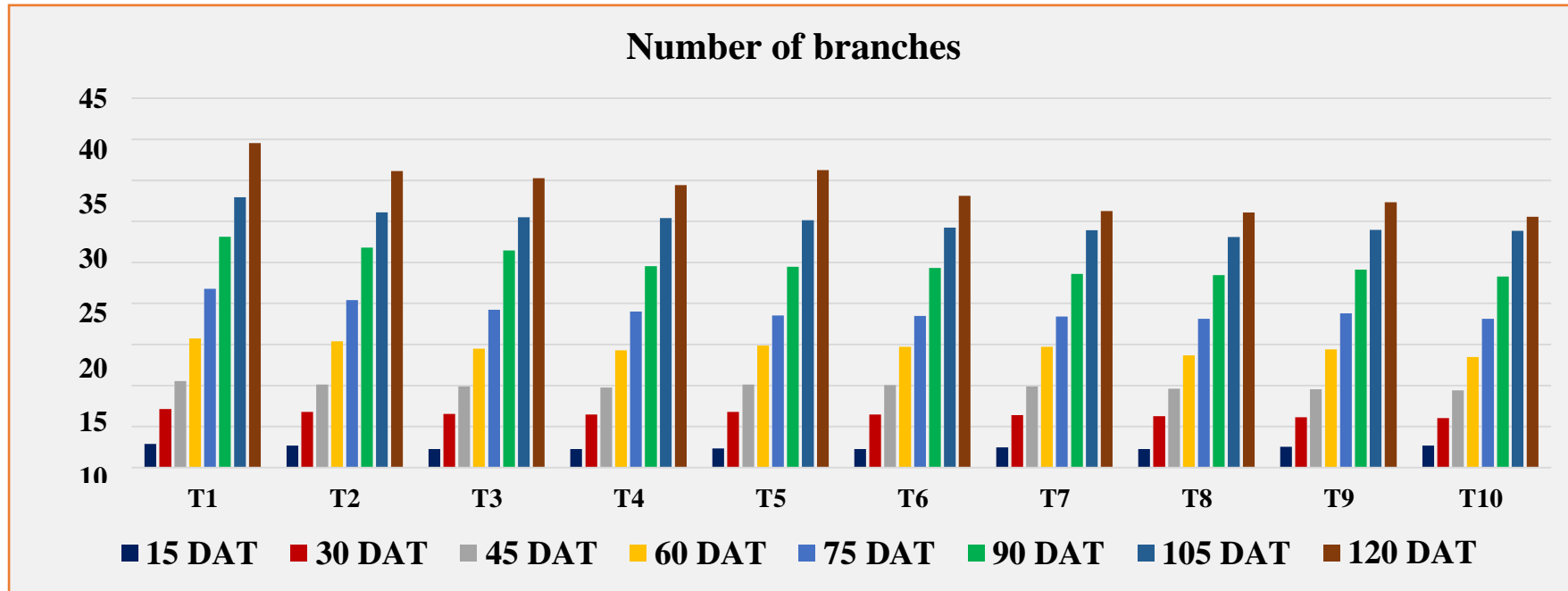
$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_5 > T_6 > T_9 > T_7 > T_8 > T_{10}}$$

At **105 DAT** primary branches was in the range of 28.09 to 32.92 with mean of 29.92 branches. Significantly maximum number

Table 13: Effect of age of rootstock and scion on number of branches in brinjal grafts

Treatment (Rootstock + scion)	Number of branches							
	15 DAT	30 DAT	45 DAT	60 DAT	75 DAT	90 DAT	105 DAT	120 DAT
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	2.87	7.13	10.53	15.73	21.80	28.13	32.92	39.56
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	2.67	6.80	10.13	15.40	20.40	26.80	31.09	36.13
T₃: Konkan prabha 30 days + Bandhware local 25 days	2.27	6.53	9.87	14.47	19.20	26.47	30.50	35.26
T₄: Konkan prabha 25 days + Bandhware local 25 days	2.27	6.47	9.73	14.27	19.00	24.53	30.40	34.42
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	2.33	6.80	10.13	14.87	18.53	24.47	30.16	36.25
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	2.27	6.47	10.07	14.73	18.47	24.33	29.25	33.12
T₇: Konkan prabha 30 days + Manjiri 25 days	2.47	6.40	9.87	14.73	18.40	23.60	28.93	31.25
T₈: Konkan prabha 25 days + Manjiri 25 days	2.27	6.27	9.60	13.67	18.13	23.47	28.87	31.10
T₉: Bandhware local seedling	2.53	6.13	9.53	14.40	18.80	24.13	28.95	32.33
T₁₀: Manjiri seedling	2.67	6.00	9.40	13.47	18.13	23.27	28.09	30.55
Range	2.27- 2.87	6.0- 7.13	9.40- 10.53	14.27- 15.73	18.13- 21.80	23.27- 28.13	28.09- 32.92	30.55- 39.56
Mean	2.46	6.50	9.89	14.57	19.09	24.92	29.92	34.00
Result	Sig	Sig	Sig	Sig	Sig	Sig	sig	Sig
S.E.m ±	0.07	0.11	0.17	0.14	0.15	0.19	0.55	0.45
CD@5%	0.21	0.33	0.42	0.41	0.44	0.56	1.62	1.34

Fig: 10 Effect of age of rootstock and scion on number of branches in brinjal grafts.



- | | |
|--|--|
| T₁ : <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days | T₆ : <i>Solanum torvum</i> 60 days + Manjiri 25 days |
| T₂ : <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days | T₇ : Konkan prabha 30 days + Manjiri 25 days |
| T₃ : Konkan prabha 30 days + Bandhtiware Local 25 days | T₈ : Konkan prabha 25 days + Manjiri 25 days |
| T₄ : Konkan prabha 25 days + Bandhtiware Local 25 days | T₉ : Bandhtiware local seedling |
| T₅ : <i>Solanum torvum</i> 70 days + Manjiri 25 days | T₁₀ : Manjiri local seedling |

of branches (32.92) were recorded in T₁ and whereas minimum number of branches (28.09) were recorded in T₁₀ which was at par T₈ (28.87), T₇ (28.93) T₉ (28.95) and T₆ (29.25).

Number of branches in brinjal grafts **120 DAT** in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_5 > T_3 > T_4 > T_6 > T_9 > T_7 > T_8 > T_{10}}$$

At **120 DAT** primary branches in the range of 30.55 to 39.56 with mean of 34.00 branches. Significantly maximum number of branches (39.56) were recorded in T₁ and while minimum number of branches (30.55) were recorded in T₁₀ which was at par T₈ (31.10) and T₇ (31.25).

Tejeswini Rathod (2017) gave results in confirmation that grafted 'Lalitha' recorded the maximum number of branches (13.07) followed by grafted 'Mahyco-9' (11.87) whereas, the self-rooted 'Sharpova' gave the minimum number of branches (8.20) under open condition.

4.3.9 Number of days required for initiation and 50% flowering

4.3.9.1 Number of days for initiation of flowering

Number of days for initiation of flowering in brinjal grafts in ascending order is given as follows.

$$\mathbf{T_5 < T_7 < T_6 < T_8 < T_1 < T_{10} < T_2 < T_3 < T_4 < T_9}$$

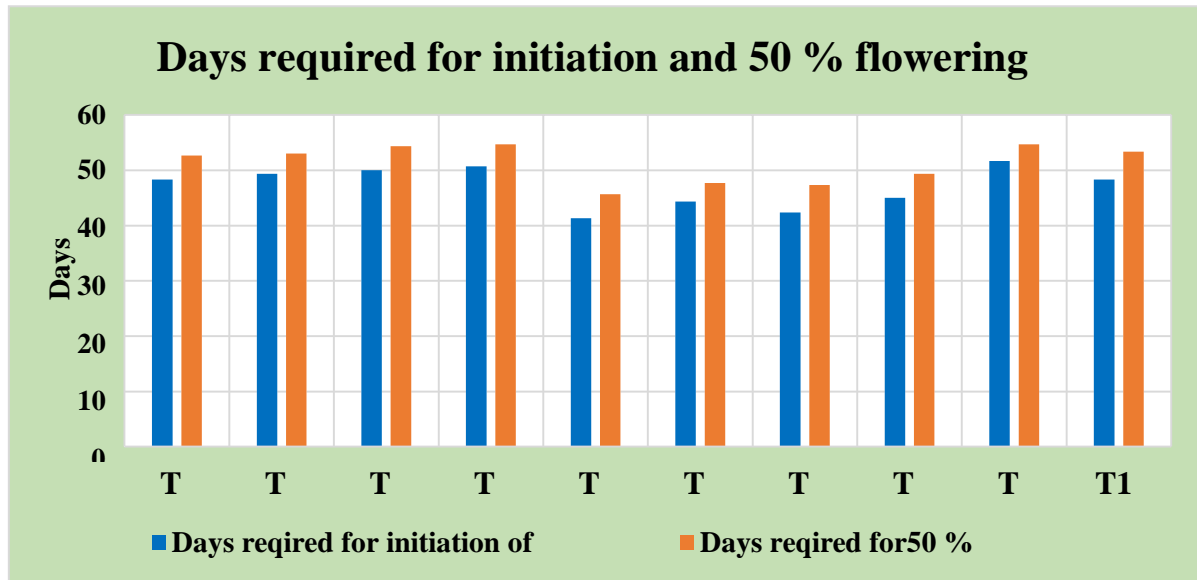
The data regarding number of days required for initiation of flowering of brinjal plants are presented in Table 14 and depicted in Fig. 11. The critical perusal of data revealed the days required for initiation of flowering was significant. Number of days for initiation of flowering was in range of 41.33 to 51.67 days with mean 47.13 days under study. Minimum days required (41.33 days) was recorded in treatment T₅ and was at par with treatment T₇ (42.33 days) whereas maximum days

required (51.67 days) was recorded in treatment T₉ which was at par with T₄ (50.67 days).

Table 14: **Effect of age of rootstock and scion on days required for initiation of flowering and 50 % flowering in brinjal grafts**

Treatment (Rootstock + scion)	Days required for initiation of flowering	Days required for 50 % flowering
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	48.33	52.67
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	49.33	53.00
T₃: Konkan prabha 30 days + Bandhware local 25 days	50.00	54.33
T₄: : Konkan prabha 25 days + Bandhware Local 25 days	50.67	54.67
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	41.33	45.67
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	44.33	47.67
T₇: Konkan prabha 30 days + Manjiri 25 days	42.33	47.33
T₈: : Konkan prabha 25 days + Manjiri 25 days	45.00	49.33
T₉ Bandhware local seedling	51.67	54.67
T₁₀: Manjiri seedling	48.33	53.33
Range	41.33-51.67	45.67-54.67
Mean	47.13	51.27
Result	Sig	Sig
S.E.m ±	0.49	0.56
CD@5%	1.46	1.66

Fig: 11 Effect of age of rootstock and scion on days required for initiation and 50 % flowering in brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhtiware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhtiware local 25 days
- T₃** : Konkani prabha 30 days + Bandhtiware local 25 days
- T₄** : Konkani prabha 25 days + Bandhtiware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum torvum* 60 days + Manjiri 25 days
- T₇** : Konkani prabha 30 days + Manjiri 25 days
- T₈** : Konkani prabha 25 days + Manjiri 25 days
- T₉** : Bandhtiware local seedling
- T₁₀** : Manjiri local seedling

The minimum days required for initiation of flowering in grafted plants as compared to seedlings might be due to the early formation of graft union between scion and rootstock which is necessary to translocate food material from root system to apical parts of plant and leads the early flowering in grafted plants. The results analogous to above findings were obtained by Nagma Surve (2019) who registered minimum number of days (44.67 days) required for initiation of flowering of brinjal plants in treatment T₃

(30 days scion grafted on 20 days rootstock) compared to seedling (46.33 days). Kumar *et al.*, (2019) investigated that grafted plants showed significantly earliest in flowering taking 38.60 and 34.53 days in Surati Ravaiya pink and Surati Ravaiya purple respectively grafted on *Solanum torvum* and compared to their counter parts (43.07 and 39.67 days).

Sabitino *et al.*, (2018) reported that brinjal grafted onto *Solanum torvum* rootstock gave the shortest time of first flower emission (49.4 DAT) whereas cv. 'Birgah' self-grafted revealed longest first flower emission time (58.9 DAT)

4.3.9.2 Number of days to 50 percent flowering

Days to 50 percent flowering is an important character to choose a good combination of brinjal graft. Number of days for 50 percent of flowering in brinjal grafts in ascending order is given as follows.

$$\underline{\mathbf{T_5}} < \mathbf{T_7} < \mathbf{T_6} < \mathbf{T_8} < \mathbf{T_1} < \mathbf{T_2} < \mathbf{T_{10}} < \mathbf{T_3} < \mathbf{T_4} < \mathbf{T_9}$$

The data regarding number of days required for 50 percent flowering of brinjal plants are presented in Table 14 and depicted in Fig. 11. The similar trend like initiation of flowering was observed in days required for 50% flowering. Days required for 50% flowering varied significantly. Days required for 50 % flowering were in range of 45.67 days to 54.67 days with mean of 51.27 days. Minimum days required for 50 % flowering (45.67 days) were recorded in treatment T₅

and was at par with T₇ (47.33 days) whereas maximum days required for 50% flowering (54.67 days) was recorded in treatment T₉ and T₄ which were at par with T₃ (54.33) and T₁₀ (53,33).

The days required for initiation and 50% flowering is an important observation deciding the earliness for the harvest. The results analogous to above findings were reported by Tejaswini Rathod (2017) who evaluated that an average of 43 to 48 days were recorded for 50% flowering after transplanting whereas, 'Lalitha' grafted and own rooted took the lowest number of days (43.33) and 'Arka Anand' took the highest number of days (48.49) in brinjal. Ndereyimana *et al.*, (2013) recorded minimum number of days to 50% flowering (31.50 and 16.50 days) in eggplant (*Solanum melongena* L.) grafts under different spacing and fertigation levels.

Nagma Surve (2019) indicated that minimum number of days (55.00 days) required for 50 % flowering of brinjal plants in treatment T₆ (30 days scion grafted on 25 days rootstock) compared to seedlings (control) 57.00 days.

4.3.10 Days for first harvest

Days for first harvest is an important yield attributing character in commercial cultivation point of view. Days required for first harvest in brinjal grafts in ascending order is given as follows.

$$\mathbf{T_5 < T_7 < T_6 < T_8 < T_{10} < T_1 < T_2 < T_3 < T_4 < T_9}$$

Results presented in Table 15 and depicted in Fig. 12 pertaining to days for first harvest. The days required for first harvest varied significantly in range of 58.40 to 74.00 days with mean of 67.17 days. Minimum days required for first harvest (58.40 days) were recorded in treatment T₅ and it was at par with T₇ (59.60 days) whereas maximum days required for first harvest (74. 00 days) were recorded in treatment T₉.

The similar findings were also obtained by Khah *et al.*, (2006) in

aulbergine; Gisbert *et al.*, (2010) in eggplant. Kekan (2018) opined that days required for first harvest in eggplant cultivar Bandhitiware local seedlings were 72.50 days. Kumar *et al.*, (2019) reported that earliness in flowering corresponded proportionally and significantly for days to first picking in both the treatments Surati Ravaiya pink (60.80 days) and Surati Ravaiya purple (54.80 days) grafted on *Solanum torvum* whereas in self-rooted plant first harvest was recorded at 65.07days, Surati Ravaiya pink and 60.00 days in Surati Ravaiya purple. Darli (2018) observed the earliest 1st harvesting in grafted tomato on eggplant rootstock (85 days) while in non-grafted tomato, 1st harvest was done at 95.9 days after transplanting.

4.3.11 Days for last harvest

Days for last harvest is also one of the important character as it decides number of harvests as well as harvesting span. Days for last harvest in brinjal grafts in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_7 > T_6 > T_8 > T_{10}}$$

Data presented in Table 15 and depicted in Fig. 12 revealed that days for last harvest varied significantly. Days for last harvest were in range of 121.27 to 145.07 with mean of 131.18 days. The treatment T₁ recorded significantly highest number of days to last harvest (145.07), while treatment T₁₀ (control) recorded significantly lowest number of days to last harvest (121.27).

Kekan (2018) observed that days required for last harvest in eggplant cultivar 'Bandhitiware local' (seedlings) were 138.40 days. Nagma Surve (2019) observed that non-grafted brinjal plants recorded lowest days to last harvest, days for last harvest of brinjal plants were 136.33 to 143.67 days. Treatment T₁ (20 days old scion grafted on 20 days old rootstock) recorded highest number of days to last harvest (143.67) while treatment T₁₀ (self-rooted) recorded lowest number of days(days) to last harvest (136.33). Samruddhi Diwale (2019) reported that days for last harvest was in the range of 70-80 days in grafted

Table 15: **Effect of age of rootstock and scion on days required for harvest and span of harvest in brinjal**

Treatment (Rootstock + scion)	Days required for first harvest	Days required for last harvest	Harvesting span
T₁: <i>Solanum torvum</i> 70 days + Bandhtiware local 25 days	69.00	145.07	76.07
T₂: <i>Solanum torvum</i> 60 days + Bandhtiware local 25 days	72.00	143.53	71.53
T₃: Konkan prabha 30 days + Bandhtiware local 25 days	72.00	136.33	64.33
T₄ : Konkan prabha 25 days + Bandhtiware local 25 days	72.40	133.60	61.20
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	58.40	127.20	67.80
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	63.20	125.07	66.67
T₇: Konkan prabha 30 days + Manjiri 25 days	59.60	125.33	65.73
T₈ : Konkan prabha 25 days + Manjiri 25 days	64.00	123.20	59.20
T₉ Bandhtiware local seedling	74.00	131.20	57.20
T₁₀: Manjiri seedling	64.60	121.27	62.87
Range	58.40- 72.4	121.27- 145.07	57.20- 76.07
Mean	66.92	131.18	65.26
Result	Sig	Sig	Sig
S.E.m ±	0.43	0.52	0.54
CD@5%	1.28	1.53	1.60

Fig: 12 Effect of age of rootstock and scion on days required for first and last harvest in brinjal grafts.

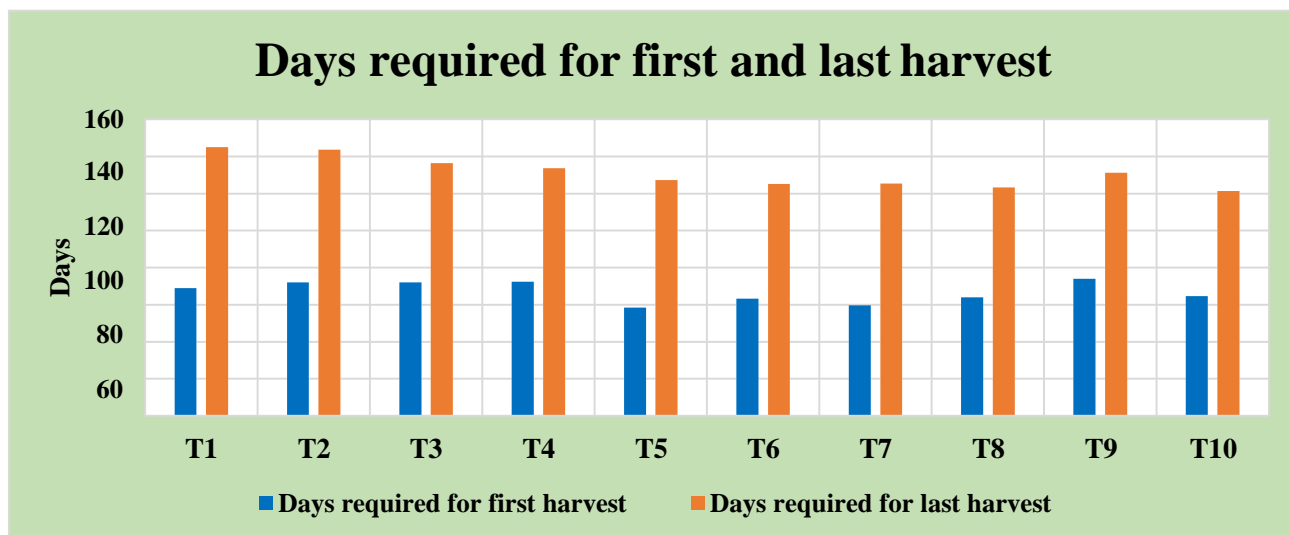
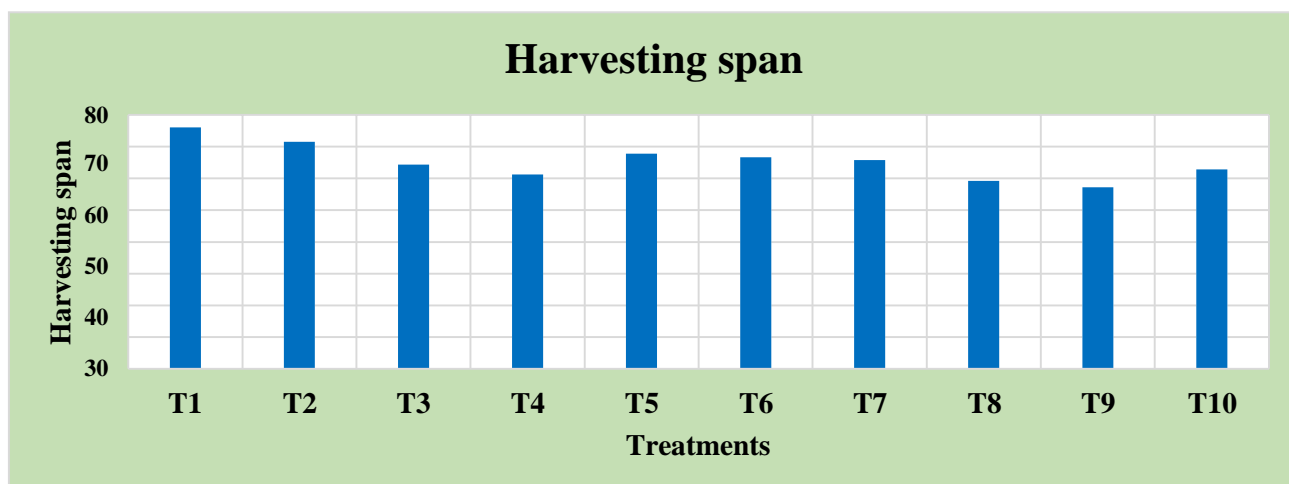


Fig: 13 Effect of age of rootstock and scion on harvesting span in brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhtiware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhtiware local 25 days
- T₃** : Konkani prabha 30 days + Bandhtiware local 25 days
- T₄** : Konkani prabha 25 days + Bandhtiware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum torvum* 60 days + Manjiri 25 days
- T₇** : Konkani prabha 30 days + Manjiri 25 days
- T₈** : Konkani prabha 25 days + Manjiri 25 days
- T₉** : Bandhtiware local seedling
- T₁₀** : Manjiri local seedling

capsicum, higher days (83.23 days) required for last harvest in treatment S₃R₂ (capsicum cv. 'Indra' grafted on 'Konkan prabha').

4.3.12 Span of harvest

Span of harvest is also important character and it decides yield potential as well as intensity and period of availability of fruits for marketing. Span of harvest in brinjal grafts in descending order is given as follows.

$$T_1 > T_2 > T_5 > T_6 > T_7 > T_3 > T_{10} > T_4 > T_8 > T_9.$$

The critical perusal of Table 15 and Fig. 13 exhibited that span of harvest, which was in the range of 57.20 to 76.07 days with mean of 65.26 days. Significantly highest span of harvest (76.07 days) was observed in T₁. While significantly lowest span of harvest (57.20 days) was observed in T₉ (control)

Haldavnekar (2015) reported that span of harvest significantly varied between 29 progenies of brinjal under study and it was in range of 53.50 days to 74.50 days with the mean of 60.98 days. Nagma Surve (2019) observed that span of harvest of brinjal plants was 60.00 to 67.00 days. The lowest span of harvest (60.00 days) was observed in T₁₀ (self-rooted) while highest span of harvest (67 days) was observed in Treatment T₉ (30 days old scion grafted on 30 days old rootstock). Samruddhi Diwale, (2019) investigated that harvesting span in grafted capsicum was in the range of 12 to 20 days, highest harvesting span (20.34 days) recorded in treatment S₁R₃ (capsicum cv. 'Ayesha' grafted on Pusa Jwala).

4.4 Physical parameters of fruit

Physical parameters namely length of fruit, girth of fruit and weight of fruit had direct relation with the yield potential of brinjal. Further, consumers' preference varies with length, girth, weight of fruit as well as colour, shape and size of fruit in brinjal.

4.4.1 Fruit length (cm)

Fruit length in brinjal grafts in descending order is given as follows.

$$\mathbf{T_9 > T_1 > T_2 > T_3 > T_4 > T_{10} > T_5 > T_6 > T_7 > T_8.}$$

The data regarding fruit length are presented in Table 16 fruit length varied significantly and was in range of 5.56 to 17.03 cm with mean of 9.79 cm. The significantly highest fruit length (17.03 cm) was found in T₉ (self-rooted) whereas significantly lowest fruit length was observed in T₈ (5.56 cm).

The highest fruit length (17.03 cm) was recorded in treatment T₉ (self-rooted var. Bandhtiware local) whereas lowest fruit length (5.56 cm) was observed in treatment T₈ (25 days Manjiri scion grafted on 25 days Konkan prabha rootstock). Reduction in length fruit produced on grafted brinjal plant as compared to self-rooted plants might be due to increase in number of fruit per plant as compared to self-rooted plants (Plate 4).

Kumar *et. al*, (2019) observed non-significant difference for length of fruit in both grafted cultivar Surati Ravaiya pink (8.23 cm) and Surati Ravaiya purple (6.75 cm) grafted on *Solanum torvum* as compared to self-rooted cultivar Surati Ravaiya pink (8.14 cm) and Surati Ravaiya purple (6.71 cm).

4.4.2 Fruit diameter (mm)

Fruit diameter in brinjal grafts in descending order is given as follows.

$$\mathbf{T_{10} > T_5 > T_9 > T_6 > T_7 > T_1 > T_8 > T_2 > T_3 > T_4.}$$

The data regarding fruit diameter are presented in Table 16. Fruit diameter was in range of 41.69 to 53.50 mm with mean of 47.71 mm. Significantly maximum (53.50 mm) fruit diameter was observed

Table 16: **Effect of age of rootstock and scion on fruit characters in brinjal grafts**

Treatment (Rootstock + scion)	Weight of fruit (g)	Length of fruit (cm)	Diameter of fruit (mm)
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	146.73	15.64	47.47
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	120.17	13.65	43.90
T₃: Konkan prabha 30 days + Bandhware local 25 days	88.47	12.92	42.14
T₄: : Konkan prabha 25 days + Bandhware local 25 days	83.83	7.88	41.69
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	77.77	6.38	51.71
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	66.83	6.24	49.03
T₇: Konkan prabha 30 days + Manjiri 25 days	76.17	5.95	47.96
T₈: : Konkan prabha 25 days + Manjiri 25 days	65.70	5.56	46.86
T₉ Bandhware local seedling	172.23	17.03	50.17
T₁₀: Manjiri seedling	82.03	6.69	53.50
Range	65.70- 172.23	5.56- 15.64	41.69- 51.71
Mean	97.99	9.79	47.44
Result	Sig	Sig	Sig
S.E.m ±	1.20	0.12	0.40
CD@5%	3.56	0.36	1.20



T₁



T₂



T₃



T₄



T₅



T₆



T₇



T₈



T₉



T₁₀

Plate 4: Fruits at harvest stage of brinjal grafts

in T₁₀ (Self-rooted), whereas significantly minimum fruit diameter (41.69 mm) was recorded in T₄ which was at par with T₃ (42.14 mm)

Maximum (53.50 mm) fruit diameter was observed in treatment T₁₀ (Self-rooted) whereas minimum fruit diameter (41.69 mm) was recorded in treatment T₄ (25 days Bandhitiware local scion grafted on 25 days Konkan prabha rootstock) diameter of fruit produces on grafted plant was reduced as compared to self-rooted plants may be due to more number of fruit produced on grafted plant as compared to self-rooted plants.

Kumar *et al.*, (2019) observed that grafted plant recorded higher fruit diameter in both grafted cultivar Surati Ravaiya pink (7.69) and Surati Ravaiya purple (6.07) grafted on *Solanum torvum* as compared to self-rooted cultivar Surati Ravaiya pink (7.63cm) and Surati Ravaiya purple (6.06). However variation between grafted and non-grafted plants observed to be non-significant.

4.4.3 Fruit weight (g)

Fruit weight in brinjal grafts in descending order is given as follows

$$\mathbf{T_9 > T_1 > T_2 > T_3 > T_4 > T_{10} > T_5 > T_6 > T_7 > T_8.}$$

The data regarding fruit weight is presented in Table 16. Fruit weight was in range of 65.70 to 172.23 g with mean of 97.99 g. Highest fruit weight (172.23) was recorded in T₉ (Self-rooted) while lowest fruit weight (65.70 g) was observed in T₈ which was at par with T₆ (66.83 g).

Highest fruit weight (172.23 g) was observed in treatment T₉ (self-rooted) while minimum fruit weight (65.70 g) was recorded in T₈ (25 days Konkan prabha rootstock grafted on 25 days Manjiri scion) Reduction of fruit weight in grafted plants might be due to more number of fruits per plant as compared to self-rooted plants.

Kumar *et al.*, (2019) reported the maximum fruit weight (73.43g) recorded in grafted 'Surati Ravaiya Pink' followed by self-rooted 'Surati Ravaiya Pink' (73.06 g) whereas, the minimum fruit weight (69.02 g)

was recorded in self-rooted 'Surati Ravaiya Purple' (control).

Nagma Surve (2019) reported that fruit weight varied non-significantly under open field conditions and was in range of 78.93 to 82.50 g with mean of 80.75 g in brinjal.

4.4.4 Number of fruits per plant

Number of fruits per plant in brinjal grafts in descending order is given as follows.

$$T_5 > T_8 > T_3 > T_4 > T_6 > T_7 > T_{10} > T_2 > T_1 > T_9$$

The data regarding number of fruit per plant are presented in Table 17. The critical perusal of data revealed the number of fruit per plant varied significantly in rang of 10.10 – 23.94 with mean of 18.68 fruit per plant. Significantly maximum number of fruit (23.94) recorded in T₅, whereas minimum number of fruit (10.10) observed in T₉

Treatment T₅ (25 days Manjiri grafted on 70 days old *Solanum torvum* rootstock) recorded maximum fruit per plant. Similar findings was recorded by Kumar *et al.* (2017) plant grafted on *Solanum torvum* gave highest number of fruit whereas non grafted plant produced lowest number fruit.

4.5 Fruit yield per plant (kg)

In any crop study, yield is the most important character. Yield is an complex character and number of other characters decides ultimate yield potential of plant. Among all the observations studied in present investigation, the yield attributes are important to judge the better yield potential of brinjal.

Table 17: **Effect of age of rootstock and scion on number of fruits per plant, fruit yield per plant (kg) and fruit yield per hectare (t) in brinjal grafts**

Treatment (Rootstock + scion)	Number of fruits per plant	Fruit yield per plant (kg)	Fruit yield per hectare (t)
T₁: <i>Solanum torvum</i> 70 days + Bandhware local 25 days	15.00	2.35	60.93
T₂: <i>Solanum torvum</i> 60 days + Bandhware local 25 days	15.49	1.99	51.56
T₃: Konkan prabha 30 days + Bandhware local 25 days	21.92	1.94	50.27
T₄: Konkan prabha 25 days + Bandhware local 25 days	21.65	1.90	49.37
T₅: <i>Solanum torvum</i> 70 days + Manjiri 25 days	23.94	1.74	45.03
T₆: <i>Solanum torvum</i> 60 days + Manjiri 25 days	21.37	1.60	41.46
T₇: Konkan prabha 30 days + Manjiri 25 days	19.17	1.48	38.25
T₈: Konkan prabha 25 days + Manjiri 25 days	22.22	1.46	37.88
T₉ Bandhware local seedling	10.10	1.74	45.21
T₁₀: Manjiri seedling	15.96	1.31	34.02
Range	10.10- 23.94	1.31-2.35	34.02- 60.93
Mean	18.68	1.75	45.40
Result	Sig	Sig	Sig
S.E.m ±	0.48	0.7	1.43
CD@5%	1.42	0.21	5.43

Fig: 14 Effect of age of rootstock and scion on fruit yield per plant (kg) in brinjal grafts.

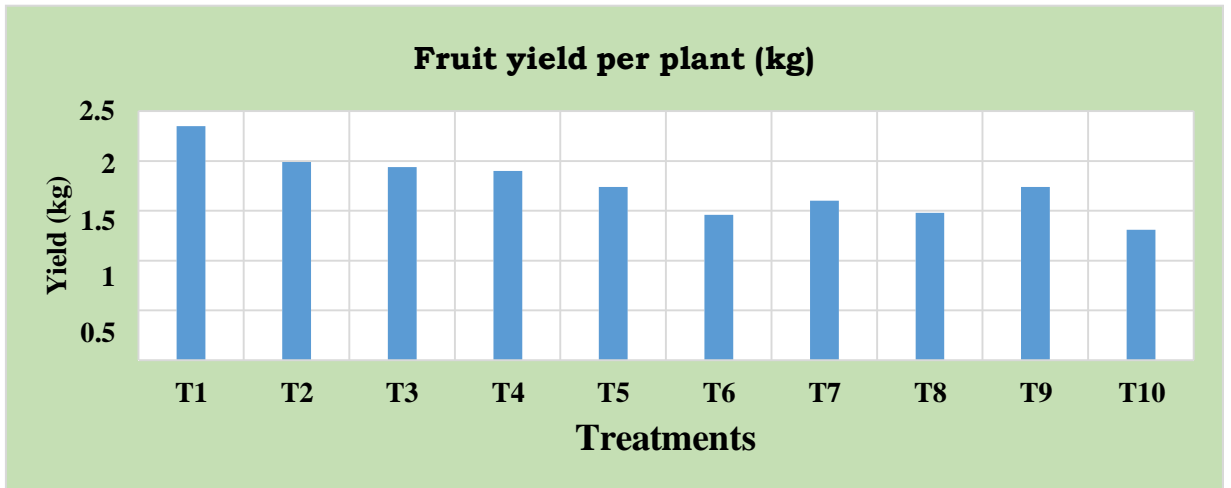
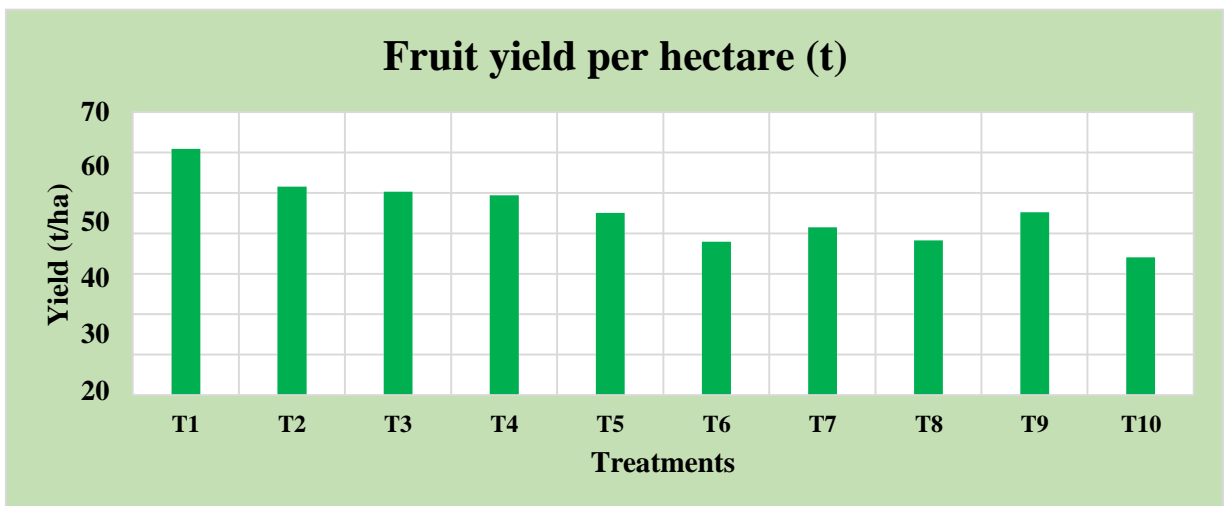


Fig: 15 Effect of age of rootstock and scion on fruit yield per hectare (t) in brinjal grafts.



Notations:

- T₁** : *Solanum torvum* 70 days + Bandhtiware local 25 days
- T₂** : *Solanum torvum* 60 days + Bandhtiware local 25 days
- T₃** : Konkan prabha 30 days + Bandhtiware local 25 days
- T₄** : Konkan prabha 25 days + Bandhtiware local 25 days
- T₅** : *Solanum torvum* 70 days + Manjiri 25 days
- T₆** : *Solanum tovumr* 60 days + Manjiri 25 days
- T₇** : Konkan prabha 30 days + Manjiri 25 days
- T₈** : Konkan prabha 25 days + Manjiri 25 days
- T₉** : Bandhtiware local seedling
- T₁₀** : Manjiri local seedling

Fruit yield per plant in brinjal grafts in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}.}$$

Data presented in Table 17 and depicted in Fig. 14 revealed yield per plant of grafted brinjal plants. The yield per plant was in range of 1.31 to 2.35 kg with mean of 1.75 kg. Significantly maximum yield per plant (2.35 kg) was observed in T₁ whereas minimum (1.31 kg) yield recorded T₁₀ (control) and it was at par with T₈ (1.46 kg) and T₇ (1.48 kg).

The maximum yield per plant (2.35 kg) was observed in treatment T₁ (Bandhtiware local 25 days grafted on *Solanum torvum* 70 days) whereas minimum (1.31 kg) yield recorded T₁₀ (self-rooted). Grafted brinjal noted more yield per plant as compared to self-rooted brinjal plants and this might be due to more number of flowers produced, grafted plant having deep root system which can uptake excessive amount of water and nutrients which resulted more vigour and flowers than self-rooted plants. Similar finding was recorded by Colla *et al.*, (2008) improvement in the nutritional status and higher CO₂ and soil water assimilation; Prioetti *et al.*, (2008) noted that grafting result in increase in the production of endogenous hormones Zijlstra *et al.*, (1994) said that grafting enhanced water and nutrient uptake.

Kumar *et al.*, (2019) reported that marketable yield per plant differed significantly between grafted and non-grafted plants of brinjal. Marketable yield was 1392.58 g per plant in grafted 'Surati Ravaiya pink' while 984.27 g per plant in self-rooted 'Surati Ravaiya pink'. Nagma Surve (2019) reported that under open field conditions yield per plant varied significantly. It was in the range of 1.33 to 1.59 kg per plant with mean of 1.53 kg. Significantly maximum yield (1.59 kg) was recorded in T₄ (20 days old scion grafted on 25 days old rootstock), whereas minimum yield (1.33 kg) was recorded in T₁₀ (self-rooted).

4.6 Yield per hectare (t)

Yield per hectare in brinjal grafts in descending order is given as follows.

$$\mathbf{T_1 > T_2 > T_3 > T_4 > T_9 > T_5 > T_6 > T_7 > T_8 > T_{10}.$$

The critical calculated data from Table 17 and depicted in Fig. 15 indicate the yield per plant and it was in the range of 34.02 to 60.93 to per plant with mean of 45.40 t. Significantly maximum yield (60.93 t) per hectare was observed in T₁, whereas significantly minimum yield (34.02 t) was recorded in T₁₀ (self-rooted).

Maximum yield (60.93 t) per hectare was found in treatment T₁ (Bandhtiware local 25 days grafted on *Solanum torvum* 70 days) while minimum yield (34.02 t) was recorded in T₁₀ (self-rooted Manjiri) due to more number of fruit and fruit having more fruit weight, length and diameter.

Similar findings was recorded by Kumar *et al.*, (2019) concluded the highest fruit yield in grafted 'Surati Ravaiya Purple' (44.46 t/ha) followed by self-rooted 'Surati Ravaiya Purple' (31.67 t/ha) whereas, lowest yield was recorded in control self-rooted 'Surati Ravaiya Pink' (17.60 t/ ha).

4.7 Economics of standardization of grafting in brinjal using *Solanum torvum* and var. Konkan prabha as rootstock.

It is evident from the Table 18 that the grafted treatment T₁ recorded more income as compared to control (T₉) where 'Bandhtiware Local' used as scion variety. The highest yield (60.93 t) was recorded in T₁ and was higher by 15.72 t/ha over control (T₉), which provide additional benefit of Rs. 590762.5 as compared to control (T₉). It was observed that, the highest B:C ratio of 3.91 was recorded in treatment T₁ (25 days scion 'Bandhtiware local' grafted on 70 days rootstock) and was profitable over control T₉ (3.82 B:C ratio).

Similarly, grafted treatment T₅ recorded more income as compared to control (T₁₀) where 'Manjiri' used as scion variety. The

highest yield (45.03 t) was recorded in T₁ and was higher by 11.02 t/ha over control (T₉), which provide additional benefit of Rs. 402362.5 as compared to control (T₁₀). It revealed that highest B:C ratio of 3.49 was recorded in treatment T₅ (25 days scion 'Manjiri' grafted on 70 days rootstock) and was profitable over control T₁₀ (3.33).

Table 18: Economics of standardization of grafting in brinjal using *Solanum torvum* and var. Konkan Prabha as a rootstock

Treatments	Yield (t/ha)	Expenditure Incurred (Rs/ha)	Gross return (Rs/t)	Net Profit	Additional benefit over control	B:C ratio
T ₁	60.93	622733	2437200	2251741	590762.5	3.91
T ₂	51.56	560266.4	2062400	1876941	215962.5	3.68
T ₃	50.27	551666.4	2010800	1825341	164362.5	3.64
T ₄	49.37	545666.4	1974800	1789341	128362.5	3.62
T ₅	45.03	516733	1801200	1615741	469249.5	3.49
T ₆	41.46	492933	1658400	1472941	326449.5	3.36
T ₇	38.25	471533	1530000	1344541	198049.5	3.24
T ₈	37.88	469066.4	1515200	1329741	183249.5	3.23
T ₉	45.21	473810.1	1808400	1660978	-	3.82
T ₁₀	34.02	388062.3	1293913	1146491	-	3.33

Notations:

T₁: *Solanum torvum* 70 days + Bandhtiware Local 25 days

T₂: *Solanum torvum* 60 days + Bandhtiware Local 25 days

T₃: Konkan Prabha 30 days + Bandhtiware Local 25 days

T₄: Konkan Prabha 25 days + Bandhtiware Local 25 days

T₅: *Solanum torvum* 70 days + Manjiri 25 days

T₆: *Solanum torvum* 60 days + Manjiri 25 days

T₇: Konkan Prabha 30 days + Manjiri 25 days

T₈: Konkan Prabha 25 days + Manjiri 25 days

T₉: Bandhtiware Local seedling

T₁₀: Manjiri seedling

CHAPTER V

SUMMARY AND CONCLUSION

The research project entitled “Standardization of grafting of brinjal (*Solanum melongena* L.) using *Solanum torvum* and cv. Konkan prabha as rootstock” was conducted during 2018-19 at College of Horticulture, Dapoli (M.S.). The results obtained are presented as under.

5.1 Girth of rootstock and scion (mm) at collar region at grafting in brinjal :

Maximum girth of rootstock was found in T₅ (1.43 mm) and minimum girth at collar region of rootstock found in treatment T₆ (1.02 mm).

Maximum girth of scion was found in treatment T₃ and T₈ (1.21 mm) and minimum girth at collar region was found in treatment T₅ (1.11 mm).

5.2 Number of leaves on rootstock and scion at grafting in brinjal:

Maximum number of leaves on rootstock was observed in treatment T₁ (3.43) whereas minimum number of leaves was observed in treatment T₄ and T₆ (3.10).

Maximum number of leaves on scion was observed in treatment T₅(3.37) which was at par with T₁ (3.30), T₄ (3.17), T₆ (3.30), T₈ (3.27) and T₁₀ (3.33), while minimum number of leaves was observed in treatment T₃ (3.07) and T₄ (3.07).

5.3 Effect of age of rootstock and scion on days required for graft union of brinjal grafts:

The minimum days required for graft union were recorded in treatment T₅ (8.07) which was at par with T₇ (8.13), T₂ (8.20), T₃ (8.20),

T₆ (8.20). While maximum days required for graft union was recorded in treatment T₄ (8.53).

5.4 Effect of age of rootstock and scion on grafting success and survival of brinjal grafts:

Highest grafting success (97.92 %) was observed in treatment T₃ followed by treatment T₄ (95.83 %) which was at par with treatment T₅ (94.83 %). The minimum grafting success was noted in treatment T₂ and T₇ (92.67 %) and it was at par with treatment T₁ and T₆ (93.75 %).

Maximum grafting survival at the time of transplanting was observed in treatment T₈ (82.25%) while minimum survival was found in treatment T₂ (63.5%).

5.5 Effect of age of rootstock and scion on girth at collar region and graft union of brinjal grafts before transplanting:

Highest girth at collar region after grafting was observed in treatment T₁ (2.10 mm) which was at par with T₃ (2.07 mm), T₄ (1.91 mm), T₉ (1.88 mm), T₂ (1.83 mm), T₅ (1.81 mm), T₁₀ (1.67 mm), T₆ (1.59 mm), T₇ (1.5 mm) while lowest girth at collar region was found in treatment T₈ (1.43 mm).

Highest girth at graft union at transplanting was found in treatment T₁ (2.51 mm) which was at par with T₃ (2.30 mm), T₂ (2.03 mm), T₄ (2.00 mm) T₅ (1.95 mm) while lowest girth was found in treatment T₈ (1.74 mm).

5.6 Effect of age of rootstock and scion on field survival of brinjal grafts:

Maximum field survival (100%) after transplanting was observed in treatment T₁, T₂, T₃, T₄, T₅, T₆, T₇, T₈ and T₉ while in treatment T₁₀ (66.67 %) survival observed after brinjal grafts transplanted in field.

5.7 Effect of age of rootstock and scion on plant height (cm) of brinjal grafts after transplanting:

Highest plant height of brinjal grafts was recorded in treatment T₁ (145.53 cm) after 120 days of transplanting while lowest plant height was recorded in treatment T₁₀ (93.27) was at par with T₈ (96.33cm), T₇ (98.03cm), T₆ (100.50 cm).

5.8 Effect of age of rootstock and scion on number of leaves of brinjal grafts after transplanting:

Maximum number of leaves of brinjal grafts was found in treatment T₁ (114.93) was at par with T₂ (113.60) and T₃ (106.20), T₄ (104.77) whereas treatment T₁₀ (control) recorded minimum number of leaves (76.43), T₈ (78.83), T₇ (87.57), T₆ (88.50) and T₅ (89.53) after 120 days of transplanting.

5.9 Effect of age of rootstock and scion on root parameters of brinjal grafts:

Longest tap root length was observed in treatment T₁ (57.54cm) after 120 DAT of brinjal grafts, while shortest tap root length was observed in treatment T₁₀ (34.11 cm) which was at par with T₈ (34.39 cm).

Maximum number of adventitious roots was observed in treatment T₁ (499.67) which was at par with T₂ (496.17), while minimum was observed in treatment T₁₀ (334.47) which as at par with T₉ (337.72).

5.10 Effect of age of rootstock and scion stem diameter above graft union (mm) of brinjal grafts after transplanting:

Significantly maximum stem diameter above graft union (23.38 mm) was observed in treatment T₁, whereas significantly minimum stem diameter above graft union (15.85 mm) was recorded in treatment T₈, after 120 DAT of brinjal grafts.

5.11 Effect of age of rootstock and scion stem diameter at graft union (mm) of brinjal grafts after transplanting:

The maximum stem diameter at graft union (25.52 mm) was observed in treatment T₁, whereas minimum stem diameter at graft union (17.27 mm) was recorded in treatment T₈ which was at par with T₇ (18.63 mm) and T₆ (18.77 mm) after 120 DAT of brinjal grafts.

5.12 Effect of age of rootstock and scion stem diameter below graft union (at collar region) (mm) of brinjal grafts after transplanting:

Maximum stem diameter at collar region (23.58 mm) was observed in treatment T₁ and was at par with T₂ (22.46 mm) whereas minimum stem diameter below graft union (17.92 mm) was recorded in treatment T₈ which was at par with T₇ (16.63 mm) after 120 days after transplanting of brinjal grafts.

5.13 Effect of age of rootstock and scion on number of branches of brinjal grafts after transplanting:

The highest number of branches at 120 DAT (39.56) were recorded in T₁ while minimum number of branches (30.55) were recorded in T₁₀ which was at par T₈ (31.10) and T₇ (31.25) after 120 DAT of brinjal grafts.

5.14 Effect of age of rootstock and scion on days required for initiation of flowering and 50 % flowering of brinjal grafts after transplanting:

Minimum days required initiation of flowering (41.33 days) was recorded in treatment T₅ and was at par with treatment T₇ (42.33 days) whereas maximum days (51.67 days) were recorded in treatment T₉ which was at par with T₄ (50.67 days).

The days required for 50 % flowering were minimum (45.67

days) was recorded in treatment T₅ and was at par with T₇ (47.33 days) whereas maximum days required for 50% flowering (54.67 days) was recorded in treatment T₉ and T₄ which was at par with T₃ (54.33) and T₁₀ (53.33).

5.15 Effect of age of rootstock and scion on days required for first harvest, days required for last harvest and span of harvest of brinjal grafts after transplanting:

The earliest harvest (58.40 DAT) was recorded in treatment T₅ and it was at par with T₇ (59.60 days) whereas maximum days required for first harvest (74.00 days) were recorded in treatment T₉.

Significantly highest number of days to last harvest (145.07) were observed in T₁, while treatment T₁₀ (control) recorded significantly lowest number of days to last harvest (121.27).

Significantly highest span of harvest (76.07 days) was observed in T₁ and was significantly superior over other treatments whereas lowest span of harvest (57.20 days) was observed in T₉ (control).

5.16 Effect of age of rootstock and scion on length, diameter and weight of fruit in brinjal grafts:

The highest fruit length (17.03 cm) was found in T₉ (self-rooted) Bandhtiware local which was significantly superior over other treatments, whereas significantly lowest fruit length was observed in T₈ (5.56 cm).

The maximum fruit diameter (53.50 mm) was observed in T₁₀ (Self-rooted Manjiri) whereas significantly minimum fruit diameter (41.69 mm) was recorded in T₄ which was at par with T₃ (42.14 mm).

Highest fruit weight (172.23 g) was recorded in T₉ (Self-rooted) while lowest fruit weight (65.70 g) was observed in T₈ which was at par with T₆ (66.83 g).

5.17 Effect of age of rootstock and scion on number of fruits per plant, yield per plant and yield per hectare of brinjal grafts after transplanting:

Maximum number of fruit per plant (23.94) was recorded in treatment T₅ (25 days Manjiri grafted on 70 day old *Solanum torvum* rootstock), while minimum number of fruit per plant (10.10) was observed in treatment T₉ i.e. Bandhitiware local seedling.

Highest fruit yield per plant (2.35 kg) was recorded in treatment T₁ (Bandhitiware local grafted on 70 day old *Solanum torvum* rootstock), while lowest yield per plant (1.31kg) was observed in treatment T₁₀ i.e. Manjiri seedling.

Maximum fruit yield per hectare (60.93 t) was observed in treatment T₁ (Bandhitiware local grafted on 70 day old *Solanum torvum* rootstock) in brinjal graft, while minimum yield per hectare (34.02 t) was recorded in treatment T₁₀ i.e. Manjiri seedling.

5.18 Economics of grafting of brinjal using *Solanum torvum* and var. Konkan prabha as a rootstock.

The highest B:C ratio of 3.91 was recorded in treatment T₁ (25 days scion 'Bandhitiware local' grafted on 70 days rootstock) and was significantly superior over control T₉ (3.82) i.e control.

Highest B:C ratio of 3.49 was recorded in treatment T₅ (25 days scion 'Manjiri' grafted on 70 days rootstock) and was significantly superior over control T₁₀ (3.33) i.e control.

Conclusion

Grafting technique in vegetable production is applied to tackle biotic as well as abiotic stresses. It can be used to increase uniformity and vigour of the various vegetable crops, for sustainable future of horticulture.

Union of brinjal graft took 8.07 to 8.53 days and minimum days required for graft union were observed in treatment T₅ where 25 days old scion of Manjiri grafted on 70 days old *Solanum torvum* rootstock. Treatment T₁ in which 25 days old Bandhitiware local scion grafted on 70 days old *Solanum torvum* rootstock was observed best among all treatments in growth and yield parameters. There was no bacterial wilt incidence found on the grafts but treatment in which seedlings of Manjiri (T₁₀) were used exhibited 66.67 % bacterial wilt infestation. Hence, grafting in brinjal can increase the production in wilt sick soils of Konkan region. Highest B:C ratio of 3.91 was observed in T₁ where 25 days old Bandhitiware local scion grafted on 70 days old *Solanum torvum* rootstock and was profitable over control T₉ (Bandhitiware local seedlings). Similarly highest B:C ratio of 3.49 was observed in T₅ where 25 days old Manjiri scion grafted on 70 days old *Solanum torvum* rootstock and was profitable over control T₁₀ (Manjiri seedlings).

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APPENDIX I

Abbreviation used

%	: Per cent	Mm	: Millimeter
/	: Per	M	: meter
@	: At the rate	m ²	: Meter square
Anon	: Anonymous	mMT	: Million metric tone
°C	: Degree Celsius	dS	: deci-siemens
CD	: Critical difference	NS	: Non-significant
cm	: Centimeter	SE	: Standard Error
cm ²	: Centimeter square	SIG	: Significant
etc.	: Etcetra	Sr. No.	: Serial number
Fig.	: Figure	t	: Tonne (S)
g	: Gram	<i>viz.</i> ,	: Namely
ha	: Hectare	<i>et. al.</i> ,	: and others
i.e.	: That is	cv.	: Cultivar
kg	: Kilogram	var.	: Variety
R.H.	: Relative Humidity	RS	: Rootstock
S	: Scion	DAG	: Days after grafting
DAT	: Days after transplanting		

APPENDIX II

Weekly Weather data during the period of study at Dapoli

(January 2020 to April 2020)

Period	T-max.	T-min.	RH-I	RH-II	Rain	BSS	Epan
	(°C)	(°C)	(%)	(%)	(mm)	(hrs.)	(mm)
01.01 - 07.01	29.4	13.9	91	55	0.0	9.4	3.2
08.01 - 14.01	31.1	16.6	92	58	0.0	8.8	3.3
15.01 - 21.01	29.5	12.7	94	57	0.0	9.5	3.6
22.01 - 28.01	33.4	15.7	92	51	0.0	9.7	3.7
29.01 - 04.02	28.3	12.7	94	54	0.0	9.5	3.5
05.02 - 11.02	30.1	13.1	93	55	0.0	9.0	3.7
12.02 - 18.02	34.4	16.0	92	45	0.0	7.2	4.4
19.02 - 25.02	34.6	15.2	90	45	0.0	9.5	4.6
26.02 - 04.03	34.9	14.3	89	48	0.0	10.1	4.7
05.03 - 11.03	29.9	15.2	89	54	0.0	10.3	5.2
05.03 - 11.03	29.9	15.2	89	54	0.0	10.3	5.2
12.03 -18.03	33.1	15.6	87	49	0.0	10.5	5.8
19.03 - 25.03	33.2	17.3	84	52	0.0	10.3	5.9
26.03 - 01.04	33.7	19.9	82	51	0.0	9.6	6.0
02.04 - 08.04	33.5	19.0	81	52	0.0	10.2	6.3
09.04 - 15.04	34.2	21.2	90	52	0.0	8.5	6.2
16.04 - 22.04	34.5	21.3	91	49	1.2	7.4	5.7
23.04 - 29.04	33.9	21.6	88	53	0.0	11.0	6.4
30.04 - 06.05	33.9	23.0	87	61	1.0	9.1	6.1

APPENDIX III

Cost of cultivation of brinjal grafts (Values in Rs.)

		T1	T2	T3	T4	T5	T6	T7	T8	T9	T10
Sr. No.	Particulars	Total	Total	Total	Total	Total	Total	Total	Total	Total	Total
1	Labour cost	10500	10500	10500	10500	10500	10500	10500	10500	10500	10500
2	Grafting cost	111111	111111	111111	111111	111111	111111	111111	111111	74074	74074
3	Field preparation	30000	30000	30000	30000	30000	30000	30000	30000	30000	30000
4	FYM	20000	20000	20000	20000	20000	20000	20000	20000	20000	20000
5	Urea	1519	1519	1519	1519	1519	1519	1519	1519	1519	1519
6	SSP	2812.5	2812.5	2812.5	2812.5	2812.5	2812.5	2812.5	2812.5	2812.5	2812.5
7	MOP	1500	1500	1500	1500	1500	1500	1500	1500	1500	1500
8	Phorate	350	350	350	350	350	350	350	350	350	350
9	Staking	1000	1000	1000	1000	1000	1000	1000	1000	0	0
10	Irrigation	6667	6667	6667	6667	6667	6667	6667	6667	6667	6667
	Input cost (A)	185459.5	185459.5	185459.5	185459.5	185459.5	185459.5	185459.5	185459.5	147422.5	147422.5
11	Land revenue	100	100	100	100	100	100	100	100	100	100
12	Interest on working capital (@ 6 %)	11127.57	11127.57	11127.57	11127.57	11127.57	11127.57	11127.57	11127.57	8845.35	8845.35
13	Interest on fixed capital @ 10%	1300	1300	1300	1300	1300	1300	1300	1300	1300	1300
14	Rental value of land (1/6 th of gross return)	406200	343733.3	335133.3	329133.3	300200	276400	255000	252533.3	301400	215652.2
15	Supervision charges (@ 10 % input cost)	18545.95	18545.95	18545.95	18545.95	18545.95	18545.95	18545.95	18545.95	14742.25	14742.25
	Total cost	622733	560266.4	551666.4	545666.4	516733	492933	471533	469066.4	473810.1	388062.3
	Gross return	2437200	2062400	2010800	1974800	1801200	1658400	1530000	1515200	1808400	1293913
	Net return	2251741	1876941	1825341	1789341	1615741	1472941	1344541	1329741	1660978	1146491
	Benefit cost ratio	3.91	3.68	3.64	3.62	3.49	3.36	3.24	3.23	3.82	3.33