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The Pharma Innovation

ISSN (E): 2277-7695
ISSN (P): 2349-8242
NAAS Rating: 5.23
TPI 2023; 12(12): 659-665

www.thepharmajournal.com
Received: 08-10-2023
Accepted: 13-11-2023

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Effect of storage condition and capping material on growth parameter of softwood grafting in jamun (*Syzygium cumini* L. Skeels) cv. Konkan Bahadoli

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Abstract
The present investigation carried out during 2022-23 in winter season at Horticulture Nursery, VNMKV, Parbhani. The experiment was laid out in FRBD (Factorial Randomized Block Design) with two factors, factor A consist of 3 storage conditions of graft i.e. S1: Poly house, S2: Shade net and S3: Open field condition and factor B consist of capping material i.e. C1: Pepsi bag, C2: Plastic bag and C3: Without capping with three replications. The experiment was farmed to study the effect of storage conditions and capping material on growth parameter of softwood graft in Jamun. Observation on growth parameter of individual treatments were recorded. The results of the present investigation revealed that, The effect of storage conditions of graft indicated that the storage at poly house (S1) recorded maximum height of graft (58.30 cm), number of leaves (13.10), length of leaves (9.17 cm), leaf area (26.78 cm2), number of shoots per graft (3.81), girth above (3.67 mm) and below (3.86 mm) bud joint, stionic ratio (0.95) and length of scion stick (28.12 cm). The effect of capping material indicated that the capping with pepsi bag (C1) recorded maximum height of graft (57.10 cm), more number of leaves (11.88), length of leaves (8.82 cm), leaf area (23.89 cm2), number of shoots per graft (3.42) and length of scion stick (25.41cm). The interaction effect of storage condition and capping material indicated that the treatment S1C1 (Poly house + Pepsi bag) recorded maximum height of graft (60.60 cm), more number of leaves (13.80), maximum length of leaves (9.63 cm), leaf area (34.70 cm2), number of shoots per graft (4.30), stionic ratio (1.10) and length of scion stick (30.46 cm).

Keywords: Jamun, softwood grafting, Konkan Bahadoli, storage condition, capping material and growth parameter

Introduction
Jamun (*Syzygium cumini* L. Skeels) is a major underutilized indigenous fruit crop of India. It is very common, large, evergreen beautiful tree of Indian sub-continent. It belongs to Myrtaceae family having chromosome number 2n=40. In Jamun there are about 400 to 500 species of which only few are considered edible fruit bearers (Chundawat, 1990) [10]. The other common name of Jamun is Java plum, Black plum, Indian blackberry, Jambolan plum and so forth. It is also known by numerous regional names including Jamun, Jambhul, Jambolanum, Phalani or Phalinda and Kalajam etc. rose apple, Water apple and Malayan rose apple are small commercial crops. It has recently gained prominence in arid regions. It is one of the hardiest fruit crops and could be easily grown in neglected and marshy areas where other fruit plants cannot be grown successfully. It is widely distributed in tropical and subtropical parts of India, Sri Lanka, Malaysia, Thailand, Australia and Philippines.

It is grown in India's tropical and subtropical regions and requires deep loam and well-drained soil for optimal growth and yield. It can also grow well under salinity and water logged conditions. It can be grown at an elevation of around 1500 m above mean sea level. Jamun is a hardy fruit tree that grows well in wastelands. It is drought resilient yet being tolerant of water stagnation and marshy wetlands. Its scattered plantation can be seen in parks, along wayside avenues, and as a windbreak.

India ranks second in Jamun production next to Brazil in area and production in the world (Bodkhe and Rajput, 2010) [8]. It is grown extensively throughout India, from the Indo-gangetic plains in the north to Tamil Nadu in the south (Singh and Srivastava, 2000) [16]. In India, Maharashtra is major Jamun producer followed by Uttar Pradesh, Tamilnadu, Gujrat and Assam (Tripathi, 2021) [17]. The Jamun is a large growing, evergreen tree attaining a height of 25-30 meter and a girth of 3-4 meter. This is long lived tree bearing fruits up to 60-70 years is usually with crocked branches and a tendency to droop smaller branches, on the whole,

forming a beautiful shape tree and is grown for shade and on the boundary. The bark is brown or greyish, fairly smooth up to 2.5 cm thick with shallow depression exfoliating as woody scales.

Leaves are smooth, shiny, lanceolate, oblong or elliptical or hardy or broadly ovate, gland dotted. The first week of March to the end of April sees the onset of greenish white fragrant blossoms in trichotomous particles. Flowers of Jamun are hermaphrodite which appears in the axils of the leaves. Anthesis start at around 8 am and lasts approximately 10 hours peaking between 10.00 am - 12.00 noon. The stigma becomes receptive one day before the anthesis and remains receptive up to 5th day (Misra and Bajpai, 1975) [18]. It is a cross pollinated crop that is pollinated by insects, wind, and gravity.

The fruit of the tree grows in clusters of only a few to 10 to 40 round or rectangular, sometimes curved, long fruits that typically change colour as they ripen from green to light-magenta, then dark purple or nearly black. Jamun fruit is purple colour due to anthocyanin. In Indonesia, a white fruited variety has been noted. The pulp is purple or white, very juicy and normally encloses a single oblong green or brown seed, tightly compressed within a leathery coat and some are seedless. The fruit flavour ranges from acidic to somewhat sweet and sometimes unpalatable. Tannins content in fruits is account for astringency of the fruit.70% of fruits are edible. The Jamun fruit has a lot of nutritional value. The principle sugar content in Jamun are glucose and fructose. Major acid found in Jamun is malic acid (0.59% of the weight of fruit). It contains a small amount of gallic and oxalic acid. In addition to its regular contents of sugar, protein 0.07%, fiber 0.9%, and minerals including Ca, P, Fe etc. it is a rich source of iron (Singh and Srivastava, 2000) [16]. Jamun is one of India's useful medicinal crops because of its refreshing and curative properties. Fruits are used in Ayurvedic Indian Medicine.

Jamun trees are typically grown from seeds, and the seedlings typically exhibit a high amount of variability and a protracted juvenile phase. If propagation is done by seed, it will take longer time to get bearing and large-scale multiplication is not possible in shorter period and true-to type plants are not obtained, so vegetative methods of propagation is used to overcome this problem.

The method of vegetative propagation came into practice largely out of the desire to perpetuate elite seedling clone and the practice of raising trees from seed has been discontinued. The most popular and regularly used vegetative propagation techniques for producing identifiable elite clones in large quantities are air layering and soft wood grafting.

In situ soft wood grafting in the mango was developed by Amin (1978) [1] at Gujarat Agricultural University, Anand, and obtained good success. This method of grafting should be useful even in Jamun for rootstock raised in polythene bags with suitable media.

Kulkarni (1990) [20] reported that 1st fortnight of October was found to be better period for soft wood grafting in Jamun. Seedling grown in polythene bags for softwood grafting at parbhani condition was February to 1st week of March with greatest success in polybags.

In Jamun softwood grafting method is gaining popularity among nurseryman and growers. The procedure involved in soft wood grafting is simple, economical, and less cumbersome. Softwood grafting has the extra benefit of employing detached scion and resulted in a relatively high rate of graft success and survival. The microclimate conditions of the location have a considerable impact on vegetative propagation tactics.

In Jamun polyembryony condition is found so there are difficulties to identify true to type, hence for obtaining true to type elite planting material the experiment had framed for softwood grafting. The survival of grafts is limited, so different storage conditions of grafts and different capping materials are also used to create humidity and prevent drying and desiccation of the graft union to get maximum growth and success of graft. In view of this, the present investigation ''Effect of Storage Condition and Capping Material on Growth Parameter of Softwood Grafting in Jamun (*Syzygium cumini* L. Skeels) cv. Konkan Bahadoli'' was carried out with the following Objectives.

1. To study the effect of storage conditions on growth parameter of grafts of Jamun.
2. To study the effect of capping material on growth parameter of grafts of Jamun.

Materials and Methods

A field experiment on Jamun was conducted during winter season at Horticulture Nursery Parbhani, Vasantrao Naik Marathwada Krishi Vidyapeeth, Parbhani. Geographically Parbhani is situated between 190 16" North latitude and 960 41" east longitudes and at an altitude of 409 meters above mean sea level (MSL). The experiment was designed in FRBD (Factorial Randomized Block Design). There were nine treatment combinations and each treatment was replicated thrice. There were two factor, factor A consist of 3 storage conditions of graft i.e. S1: Poly house, S2: Shade net and S3: Open field condition and factor B consist of capping material i.e. C1: Pepsi bag (1.5×6 inches), C2: Plastic bag (4×6 inches) and C3: Without capping.

In order to evaluate the effect of different storage condition and capping material on growth parameter of softwood graft of jamun, necessary periodical observations were recorded at 30, 60, 90 and 120 DAG and the recorded data was statistically analysed by ANOVA method given by Panse and Sukhatme 1985 [2].

Results and Discussion

Height of graft (cm)

Data indicate that height of graft was significantly influenced by different storage condition at 30, 60, 90 and 120 DAG and it is represented in table 1. Storage at (S1) poly house recorded significantly maximum height of graft (52.38, 53.51, 55.37 and 58.30 cm). Minimum height is observed in (S3) open field condition (43.20, 44.44, 45.77 and 46.99 cm). The finding are aligned with Sivudu *et al.,* (2014) [3] in Mango and Gotur *et al.,* (2017) [5] in Guava. It may be due to congenial temperature and humidity under poly house which help in rapid callusing and early contact between rootstock and scion and also reducing the risk of graft failure due to external factors. It is evident from the data on height of graft was significantly influenced by different capping material at 30,60,90 and 120 days after grafting. Significantly maximum height of graft was observed in capping with (C1) pepsi bag (51.34, 52.23, 53.87 and 57.10 cm) whereas, minimum height of graft was found in (C3) without capping (45.43, 46.59, 48.16 and 49.49 cm). Similar result are reported by Islam (2012) [21] in Mango.

Height of graft is recorded maximum in interaction effect of S1C1. This might be due to controlled environment and micro climate around graft union helping in cambium layer formation. Height of graft is positively correlated with number of leaves. The photosynthetic food produced by leaves was in turn utilized to continue the primary growth at faster rate and resulted as higher graft height. These findings are in agreement with finding observed by Visen *et al.,* (2010) [4] in Guava.

Number of leaves per graft

Number of leaves per graft were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 2. Storage at (S1) poly house recorded significantly maximum number of leaves (7.54, 8.32, 9.86 and 13.10), while minimum number of leaves were observed in (S3) open field condition (6.71,7.00, 8.50 and 9.09). This might be due to favorable growing condition with enhanced CO2 accumulation inpoly house as compared with other conditions, which increased the rate of photosynthesis and development of more number of leaves. These are in line with those results obtained by Sivudu *et al.,* (2014) [3] in Mango, Gotur *et al.,* (2017) [5] in Guava and Mithapara and Karetha (2020) [19] in Sapota.

Number of leaves per graft were significantly influenced by different capping material at 60, 90 and 120 days after grafting. Capping with (C1) pepsi bag recorded significantly maximum number of leaves (7.72, 9.48 and 11.88), while minimum number of leaves were observed in (C3) without capping (7.31, 7.98 and 9.70). It might be due to early sprouting of buds and optimum maturity of scion with congenial environmental conditions promote the growth of grafts results in maximum number of leaves. These results are similar to result noted by Bhilare *et al.,* (2018) [7] in Lemon and Ghosh *et al*., (2010) [13] in Sapota. Number of leaves per graft is recorded maximum in interaction effect of S1C1. These results are in conformity with results reported by Dewangan *et al.,* (2016) [16] in Mango.

Length of leaves (cm)

Length of leaves per graft were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 3. Storage at (S1) poly house recorded significantly maximum length of leaves (4.82, 5.82, 7.68 and 9.17 cm), while minimum length of leaves were observed in (S3) open field condition (4.19, 4.36, 7.04 and 7.81cm). This might be due to micro climate condition with enhanced CO2 accumulation in poly house as compared with other conditions, which increased the rate of photosynthesis and development of increased length leaves. Similar result was obtained by Bhilare *et al.,* (2018) [7] in Lemon, Sivudu *et al.,* (2014) [3] in Mango.

Length of leaves per graft were significantly influenced by different capping material at 60, 90 and 120 days after grafting. Maximum length of leaves was recorded in capping with (C2) plastic bag (5.33, 8.06 and 8.82 cm). Minimum length of leaves was recorded in (C3) without capping (4.47, 6.36 and 7.89 cm). This might be due to controlled micro environment around graft this can increase humidity and maintain stable temperature which promote growth, resulting in length of leaves. The interaction effect between storage condition (S) and capping material (C) was significantly influenced at interval of grafting i.e. 60, 90 and 120 days respectively. Length of leaves per graft is recorded maximum in interaction effect of S1C1. Similar result was obtained by Sivudu *et al.,* (2014) [3] in mango and Bhilare *et al.,* (2018) [7] in Lemon.

Leaf area (cm2)

Leaf area were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 4. Storage at (S1) poly house recorded significantly maximum leaf area (14.03, 17.13, 21.56 and 26.78 cm2), while it was minimum in (C3) open field condition (9.62, 11.14, 13.42 and 16.20 cm2). This might be due to vigorous growth of plant in poly hose condition due to micro climate and strong bud union and development of normal vascular tissue at the bud union which regulates the transport of water and nutrient and thereby increase leaf and leaf area accordingly. These similar findings are in accordance by Chander *et al*., (2016) [9] Jamun.

It is evident from the data on leaf area was significantly influenced by different capping material at 30,60,90 and 120 days after grafting. Significantly maximum leaf area was observed in capping with (C1) pepsi bag (12.66, 15.53, 19.80 and 23.89 cm2) whereas, minimum leaf area was found in (C3) without capping (8.90, 10.81, 13.10 and 16.18 cm2). Pepsi bag capping might have reduced rate of transpiration and increased humidity around graft joint, which protect graft from desiccation. The congenial weather conditions resulted into early sprouting of grafts, probably due to early sprouting grafts took maximum duration for growth as compared to other treatments. Similar result are reported by Bhilare *et al.,* (2018) [7] in Lemon.

Leaf area is recorded maximum in interaction effect of S1C1. This might be due to bigger size of the leaves. Similar result was obtained by Chander *et al*., (2016) [9] Jamun and Bhilare *et al.,* (2018) [7] in Lemon.

Number of shoots per graft

Number of shoots per graft were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 5. Storage at (S1) poly house (2.86, 3.03, 3.37 and 3.81) recorded significantly maximum number of shoots per graft, while it was minimum number of shoots per graft in (C3) open field condition (1.86, 2.12, 2.40 and 2.67). This might be due to more number of active swallow bud which accumulate food material were present in scion shoot which cause more number of shoots. The findings are in aligned with Chavada *et al.,* (2018) [12] in Jamun and Parmar *et al.,* (2019) [15] in Mulberry.

It is evident from the data on number of shoots per graft was significantly influenced by different capping material at 30,60,90 and 120 days after grafting. Significantly maximum number of shoots per graft was observed in capping with (C1) pepsi bag (2.42, 2.72, 3.08 and 3.42) whereas, minimum number of shoots per graft was found in (C3) without capping (2.00, 2.19, 2.43 and 2.77). This might be due to accumulation of food material in scion stick. The findings are aligned with Mane and Nalage *et al.,* (2017) [14] in Tamarind. Number of shoots per graft is recorded maximum in interaction effect of S1C1. Similar findings aligned with Chavada *et al.,* (2018) [12] in Jamun, Mane and Nalage *et al.,* (2017) [14] in Tamarind and Parmar *et al.,* (2019) [15] in Mulberry.

Length of scion stick after success of graft (cm): Length of scion stick after success of graft were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 6. Storage at (S1) poly house (22.60, 24.74,26.62 and 28.12 cm) recorded significantly maximum length of scion stick after success of graft, while minimum length of scion stick after success of graft were observed in (S3) open field condition (18.41,19.38, 20.06 and 21.18 cm). This might be due to that prevailing ideal temperature and relative humidity which is congenial for plant activity which had resulted in increased scion length. Similar result are also reported by Parmar *et al.*, (2019) [15] in Mulberry.

Length of scion stick after success of graft were significantly influenced by different capping material at 30, 60, 90 and 120 days after grafting. Capping with (C1) pepsi bag (21.15, 23.13, 24.00 and 25.41 cm) recorded significantly maximum length of scion stick after success of graft, while minimum length of scion stick after success of graft were observed in (C3) without capping (19.43, 20.80, 21.91 and 22.93 cm). This might be due to early sprouting of buds resulting in early and better union of stock and scion. Similar result are also reported by Parmar *et al.*, (2019) [15] in Mulberry. Length of scion stick after success of graft was recorded maximum in interaction effect of S1C1. Similar result are also reported by Kumar *et al.*, (2018) [6] in Guava.

Girth of the graft above and below the graft joint after success (mm)

Girth above the graft joint after success: Girth above the graft joint after success were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 7. Storage at (S1) poly house (3.04, 3.21, 3.46 and 3.67 mm) recorded significantly maximum girth above the graft joint after success, while it was minimum in (C3) open field condition (1.11, 1.29, 1.48 and 1.77 mm). This might be due to poly house provide congenial condition for more meristematic activity resulted in increased graft girth. Similar result was obtained by Gotur *et al*., (2017) [5] in Guava and Parmar *et al.*, (2019) [15] in Mulberry.

It is evident from the data on girth above the graft joint after success was significantly influenced by different capping material at 30,60,90 and 120 days after grafting. Significantly maximum girth above the graft joint after success was observed in capping with (C2) plastic bag (2.38,2.59,2.82 and 3.04 mm) whereas, minimum girth above the graft joint after success was found in (C3) without capping (1.98, 2.12, 2.36 and 2.61 mm). This might be due to high humidity maintained near the graft union leads more cambium contact between cut portion of stock and scion that contributed in early callus development leading to quicker repair of broken cells resulting in early union development and thereby, maintained increased rate of growth in terms of girth of graft. Similar result was obtained by Parmar *et al*., (2019) [15] in Mulberry.

The interaction effect between storage condition (S) and capping material (C) were found non-significant on girth above the graft joint after success at 30, 60, 90 and 120 days after grafting.

Girth below the graft joint after success: Girth below the graft joint after success were significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 7. Storage at (S1) poly house (3.26, 3.31, 3.50 and 3.86 mm) recorded significantly maximum girth below the graft joint after success, while it was minimum in (S3) open field condition (1.46, 1.61, 1.84 and 2.10 mm). This might be due to poly house provide congenial condition for more meristematic activity resulted in increased graft girth. Similar result was obtained by Gotur *et al*., (2017) [5] in Guava and Parmar *et al.*, (2019) [15] in Mulberry.

It is evident from the data on girth below the graft joint after success was significantly influenced by different capping material at 60,90 and 120 days after grafting. Significantly maximum girth below the graft joint after success was observed in capping with(C2) plastic bag (2.67,2.83,3.02 and 3.27mm) whereas, minimum girth below the graft joint after success was found in (C3) without capping (2.28, 2.37, 2.61 and 2.91mm).

The interaction effect between storage condition (S) and capping material (C) were found non-significant on girth below the graft joint after success at 30, 60, 90 and 120 days after grafting**.**

Stionic ratio: Data on stionic ratio was significantly influenced by different storage conditions at 30, 60, 90 and 120 DAG and it is represented in table 8. maximum stionic ratio was recorded in (S1) poly house condition (0.93, 0.97, 0.99 and 0.95), while minimum stionic ratio was recorded in (S3) open field condition (0.76, 0.80, 0.80 and 0.84). This might be due to more stem girth of the graft above and below bud joint.

Stionic ratio were non- significantly influenced by different capping material at 30, 60, 90 and 120 days. The interaction effect between storage condition (S) and capping material (C) were found non-significant on Stionic ratio at 30 days after grafting and interaction between storage condition (S) and capping material (C) were found significant on Stionic ratio at 60, 90 and120 days after grafting. Stionic ratio was recorded maximum in interaction effect of S1C1. This might be due to more stem girth of the graft above and below bud joint.

Table 1: Effect of storage conditions and capping material on Height of graft (cm).

Treatments	Height of graft			
	30	60	90	120
Storage condition (S)				
S1	52.38	53.51	55.37	58.30
S2	49.68	50.57	52.32	55.41
S3	43.20	44.44	45.77	46.99
SE±	0.70	0.61	0.59	0.54
CD at 5%	2.11	1.83	1.77	1.62
Capping material (C)				
C1	51.34	52.23	53.87	57.10
C2	48.48	49.70	51.43	54.11
C3	45.43	46.59	48.16	49.49
SE±	0.70	0.61	0.59	0.54
CD at 5%	2.11	1.83	1.77	1.62
Interaction (S× C)				
S1 C1	55.40	56.60	58.00	60.60
S1 C2	52.93	54.10	55.70	59.40
S1 C3	48.80	49.83	52.43	56.53
S2 C1	49.53	49.53	51.40	54.93
S2 C2	51.60	52.70	55.03	58.40
S2 C3	47.90	49.50	50.53	51.33
S3 C1	49.10	50.60	52.20	54.20
S3 C2	40.90	42.30	43.60	44.60
S3 C3	39.60	40.50	41.50	42.20
SE±	1.22	1.05	1.02	0.93
CD at 5%	3.66	3.17	3.07	2.81

Table 2: Effect of storage conditions and capping material on Number of leaves

Treatments	Number of leaves			
	30	60	90	120
Storage condition (S)				
S1	7.54	8.32	9.86	13.10
S2	6.99	7.42	8.56	11.88
S3	6.71	7.00	8.50	9.09
SE±	0.14	0.11	0.10	0.10
CD at 5%	0.44	0.35	0.30	0.30
Capping material (C)				
C1	7.24	7.72	9.48	11.88
C2	7.19	7.71	9.46	11.78
C3	6.81	7.31	7.98	9.70
SE±	0.14	0.11	0.10	0.10
CD at 5%	NS	0.35	0.30	0.30
Interaction (S× C)				
S1 C1	7.80	8.60	10.73	13.80
S1 C2	7.50	8.23	10.23	13.33
S1 C3	7.40	8.00	8.60	12.20
S2 C1	7.23	7.53	8.30	11.80
S2 C2	7.33	8.20	9.60	13.00
S2 C3	6.40	6.73	7.80	8.80
S3 C1	6.73	7.10	9.43	10.10
S3 C2	6.80	6.90	8.53	9.03
S3 C3	6.63	7.03	7.53	8.20
SE±	0.25	0.20	0.17	0.17
CD at 5%	NS	0.61	0.51	0.53

Table 3: Effect of storage conditions and capping material on Length of leaves (cm)

Treatments	Length of leaves			
	30	60	90	120
Storage condition (S)				
S1	4.82	5.82	7.68	9.17
S2	4.47	4.84	7.47	8.19
S3	4.19	4.36	7.04	7.81
SE±	0.14	0.12	0.08	0.09
CD at 5%	0.42	0.37	0.26	0.27
Capping material (C)				
C1	4.57	5.22	7.78	8.46
C2	5.00	5.33	8.06	8.82
C3	3.91	4.47	6.36	7.89
SE±	0.14	0.12	0.08	0.09
CD at 5%	NS	0.37	0.26	0.27
Interaction (S× C)				
S1 C1	5.30	6.43	8.40	9.63
S1 C2	5.26	5.60	8.10	9.33
S1 C3	4.03	5.43	6.53	8.53
S2 C1	4.40	4.73	7.43	8.03
S2 C2	5.0	5.50	8.10	8.87
S2 C3	4.03	4.30	6.86	7.80
S3 C1	4.13	4.50	7.50	7.70
S3 C2	4.80	4.90	7.96	8.36
S3 C3	3.66	3.70	5.66	7.36
SE±	0.24	0.21	0.15	0.16
CD at 5%	NS	0.64	0.46	0.48

Table 4: Effect of storage conditions and capping material on Leaf area (cm2)

Treatments	Leaf area			
	30	60	90	120
Storage condition (S)				
S1	14.03	17.13	21.56	26.78
S2	9.76	11.74	15.36	18.52
S3	9.62	11.14	13.42	16.20
SE±	0.51	0.63	0.45	0.59
CD at 5%	1.53	1.88	1.36	1.77
Capping material (C)				
C1	12.66	15.53	19.80	23.89
C2	11.86	13.68	17.45	21.43
C3	8.90	10.81	13.10	16.18
SE±	0.51	0.63	0.45	0.59
CD at 5%	1.53	1.88	1.36	1.77
Interaction (S× C)				
S1 C1	16.86	21.36	27.60	34.70
S1 C2	13.23	15.13	19.50	24.26
S1 C3	11.73	13.96	17.60	21.70
S2 C1	9.66	11.83	15.10	17.23
S2 C2	12.00	14.90	18.86	24.00
S2 C3	7.86	9.43	12.13	14.06
S3 C1	11.43	13.40	16.70	19.80
S3 C2	10.60	11.93	14.00	16.03
S3 C3	6.83	8.10	9.56	12.80
SE±	0.88	1.09	0.77	1.02
CD at 5%	NS	3.27	2.35	3.08

Table 5: Effect of storage conditions and capping material on Number of shoots per graft

Treatments	Number of shoots per graft			
	30	60	90	120
Storage condition (S)				
S1	2.86	3.03	3.37	3.81
S2	2.11	2.41	2.68	2.92
S3	1.86	2.12	2.40	2.67
SE±	0.07	0.06	0.06	0.05
CD at 5%	0.21	0.20	0.18	0.16
Capping material (C)				
C1	2.42	2.72	3.08	3.42
C2	2.40	2.66	2.93	3.21
C3	2.00	2.19	2.43	2.77
SE±	0.07	0.06	0.06	0.05
CD at 5%	0.21	0.20	0.18	0.16
Interaction (S× C)				
S1 C1	3.03	3.30	3.73	4.30
S1 C2	2.83	3.00	3.30	3.70
S1 C3	2.36	2.76	3.03	3.23
S2 C1	2.13	2.36	2.70	2.93
S2 C2	2.70	2.80	3.10	3.43
S2 C3	1.83	2.10	2.30	2.60
S3 C1	2.10	2.50	2.80	3.03
S3 C2	2.00	2.20	2.46	2.70
S3 C3	1.50	1.66	1.93	2.26
SE±	0.12	0.11	0.10	0.09
CD at 5%	NS	0.35	0.32	0.29

Table 6: Effect of storage conditions and capping material on Length of scion stick after success (cm)

Treatments	Length of scion stick			
	30	60	90	120
Storage condition (S)				
S1	22.60	24.74	26.62	28.12
S2	20.44	22.41	22.93	23.96
S3	18.41	19.38	20.06	21.18
SE±	0.34	0.36	0.28	0.25
CD at 5%	1.05	1.11	0.85	0.78
Capping material (C)				
C1	21.15	23.13	24.00	25.41
C2	20.86	22.61	23.70	24.93
C3	19.43	20.80	21.91	22.93
SE±	0.34	0.36	0.28	0.25
CD at 5%	1.05	1.11	0.85	0.78
Interaction (S× C)				
S1 C1	23.90	26.06	28.26	30.46
S1 C2	22.53	24.43	26.76	27.60
S1 C3	21.36	23.73	24.83	26.30
S2 C1	20.13	22.50	22.66	23.50
S2 C2	21.33	23.53	23.70	25.33
S2 C3	19.86	21.20	22.43	23.06
S3 C1	19.43	20.83	21.06	22.26
S3 C2	18.73	19.86	20.63	21.86
S3 C3	17.06	17.46	18.50	19.43
SE±	0.60	0.63	0.49	0.44
CD at 5%	NS	NS	1.47	1.35

Table 7: Effect of storage conditions and capping material on stem girth above the bud joint and below the bud joint (mm)

Treatments	Stem girth Above				Stem girth Below			
	30	60	90	120	30	60	90	120
Storage condition (S)								
S1	3.04	3.21	3.46	3.67	3.26	3.31	3.50	3.86
S2	2.54	2.73	2.98	3.21	2.81	2.98	3.16	3.43
S3	1.11	1.29	1.48	1.77	1.46	1.61	1.84	2.10
SE±	0.09	0.09	0.10	0.10	0.12	0.08	0.08	0.09
CD at 5%	0.28	0.27	0.30	0.30	0.37	0.25	0.25	0.28
Capping material (T)								
C1	2.34	2.52	2.73	2.99	2.58	2.70	2.87	3.21
C2	2.38	2.59	2.82	3.04	2.67	2.83	3.02	3.27
C3	1.98	2.12	2.36	2.61	2.28	2.37	2.61	2.91
SE±	0.09	0.09	0.10	0.10	0.12	0.08	0.08	0.09
CD at 5%	0.28	0.27	0.30	0.30	NS	0.25	0.25	0.28
Interaction (S× C)								
S1 C1	3.30	3.46	3.70	3.93	3.30	3.25	3.40	4.00
S1 C2	3.00	3.20	3.46	3.63	3.33	3.46	3.63	3.73
S1 C3	2.83	3.00	3.20	3.43	3.15	3.20	3.46	3.86
S2 C1	2.53	2.66	2.90	3.10	2.80	3.06	3.26	3.63
S2 C2	2.86	3.10	3.36	3.63	3.06	3.20	3.33	3.60
S2 C3	2.23	2.43	2.66	2.90	2.54	2.66	2.86	3.06
S3 C1	1.20	1.43	1.60	1.93	1.63	1.77	1.93	2.20
S3 C2	1.26	1.46	1.63	1.86	1.59	1.83	2.10	2.30
S3 C3	0.90	1.00	1.20	1.50	1.16	1.23	1.50	1.80
SE±	0.16	0.16	0.17	0.17	0.21	0.14	0.14	0.16
CD at 5%	NS	NS	NS	NS	NS	NS	NS	NS

Table 8: Effect of storage conditions and capping material on stionic ratio

Treatments	Stionic ratio			
	30	60	90	120
Storage condition (S)				
S1	0.93	0.97	0.99	0.95
S2	0.91	0.92	0.94	0.94
S3	0.76	0.80	0.80	0.84
SE±	0.02	0.02	0.01	0.01
CD at 5%	0.07	0.06	0.05	0.05
Capping material (C)				
C1	0.88	0.91	0.93	0.91
C2	0.88	0.90	0.91	0.93
C3	0.84	0.87	0.88	0.89
SE±	0.02	0.02	0.01	0.01
CD at 5%	NS	NS	NS	NS
Interaction (S× C)				
S1 C1	1.00	1.10	1.10	1.00
S1 C2	0.90	0.92	1.00	1.00
S1 C3	0.90	0.92	0.92	0.90
S2 C1	0.90	0.90	0.90	0.90
S2 C2	0.93	1.00	1.01	1.00
S2 C3	0.88	0.91	0.93	0.94
S3 C1	0.73	0.80	0.82	0.90
S3 C2	0.81	0.80	0.80	0.83
S3 C3	0.74	0.78	0.80	0.81
SE±	0.04	0.03	0.03	0.03
CD at 5%	NS	0.10	0.09	0.09

Conclusion

From the present investigation it can be concluded that

Among storage conditions, storage at poly house showed maximum height of graft, number of leaves, length of leaves, leaf area, number of shoots per graft, girth above and below bud joint, stionic ratio and length of scion stick. Storage at poly house condition showed best results.

Among capping materials, capping with pepsi bag showed maximum height of graft, more number of leaves, length of leaves, leaf area, number of shoots per graft and length of scion stick. Capping with pepsi bag showed better result among other treatments.

Interaction effect of S1C1 i.e. (poly house + pepsi bag) significantly recorded maximum height of graft, more number of leaves, maximum length of leaves, leaf area, number of shoots per graft, stionic ratio and length of scion stick. Among interaction effect S1C1 i.e. (poly house + pepsi bag) showed best result among other treatments.

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