

Original Research Article

“Standardization of method and time of budding in Jamun (*Syzygium cumini* Skeels)”

ABSTRACT

The present investigation was conducted at the Research Farm of Department of Horticulture, SHUATS, Prayagraj, on 1-year old rootstocks of Jamun during the period June 2022 to October 2022 with the objective to find out the suitable time and method of budding in Jamun. The statistical design adopted for the experiment was Factorial completely randomised design (Factorial CRD) with three replications and eighteen treatment combinations. *viz.* T₁ (15th June, T-Budding and Patch budding), T₂ (30th June, T-Budding and Patch budding), T₃ (15th July, T-Budding and Patch budding), T₄ (30th July, T-Budding and Patch budding), T₅ (15th August, T-Budding and Patch budding), T₆ (30th August, T-Budding and Patch budding), T₇ (15th September, T-Budding and Patch budding), T₈ (30th September, T-Budding and Patch budding), T₉ (15th October, T-Budding and Patch budding). This study comprises of nine planting times commencing from June 2022 to October 2022 and two methods of propagation *i.e.* T-Budding and Patch budding. The results revealed that among the methods of budding adopted Patch budding during the period 1-15th August was found to be exceptional in terms of highest percent success (92.9%), number of branches (2.5), bud take (89.4%), length of the new sprout (22.7 cm), stem thickness (20.9 mm), leaf area (41.8 cm²), number of leaves per plant (14.9), and number of days to bud sprout was best in terms of minimum days (20.3). The lowest observations were recorded in T₉ (15th October) pertaining for both T-Budding and Patch budding. Thus, based on the results obtained from the experiment Patch budding during the month of August was found to be the most effective for Jamun propagation.

Key words: *Patch budding, T-budding, Jamun, Percent success, Bud take, Propagation*

Introduction

Jamun (*Syzygium cumini* Skeels.), an indigenous and significant minor crop in India, recently attained major importance in arid zones under commercial exploitation (**Baloda *et al.* 2016**). Jamun is widely grown throughout most of India, from the Indo-Gangetic Plains in the North to Tamil Nadu in the South (**Singh and Srivastava, 2000**). India is home to Jamun. It is extensively

spread in India, Sri Lanka, Malaysia, Thailand, Australia, the Philippines, Burma, Ceylon, Nepal, Pakistan, and Bangladesh, all of which are tropical or subtropical regions. According to the world's production and area rankings India second rank. (**Bodkhe and Rajput 2010**). In 2017–18, under Tamil Nadu conditions, there were 156 hectares of land and 1014 tonnes of produce per hectare. The majority of the tree's components, including the bark, leaves, seeds, and fruits, are used as complementary medicines to treat a variety of ailments, giving the tree significant economic significance. Well-known traditional remedies employ it to help diabetic people manage their blood sugar levels.

The tree is abundant in phytochemicals such gallic acid, terpenoids, tannins, anthocyanins, glycoside jambolin, and other minerals. According to **Chaudhary and Mukhopadhyay (2012)**, these diverse ranges of health-promoting chemicals make them a potential candidate to be employed as a nutraceutical.

In added asexual techniques are easy way to preserve the certain characters of variety. Jamun can be propagated by different techniques viz. softwood grafting (**Subash et al. 2016**), patch budding (**Sharma et al. 2016**), cuttings (**Abdullah et al. 2006**). The time of propagation depends mainly on temperature, humidity and availability of planting material reported that (**Angadi et al. 2011**) maximum (100%) graft take was noticed in the months of October. (**Bharad et al. 2011**) in jamun at june, (**Mutteppa et al. 2017**) in guava at January.

The timing and mode of operation should be considered while selecting a particular methodology for spreading jamun since the efficacy of each varies from place to region owing to variations in agroclimatic conditions. Any strategy, no matter how effective it may be in one location, may not work in another. Similar to how a certain approach that is successfully used may change depending on the surroundings, including temperature, relative humidity etc. Therefore, the present study was conducted standardize the method and time of propagation in jamun var. konkan Bahadoli in Tamilnadu.

MATERIALS AND METHODS

The experiment was conducted at the Research Farm, Department of Horticulture, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, for a period lasting from June 2022 to October 2022. Experiment was laid out in

factorial completely randomized design (FCRD) with 9 treatment and 3 replication. Two methods of budding i.e. T-budding, Patch budding were performed on first 15th days of the each month from June to October 2022. The location of experimental site is situated at an elevation of 98 meters above mean sea level (MSL) at 25.45⁰ North latitude and 81.84⁰ East longitudes.

The present experiment was carried out during the period of June, 2022 to October, 2022 at main experiment station, Department of Horticulture. Desi rootstock of 0.5 to 1cm with uniform size and vigour were selected for budding. Rootstocks were procured from Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur, (M.P.). Rajamun tree and CISH J-42 were selected as the scion material for budding.

The biometrical observation were recorded on five randomly selected plants of each replication to assess the morphological characters, *i.e.* Number of days to bud sprout, Number of leaves per budling after 120 days, Leaf area (cm²), Stem thickness/stem girth, Length of the new sprout, Percent success of the sprout, Percent bud take, Number of branches per bud.

Result and Discussion:

Number of days to bud sprout

According to the data presented in Table 1, the minimum (25.4) number of days to bud sprout were found with Patch budding and the best time to perform budding was performed on 15th August. Number of days taken to sprouting of jamun was also influenced by the interaction of time and methods of propagation in jamun where minimum (21.7) number of days to sprout was observed in patch budding during 1-15th August. The interaction of time and methods of propagation showed a significant effect on average days taken for bud sprouting. The maximum (31.1) number of days to bud sprouting were recorded under T-Budding on 15th June.

Regardless of planting time or propagation technique, the cause for early sprouting may be linked to its improved capacity to respond to the meteorological circumstances present at the time of propagation as well as better physiological conditions and more active buds. The apical dominance and rate of substrate supply, along with the presence of a suitable environment in terms of temperature, moisture, and oxygen, control the emerging sprout. Cell division occurs in the presence of phytohormones, and energy released by the hydrolysis of carbohydrates and polysaccharides occurs through enzymatic pathways is used.

The propagation procedure should be carried out when favourable weather conditions are anticipated, and the cambium tissue is in an active state. A higher temperature promotes the production of calluses that connect the scion buds to the stock. Results are consistent with those found by **Panday and Singh (2001)** in Mango and **Giri, and Lenka (2007)** in Jamun.

Number of leaves per budling after 120 days

The results on the number of leaves per bud clearly showed that the number of leaves per bud increased as the development stages progressed in various treatment combinations. As per the data presented in Table 2, at 120 days after budding the maximum (13.4 and 11.8) number of leaves were found when budding was done on 15th August and 30th August, whereas it was found to be minimum (6.0) on 15th October.

The treatment combination of propagation time and method substantially raised the number of leaves per budling (14.9) in combination of 15th August with Patch Budding. The number of leaves were lowest (5.5) when budding was performed on 15th October in combined with T-Budding.

The genetic characteristics of a variety as well as activity and better bud healing during these months are other potential explanations for the increased number of leaves. Vegetative growth may also have been enhanced as a result of physiological processes that were activated by stimulating factors in the plant's metabolism and growth. The findings indicating the most shoots and leaves between August 1 and 15 are consistent with those of **Gurjar and Singh (2012) in Aonla**, who discovered that during the rainy season, well-matured rootstock is promoted by high atmospheric humidity as well as moderately high temperatures. The buds produced the least number of leaves when grafting was done on 15th June and 15th October. **Angadi and Karadi (2012)**

Leaf area (cm²)

According to the data presented in Table 3, the maximum (30.4 cm²) and minimum (24.4 cm²) leaf area were recorded under Patch budding and T-Budding respectively. As influenced by the effect of time of budding, maximum (37.0) and minimum (14.8) leaf area were found be on 15th August and 15th October respectively. Therefore, leaf area was recorded highest (41.8) on 15th August in combination with Patch budding.

The highest leaf area might be attributed to the favourable meteorological conditions, which may have resulted in higher leaf development. **Sivudu *et al.* (2014).**

Stem girth (mm)

The data presented in the Table 4, revealed that the maximum (17.0 mm) and minimum (8.4 mm) stem girth were recorded under Patch budding and T-budding respectively. The interaction of method and time was found to be significant. The best results were observed on 15th August (20.9 mm) followed by 30th August (20.6 mm) in combination with Patch budding.

The growth stimuli might be related to endogenous gibberellin levels, which appear to correspond with enhanced cell division and cell enlargement. This might be due to the stock's rapid development, which ended up resulting in an increase in stem thickness. **Chovatia and Singh (2000) and Bharad *et al.* (2006)** showed similar results in jamun.

Length of the new sprout (cm)

The findings of the data presented in the Table 5, maximum (14.9 cm) sprout length was found to be in Patch budding, whereas it was lower (12.5 cm) in T-Budding. The interaction between method and time was found to be non-significant. Therefore, maximum (22.7 cm) sprout length was found to be on 15th August with Patch budding.

Higher bud temperatures stimulated shoot development and advanced the date of bud break. The lowest (7.0 cm) sprout length were found in the case of T-budding. Similar results were proposed by **Baloda S *et al.*, 2016.**

Percent success of the sprout

It is evident from the data presented in Table 6, that the highest percent success (70.5%) was recorded on 15th August and among various methods of propagation the highest (61.1%) per cent success was recorded in patch budding while the minimum per cent success was (22.4%) on October and (36.5%) with T-Budding. Interaction of time and methods of propagation also had a significant effect on per cent success of Jamun.

Patch budding has the superiority over other procedures in terms of percent success which may be related to the bigger bark and cambium tissues in the patch budding operation. Highest success in patch budding is in accordance with the findings of **Manohran *et al.*, (2000).**

This might also be as a result of an appropriate humidity and temperature for success. The minimum or below average percentage of successful bud-take was recorded in the budding performed during 15th June and 15th October.

Percent bud take

The data pertaining to bud take % as presented in the Table .7, revealed that the highest bud take (60.8%) was recorded on 15th August and among various methods of propagation the highest (67.4%) bud take % was recorded in patch budding while the minimum bud take % was (30.3%) on October and (19.5%) with T-Budding. The interaction between method and time resulted to be significant.

Weather played an important role of bud union and sprouting as it is the time when cambium layer is in its active stage which ensures callus interlocking and highest essential callus production, as advocated by **Moran et al. (1972)**.

The beneficial effect could be attributed to high humidity stretched for longer period in August, which prevents desiccation of the scion. The environmental conditions for misthouse buds can be readily controlled, there by permitting greater reliability of budding over long period, when compared to outdoor budding operation, as reported by **Hartmann and Kester (1979)**.

Number of branches per bud

The results presented in the Table .8, revealed that the highest (2.15) number of branches were recorded on 15th August and were also higher (1.56) with Patch budding. The interaction between time and method was found to be non-significant. Minimum (1.05) number of shots were observed on 15th October and were lower (1.0) with T-budding. Therefore, patch budding when performed on 15th august gave the highest (2.56) number of branches per bud.

The result could be attributed to favourable climatic parameters during the monsoon, which aided in faster growths that acted positively on the rootstock and scion shoot, which might have occurred due to the longer time available for growth in meristematic cells combined with better physiological processes such as photosynthesis and lower respiration. This result is similar with **Rani et al. (2015)**.

CONCLUSION

Based on the results obtained from the present investigation, it can be concluded that the propagating period for Jamun from 1-15th August was found to be the best and among the methods of budding, Patch budding was found to be the best for jamun propagation in subtropical condition at Prayagraj. At this period days to bud sprouting (25.4), leaf area (41.8 cm²), shoot diameter (20.9 mm), number of leaves (14.9), bud take % (89.4 %), number of branches (2.56), percent success (92.9 %), length of the new sprout (22.7 cm) were found be best in this duration. Due to a lack of standardised propagation methods, farmers usually begin cultivating their plants from seeds, which leads in a lack of production of plants that are true to type and makes it difficult for them to make a significant profit from their products. As a result, standardizing the Patch budding technique of propagation will make commercial manufacturing of planting material easier, resulting in increased output on a wide scale.

Table 1 Effect of budding time and method on number of days to bud sprout of Jamun (*Syzygium cumuni* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|------------------------|----------------|----------------|----------------|----------------|------------------|------------------|---------------------|---------------------|-------------------|---------------|
| T-BUDDING | 31.167 | 30.917 | 30.583 | 30.583 | 24.500 | 25.967 | 30.333 | 30.583 | 30.567 | 29.467 |
| PATCH BUDDING | 29.000 | 28.533 | 25.800 | 25.467 | 20.333 | 20.933 | 23.000 | 26.467 | 29.067 | 25.400 |
| Mean | 30.083 | 29.725 | 28.192 | 28.025 | 22.417 | 23.450 | 26.667 | 28.525 | 29.817 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 0.362 | 0.178 | 0.126 | S | | | | | |
| Time | | 0.768 | 0.377 | 0.267 | S | | | | | |
| (Method x Time) | | 1.085 | 0.533 | 0.377 | S | | | | | |

Table 2 Effect of budding time and method on number of leaves per budding after 120 days on Jamun (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------------------------|---------------------------------|------------------------------------|------------------------------------|----------------------------------|---------------|
| T- BUDDING | 6.610 | 7.500 | 10.450 | 11.083 | 11.833 | 11.433 | 10.833 | 8.277 | 5.500 | 9.280 |
| PATCH BUDDING | 8.133 | 9.100 | 9.200 | 10.020 | 14.977 | 12.353 | 10.467 | 9.487 | 6.687 | 10.047 |
| Mean | 7.372 | 8.300 | 9.825 | 10.552 | 13.405 | 11.893 | 10.650 | 8.882 | 6.093 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 0.517 | 0.254 | 0.180 | S | | | | | |
| Time | | 1.098 | 0.539 | 0.381 | S | | | | | |
| (Method x Time) | | 1.552 | 0.762 | 0.539 | S | | | | | |

Table 3 Effect of budding time and method on leaf area (cm²) in Jamun (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------------------------|---------------------------------|------------------------------------|------------------------------------|----------------------------------|---------------|
| T- BUDDING | 18.933 | 19.333 | 25.267 | 27.267 | 32.267 | 29.967 | 29.267 | 23.800 | 14.333 | 24.493 |
| PATCH BUDDING | 22.900 | 26.900 | 29.167 | 32.633 | 41.800 | 41.300 | 36.100 | 28.000 | 15.267 | 30.450 |
| Mean | 20.917 | 23.117 | 27.217 | 29.950 | 37.033 | 35.633 | 32.683 | 25.900 | 14.800 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 1.030 | 0.506 | 0.358 | S | | | | | |
| Time | | 2.185 | 1.073 | 0.759 | S | | | | | |
| (Method x Time) | | 3.090 | 1.517 | 1.073 | S | | | | | |

Table 4 Effect of budding method and time on stem thickness (mm) in Jamun (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|----------------------------|----------------------|----------------------|----------------------|----------------------|------------------------|------------------------|---------------------------|---------------------------|-------------------------|---------------|
| T- BUDDING | 7.027 | 7.337 | 8.273 | 8.670 | 10.967 | 10.570 | 9.000 | 7.413 | 7.007 | 8.474 |
| PATCH BUDDING | 15.100 | 15.603 | 16.947 | 17.080 | 20.927 | 20.633 | 18.667 | 17.193 | 11.493 | 17.071 |
| Mean | 11.063 | 11.470 | 12.610 | 12.875 | 15.947 | 15.602 | 13.833 | 12.303 | 9.250 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 0.370 | 0.182 | 0.128 | S | | | | | |
| Time | | 0.784 | 0.385 | 0.272 | S | | | | | |
| (Method x Time) | | 1.109 | 0.545 | 0.385 | S | | | | | |

Table 5 Effect of budding method and time on length of the new sprout (cm) in Jamun (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------------------------|---------------------------------|------------------------------------|------------------------------------|----------------------------------|---------------|
| T- BUDDING | 8.200 | 10.333 | 10.833 | 11.200 | 20.400 | 20.267 | 14.233 | 10.467 | 7.033 | 12.552 |
| PATCH BUDDING | 11.373 | 12.353 | 13.413 | 14.580 | 22.793 | 20.427 | 14.840 | 13.313 | 11.320 | 14.935 |
| Mean | 9.787 | 11.343 | 12.123 | 12.890 | 21.597 | 20.347 | 14.537 | 11.890 | 9.177 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 1.090 | 0.535 | 0.378 | S | | | | | |
| Time | | 2.312 | 1.135 | 0.803 | S | | | | | |
| (Method x Time) | | N/A | 1.606 | 1.135 | NS | | | | | |

Table 6 Effect of budding time and method on Percent success of Jamun budding (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|----------------------------|----------------------|----------------------|----------------------|----------------------|------------------------|------------------------|---------------------------|---------------------------|-------------------------|---------------|
| T- BUDDING | 27.193 | 26.927 | 40.213 | 40.833 | 48.107 | 47.913 | 41.017 | 36.637 | 19.680 | 36.502 |
| PATCH BUDDING | 31.183 | 48.653 | 61.440 | 68.787 | 92.907 | 86.080 | 85.423 | 50.593 | 25.150 | 61.134 |
| Mean | 29.188 | 37.790 | 50.827 | 54.810 | 70.507 | 66.997 | 63.220 | 43.615 | 22.415 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 2.885 | 1.417 | 1.002 | S | | | | | |
| Time | | 6.119 | 3.005 | 2.125 | S | | | | | |
| (Method x Time) | | 8.654 | 4.250 | 3.005 | S | | | | | |

Table 7 Effect of budding time and method on Bud take (%) of Jamun (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|----------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|---------------------------------|---------------------------------|------------------------------------|------------------------------------|----------------------------------|---------------|
| T- BUDDING | 11.933 | 15.033 | 19.233 | 21.350 | 32.267 | 27.387 | 25.000 | 13.200 | 10.343 | 19.527 |
| PATCH BUDDING | 52.767 | 60.533 | 65.673 | 71.573 | 89.407 | 83.637 | 78.080 | 54.967 | 50.343 | 67.442 |
| Mean | 32.350 | 37.783 | 42.453 | 46.462 | 60.837 | 55.512 | 51.540 | 34.083 | 30.343 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | 0.349 | 0.171 | 0.121 | S | | | | | |
| Time | | 0.740 | 0.363 | 0.257 | S | | | | | |
| (Method x Time) | | 1.046 | 0.514 | 0.363 | S | | | | | |

Table 8 Effect of budding time and method on number of branches per bud in Jamun (*Syzygium cumini* Skeels)

| | 15th June 2022 | 30th June 2022 | 15th July 2022 | 30th July 2022 | 15th August 2022 | 30th August 2022 | 15th September 2022 | 30th September 2022 | 15th October 2022 | Mean |
|------------------------|----------------|----------------|----------------|----------------|------------------|------------------|---------------------|---------------------|-------------------|-------------|
| T-BUDDING | 1.00 | 1.23 | 1.20 | 1.43 | 1.73 | 1.50 | 1.43 | 1.10 | 1.05 | 1.30 |
| PATCH BUDDING | 1.10 | 1.34 | 1.55 | 1.66 | 2.56 | 1.90 | 1.80 | 1.07 | 1.05 | 1.56 |
| Mean | 1.05 | 1.29 | 1.38 | 1.55 | 2.15 | 1.70 | 1.62 | 1.08 | 1.05 | |
| | | C.D. | SE(d) | SE(m) | F-Test | | | | | |
| Method | | N/A | 0.710 | 0.502 | NS | | | | | |
| Time | | N/A | 1.506 | 1.065 | NS | | | | | |
| (Method x Time) | | N/A | 2.130 | 1.506 | NS | | | | | |

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