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SUCCESS EVALUATION OF BUDDING METHODS AND TIMINGS IN BAEL (*AEGLE MARMELOS* L.) cv. NB-5

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ABSTRACT

To determine the best time and techniques for commercial multiplication of bael (*Aegle marmelos* L.) the current study, "Success evaluations of budding methods and timing in bael (*Aegle marmelos* L.)" was conducted during 2022 at the Experimental unit of the Department of Horticulture, Tilak Dhari Post Graduate College, Jaunpur, U.P.. It consists of two propagation techniques, patch budding and T-budding, and six propagation times that run from June to August at fortnightly interval *viz.* 7 June, 21 June, 7 July, 21 July, 7 August and 21 August. According to the study's findings, patch budding was the most successful propagation techniques in terms of the least days taken for sprouting (15.22 days), the highest percentage of bud take (83.96%), maximum shoot length (34.81 cm), number of leaves (19.69), leaf area (56.20 cm^2), mean root length (19.63 cm) and the total number of roots per plant (32.45). Among planting times, 21st June proved to be the most suitable in improving the root, shoot and leaf parameters.

***Keyword*:** Bael, patch budding, T-budding, shoot length, leaf area, bud take percentage, mean root length

Introduction

Bael (*Aegle marmelos* L.) is one of the most neglected and underutilized fruit crops however, considered as nutritious and medicinal powerhouse. Despite having several nutritional and therapeutic benefits for humans, not much focus has been given on its development, research and production. Bael grows naturally from seed in tropical and subtropical regions of dry deciduous forests. Its many applications and ability to tolerate adverse climatic conditions make it extremely important in wasteland development and dry land horticulture. Owing to its Indian origin, a diverse genetic foundation exists across the nation, which requires commercial cultivation and conservation. Because of its cross-pollinated nature when reproduced through seed, a wide variability exists its population. Vegetative propagation ensures multiplication of selected, elite clones for commercial production and conservation. Though the timing of propagation varied depending on the location, several experts believed that budding was the best suitable technique for its commercial propagation (Kumar *et al*., 1995; Tripathi and Kumar, 2004).

Currently, wedge-grafting is widely used in a variety of fruit crops, including custard apples (Ghosh *et al*., 2004), sapota (Pampanna and Sulikeri, 2000) and jamun (Madalageri *et al*., 1991). Unfortunately, there is very little information available on the best method and suitable time period for successful bael propagation. Many districts in Uttar Pradesh with sandy loam soil zone contain a sizable population of elite bael genotypes, but there is no information on how they are propagated? This experiment was aimed to standardize propagation techniques and optimal propagation times for bael in nurseries and fields in the southeast region of Uttar Pradesh in order.

Materials and Methods

The investigation was conducted at an experimental unit of Tilak Dhari Post Graduate College, Jaunpur during 2022. The study location has sandy loam soil and a dry subtropical climate. **Table 1** displays meteorological data for this time period. Seedlings (rootstocks) were raised from seeds of fruits collected from a single, elite plant from a nearby village. A year prior to budding, these were raised in

open conditions in 25cm x 15cm perforated black polythene bags. Before budding (Patch and 'T'), seedlings were headed back 30-40 cm above the ground. For patch and T budding, forty budlings each were created and each was repeated three times using a Randomized Block Design. The budding operation was conducted in an open field condition at fortnightly interval *viz.* on 7 June, 21 June, 7 July, 21 July, 7 August and 21 August. A total of 240 budlings prepared using bud wood of a selected elite plant of the cultivar Narendra Bael-5. Success rate of propagation and data on plant growth were recorded four months after budding.

Results and Discussion

For a nursery to be effective, obtaining optimal growth and knowledge about the appropriate propagation techniques and timing are critical. The investigation's findings showed that patch budding outperformed "T" budding in terms of success regardless of the operating period. The optimal period for patch and "T" budding was from mid-June to mid-July (June 21–July 21).

Table 1 : Mean meteorological data of 2022 recorded for the period under investigation

Week No.	Month & Date	Rainfall mm	Temperature ^{0}C		R.H. %		Wind Speed km/h	Sunshine hours	Evaporation mm
			MAX	MIN	Morn.	Even			
23	June 04-10	0.0	42.9	26.5	75	30	4.0	8.6	7.9
24	11-17	0.0	41.0	27.7	62	37	5.9	6.9	9.3
25	18-24	109.8	37.9	22.5	48	49	5.5	7.4	6.1
26	25-01	237.4	36.1	24.0	86	61	4.1	4.0	4.3
27	July 02-08	0.2	34.9	24.7	84	68	5.0	6.8	4.6
28	09-15	0.0	37.0	25.5	73	53	8.4	10.4	8.0
29	16-22	155.2	34.7	24.3	81	64	6.3	7.3	5.9
30	23-29	255.4	33.6	23.2	89	67	4.6	5.2	3.1
31	30-05	90.0	34	22.3	91	70	3.1	3.4	3.6
32	Aug 06-12	20.6	32.4	23.7	87	75	6.6	5.9	4.0
33	13-19	47.0	33.5	22.5	85	67	5.9	6.8	4.0
34	20-26	139.8	37.9	22.5	91	73	5.2	4.9	2.9

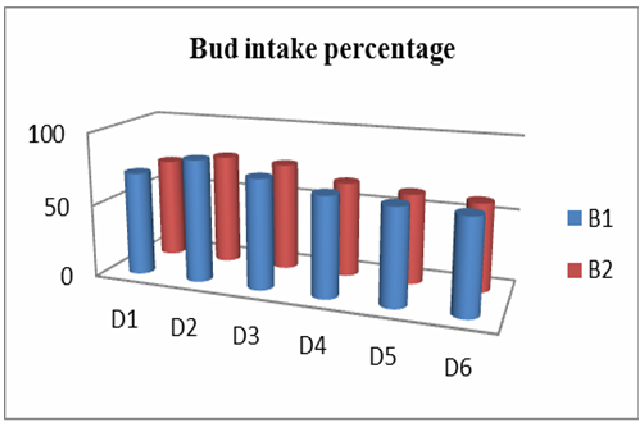
Patch budding produced the most bud take, which was 65–85%, while "T" budding produced 50–65%. This can be because the stock and budwood are physiologically more active during these months. It is well known that during the months of May and June, plants begin a new growth flush following an extended period of dormancy. It is possible that this led to healthy cambial activity and sap flow. It is possible that the stocks' and the buds' physiological state played a major role in achieving better budding success. June was the month with the highest success rate since the weather was perfect and the stock and bud wood plants were in an active growth phase.

According to the investigation's findings, the bud take percentage of those patch-budded on June 21st (83.96%) was the greatest (Table 2), followed by those on July 7th (75.40%). After July 21, the success rate sharply decreased, most likely as a result of the continuous rain. This might have had an impact on cambial activity in both the stock and the scion as well as bud union, which are known to be strongly connected with the current atmospheric circumstances (Kumar *et al.*, 1995). Since June-budded plants had shoot lengths of 36 to 40 cm and leaf counts of 32 to 46, it was determined that the growth of the successful plants was sufficient.

Regardless of the time of operation, it was shown that plants raised using patch budding, as opposed to "T" budding, had greater growth in terms of days taken for bud sprouting, shoot length, number and area of leaves, mean root length and total number of roots per plant. After analyzing the data in Table 3, it was found that, among the various propagation times and techniques, patch budding took the least days for bud sprouting (15.22 days), whereas "T" budding took maximum days for bud sprouting (20.18 days).

Table & Fig. 2 : Success evaluations of budding methods and timing on bud take percentage in bael

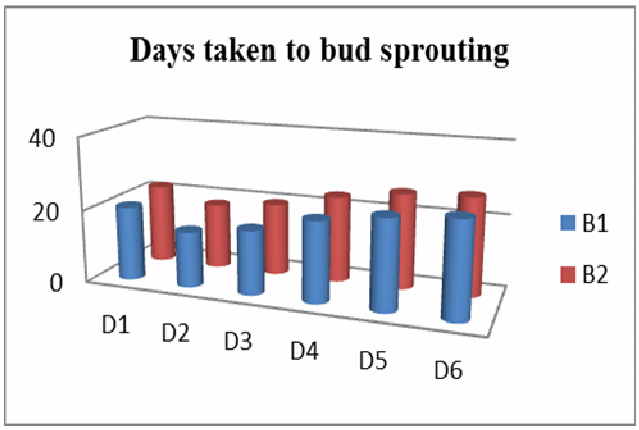
Bud takes Percentage	B_1	B_2	Mean
D_1	71.13	61.04	**66.085**
D_2	83.96	68.02	**75.99**
D_3	75.4	63.54	**69.47**
D_4	68.51	56.31	**62.41**
D_5	66.08	53.73	**59.905**
D_6	64.67	51.76	**58.215**
Mean	**71.63**	**59.07**	
Comparison	**B**	**D**	**B x D**
S. Em±	0.04	0.05	0.09
C.D. @5%	0.10	0.12	0.24



The number of days taken for bud sprouting in bael was shown to be significantly influenced by the propagation time; on June 21, plants that had budded showed the shortest sprouting time. When the cambium tissue is in the active stage and a favorable temperature is anticipated, that is when the propagation operation should occur. A higher temperature promotes the production of calluses, which connect the scion buds to the stock. The outcomes conform to the findings of Sivudu *et al*. (2014) in mango, Dixit *et al.* (2019) in Jamun, Singh and Parmar (1998) in Aonla.

Table & Fig: 3 Success evaluations of budding methods and timing on days taken to bud sprouting in bael

Days taken to bud Sprouting	B1	B2	Mean
D1	20.38	24.51	**22.445**
D2	15.22	20.18	**17.7**
D3	17.54	22.08	**19.81**
D4	21.96	26.64	**24.3**
D5	24.56	27.37	**25.965**
D6	26.06	28.02	**27.04**
Mean	**20.95**	**24.8**	
Comparison	**B**	**D**	**B x D**
S. Em±	0.04	0.05	0.09
C.D. @5%	0.10	0.12	0.24



Highest shoot length (34.81 cm) was reached (Table 4) when patch budding was done on June 21, with the maximum number of leaf (19.69) in plants budded on June 21(Table 5), and the maximum leaf area (56.20 cm^2) in plants patch budded on July 21 (Table 6). In 'T' budding, the plants budded on June 21st had the tallest shoot (28.15 cm), followed by those budded on July 7th (23.84 cm). Plants budded on June 21, had the highest leaf number in this location, closely followed by plants budded on July 7. The outcome could be attributed to the monsoon's favorable climatic conditions, which aided in faster growth and had a positive effect on the rootstock and scion shoot. This could have occurred because meristematic cells had more time to grow, improved physiological processes like photosynthesis and reduced respiration. This outcome is comparable to the mango study by Panchal *et al.* (2022), Rawat *et al.* (2023); and Rani *et al.* (2015) in guava.

Table & Fig 4 : Success evaluations of budding methods and timing on shoot length (cm) in bael

Shoot length (cm)	B1	B2	Mean
D1	27.20	21.03	**24.115**
D2	34.81	28.15	**31.48**
D3	29.98	23.84	**26.91**
D4	24.84	17.53	**21.185**
D5	23.00	15.98	**19.49**
D6	21.42	14.41	**17.915**
Mean	**26.88**	**20.16**	
Comparison	**B**	**D**	**B x D**
S. Em±	0.03	0.03	0.06
C.D. @5%	0.06	0.08	0.15

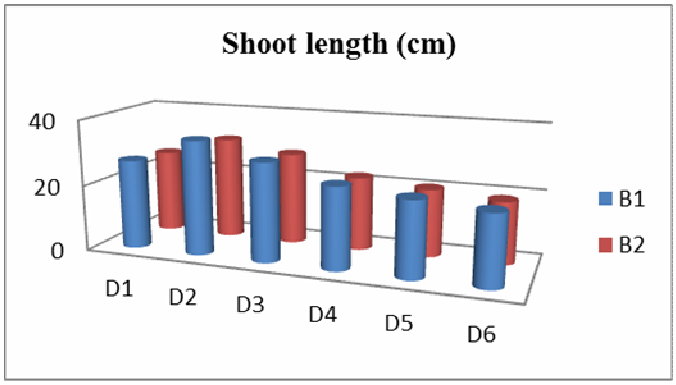


Table & Fig 5 : Success evaluations of budding methods and timing on total number leaves per plant (cm) in bael

Total number leaves per plant	B1	B2	Mean
D1	13.61	11.59	**12.6**
D2	19.69	15.32	**17.505**
D3	15.99	13.26	**14.625**
D4	12.67	9.67	**11.17**
D5	10.30	8.23	**9.265**
D6	9.73	7.51	**8.62**
Mean	**13.67**	**10.93**	
Comparison	**B**	**D**	**BxD**
S.Em±	0.03	0.04	0.08
C.D. @5%	0.09	0.11	0.21

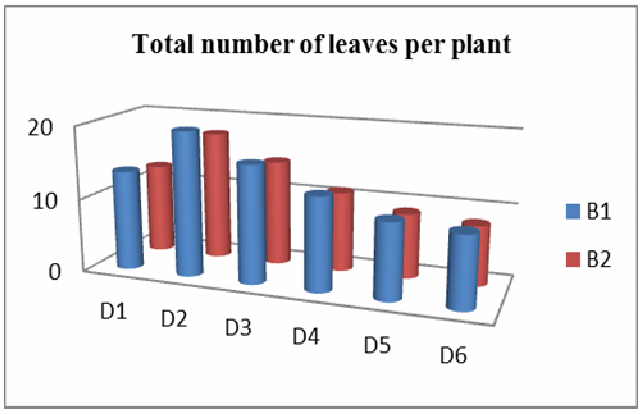
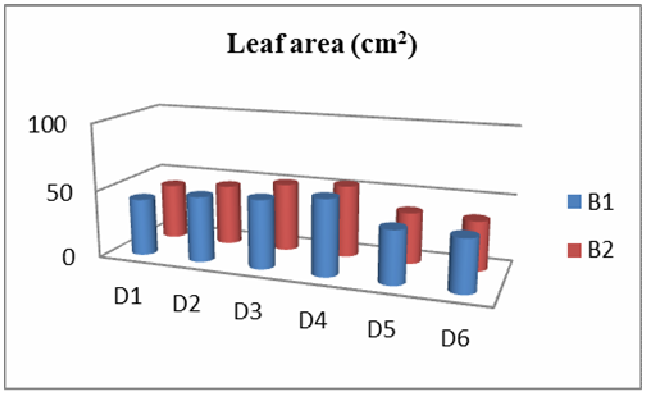


Table & Fig 6 : Success evaluations of budding methods and timing on leaf area (cm^2) in bael

Leaf area (cm^2)	B1	B2	Mean
D1	42.37	40.54	**41.455**
D2	48.68	42.2	**45.44**
D3	51.06	46.49	**48.775**
D4	56.20	49.81	**53.005**
D5	39.27	34.83	**37.05**
D6	38.72	32.07	**35.395**
Mean	**46.05**	**40.99**	
Comparison	**B**	**D**	**BxD**
S.Em±	0.05	0.06	0.12
C.D. @5%	0.14	0.17	0.33



The longest mean root length (19.63 cm) among the budding techniques was achieved by patch budding (Table 7), closely followed by (17.80 cm). The timing of budding had no discernible impact on the mean root length. A preliminary review of the data in Table 8 revealed that neither the method nor the timing of budding significantly affected the total numbers of roots in the budded plants. On June 21, however, plants with patch budding and T-budding demonstrated maximum root counts of 32.45 and 24.27, respectively.


Plate 1 : Experimental field overview


Plate 2 : Budding and bud sprouting

Table & Fig. 7 : Success evaluations of budding methods and timing on mean root length (cm) in bael

Mean root length (cm)	B1	B2	Mean
D1	14.40	14.08	**14.24**
D2	19.63	17.74	**18.685**
D3	17.80	16.5	**17.15**
D4	15.63	15.13	**15.38**
D5	14.19	13.86	**14.025**
D6	13.79	13.41	**13.6**
Mean	**15.91**	**15.12**	
Comparison	**B**	**D**	**B x D**
S. Em±	0.14	0.17	0.34
C.D. @5%	0.39	0.48	0.96

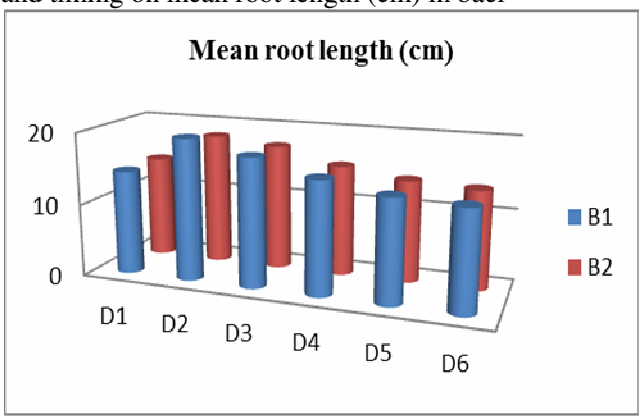
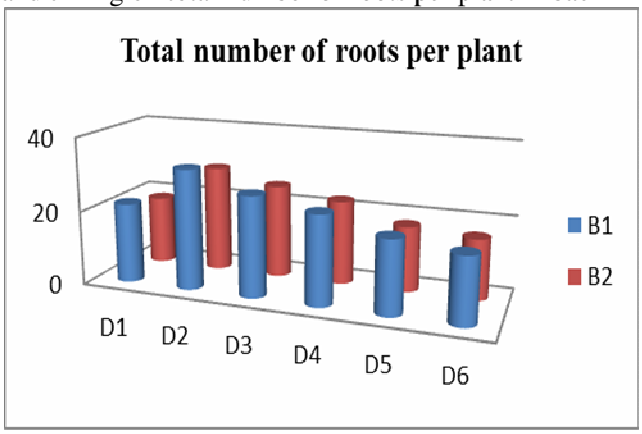


Table & Fig. 8 : Success evaluations of budding methods and timing on total number of roots per plant in bael

Total number of roots per plant	B1	B2	Mean
D1	21.54	17.82	**19.68**
D2	32.45	24.27	**28.36**
D3	27.14	21.52	**24.33**
D4	24.15	20.68	**22.415**
D5	19.88	17.01	**18.445**
D6	17.87	15.85	**16.86**
Mean	**23.84**	**19.53**	
Comparison	**B**	**D**	**B x D**
S. Em±	0.05	0.06	0.11
C.D. @5%	0.12	0.15	0.29



Conclusion

Bael, one of the most important native fruit plants, has many medicinal uses. Its numerous uses might increase its popularity in the future. Looking into the importance of this fruit, the demand for its planting material is increasing day by day. To meet the demand for true to type planting material, the vegetative propagation method was standardized to yield high-quality planting material. Locally available seeds from single genome of bael tree were used as planting material as rootstocks. Uniform rootstocks of 12 to 14 months old were used for budding operation. It was found that the suitable method for multiplying bael is patch budding during June and July (before the start of the rainy season). This method and time need to be disseminated in order to improve the plant's success and survival in the southeastern Uttar Pradesh.

References

Dixit, P., Kumar, A., Prakash, S., Kumar, M., Kumar, V., Shukla, S., Kumar, M. and Kumar, U. (2019). Effect of time, techniques and environment of propagation on performance of guava (*Psidium guajava* L.). *Indian Journal of Agricultural Sciences*, 89, 415-419.

Ghosh, S.N., Manna, S. and Mathew, B. (2004). Effect of season on success of grafting in custard apple under semi-arid condition of West Bengal. *The Hort. J.,* 17, 89-91.

Kumar, D., Singh, S.P. and Rajput, C. B. S. (1995). Influence of environmental factors and methods of budding in bael. *Ind. J. Hort.,* 52, 170-173.

Madalageri, M.B., Patil, V.S. and Nalawadi, U.G. (1991). Propagation of jamun (*Syzygium cumini*) by softwood wedge grafting. *My forest,* 27, 176-178.

Pampanna, Y. and Sulikeri, G. S. (2000). Effect of season on the success and growth of softwood grafts in sapota on invigorated rayan rootstock. *Karnataka J. Agril.Sci.,* 13, 779-782.

Panchal, S. B., Patel, C.R. and Chaudhary, H.L. (2022). Effect of grafting time and methods in custard apple (*Annona squamosa* L.) *cv*. Sindhan under South Gujarat condition. *Res. J. Environ. Sci.,* 5 (6), 39-41.

Rani. S., Sharma, A., Wali, V.K., Bakshi, P., Ahmed, S. (2015). The standardization of method and time of propagation in guava (*Psidium guajava*). *Indian Journal of Agricultural Sciences*. 85 (9), 1162-9.

Rawat, A., Joseph, A. V. and Bahadur, V. (2023). Standardization of Methods and Time of Budding in Jamun (*Syzygium cumini* Skeels). *Int. J. Plant Sci.*, 35 (17), 381-390.

Singh, G.K. and Parmar, A.S. (1998). Studies on the effects of methods and dates of budding in Aonla (*Emblica officinalis* Gaertn). *Annals of Arid zone*. 37 (2), 199-201.

Sivudu, B.V., Reddy, M.L.N., Baburatan, P., Dorajeerao, A.V.D. (2014). Effect of structural conditions on veneer grafting success and survival of mango grafts (*Mangifera indica* cv. Banganpalli). Plant Arch., 14, 71-75.

Tripathi, A. and Kumar, R. (2004). Studies on the effect of method and time of budding in bael. *Haryana J. Hortl. Sci.,* 33, 195-98.