



Effects of leaf and node retention on rootstock of epicotyl grafting in mango

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ABSTRACT

The present study was conducted to investigate the effect of leaf and node retention on the rootstock on success and growth of epicotyl grafting in ten varieties of mango. The experiment was conducted at the Germplasm Centre (GPC) of Fruit tree improvement project (FTIP), Department of Horticulture, Bangladesh Agricultural University, during the period from September, 2003 to May, 2004. The experiment consisted of (i) grafting at three different positions of rootstock viz., above 2nd node, above 1st node and without node and (ii) ten varieties viz., Amrapali, Mallika, Sindhu, Hybrid-10, Mixed special, Gopalbhog, Langra, Fazli, Ashwina and Neelumbori. The days required for first flush, percentage of success, increase in diameter and length of rootstock and scion, stionic height, number of new leaves per graft and survivability were significantly influenced by variety and retention of stock leaf and node. The effect of varieties and retention of stock leaf and node was found statistically significant. The minimum time required for first flush (15.69 days), highest percentage of success (93.58%) and survival (83.56%) were achieved in Sindhu, at grafting above the 2nd node. Maximum scion length and stionic height were achieved in Langra, at grafting above 2nd node (30.65 cm and 70.38 cm respectively). The highest numbers of leaves per graft and canopy volumes were recorded at 240 DAG in Mallika and Amrapali (27.89 leaves and 55468.33 cm³, respectively) while grafting above the 2nd node. So, grafting above the 2nd node is suitable for the highest success, survivability and stionic growth for all varieties of mango.

INTRODUCTION

Mango (*Mangifera indica* L.) belonging to the family Anacardiaceae is one of the most important and popular fruits of Bangladesh. It has been cultivated in this sub-continent from 4000 years ago (Candole, 1984). Mango originated in Indian sub-continent during the prehistoric times (Mukherjee, 1998). Mango ranks third among the tropical fruits grown in the world with the total production of 28848 thousand metric tons. In Bangladesh, it ranks, first in terms of area and third in production. It occupies an area of about 50607.28 hectares, with the production of 243 thousand tones of fruits and Bangladesh produces annually 187220 MT of mangoes with average yield of 3.69 ton per hectare (BBS, 2004). This yield is much lower compared to that of the neighboring countries like India (8.95 t/ha) (Ghosh, 1998) and the Philippines (9.41 t/ha) (Espino and Javier, 1989). Mango can be propagated both sexual and asexual methods. Asexual or vegetative propagation is the method to get true-to-type plants. There are many methods of mango propagation in mango growing countries

like Thailand, the Philippines, India, and Pakistan among which now a day's cleft grafting at young stock (epicotyl grafting) is the most commonly adapted method. Contact grafting being a traditional method is expensive, laborious and time consuming. On the other hand, cleft or epicotyl is easier method to use than veneer grafting (Nooruzzaman, 2003). Various factors influence the success and growth of mango grafts viz. time of operation, grafting method, defoliation period of scion, age of the rootstock and leaf and node retention on rootstock. Among these, leaf and node retention on rootstock is an important factor for higher success, survivability and growth of grafts (Dhakar and Huda, 1987; Ram, 1993; Aftab, 2004). But the information or research work regarding this in Bangladesh is very much limited. Therefore, it is the time to find out the appropriate position of epicotyl grafting on rootstock for rapid growth and extension of good varieties of mango and to obtain true-to-type planting materials, which is pre-requisite for strengthening mango production in Bangladesh. Considering these facts in mind the research work was undertaken to study

the effect of leaf and node retention on rootstock on success and growth of epicotyl grafting in ten varieties of mango.

MATERIALS AND METHODS

The present experiment was conducted at the 'Germplasm Centre' (GPC) of Fruit Tree Improvement Project (FTIP), Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from September, 2003 to May, 2004. The selected area was a medium high land. It was fertile and well drained and slightly acidic with the pH varying from 5.5 to 6.8 (BARC, 1989). The experiment consisted of two factors namely (a) varieties viz. Amrapali, Mallika, Sindhu, Hybrid-10, Mixed special, Gopalbhog, Langra, Ashwina, Neelumbori (b) stock leaf and node retention viz. grafting above the 2nd node having average five leaves (T₁), grafting above the 1st node having average three leaves (T₂) and control (grafting with no leaf and node- T₃). The photographs have been shown in Figure 7. The experiment consisted of 30 treatment combinations. The two factor experiment was conducted in Randomized Complete Block Design (RCBD) with three replications. Epicotyl grafting is one of the simplest and easiest types of vegetative of propagation and is used in making top working for changing varieties. The smooth long slopping wedge cuts at the base of the scion gave an appearance of a sharp chissel. The rootstock was at first deheaded by giving horizontal cut at three positions (above 2nd node, above 1st node and below 1st node) and then a vertical split cut or cleft was made by a thin and sharp bladed grafting knife at the center of the horizontal cut surface of the stock having a depth of approximately 3-4 cm. When both the stock and scion were prepared, then the scion was inserted into the cleft of stock through slight opening of the splits. Necessary measures were taken to make the plot free from weeds and to create a favorable environment to ensure proper growth and development of grafted plants. Ten successful grafts were selected for data collection except recording of days required to first flush, percentages of success and survivability, stionic height and canopy volume. The MSTAT computer program statistically analyzed the collected data and results were

interpreted. The differences between the means were evaluated by the least significant differences (LSD) test.

RESULTS AND DISCUSSION

Effects of variety

Different varieties included in this investigation significantly affected the days required to first, percentage of success and survivability, stionic height and canopy volume (Tables 1, 2, 3 and Figures 1, 2, 3). In case of variety, Sindhu took minimum time to days required for first flush (16.41 days) while Neelumbori took maximum time (19.67 days). The highest success and survival percentage were achieved in Sindhu (80.12% and 69.85%, respectively) while the lowest was observed in Goplabhog (55.22% and 49.14%, respectively). At 240 DAG operation Langra gave the highest scion length and stionic height (23.74 cm and 53.18 cm, respectively) and the lowest results were recorded in Sindhu (16.60 and 44.35 cm, respectively). In case of number of leaves per graft and canopy volume Gopalbhog and Amrapali gave maximum results (23.11 leaves and 36380.07 cm³, respectively) while the lowest result was recorded in Neelumbori and Sindhu (15.50 leaves and 21686.18 cm³, respectively).

Effects of retention of leaf and node on rootstock

Retention of stock leaf and node also significantly affected the parameters studied (Tables 4, 5, 6 and Figures 4, 5, 6). Retention of stock leaf and node the highest results were always observed in grafting above the 2nd node in respect of all parameters. The minimum days required to first flush and highest success and survival percentages were recorded in grafting above the 2nd node (17.41 days, 74.40% and 68.34% respectively) where as the maximum days required to first flush and the lowest success and survival results were recorded in control i.e., grafting with no leaf and node (19.35 days, 50.32% and 42.33%, respectively). Similarly the highest scion length, stionic height, new leaf per graft and canopy volume were achieved in grafting above the 2nd node (22.64 cm, 64.70 cm, 23.6 leaves and 43961.22 cm³, respectively) while the lowest

results were recorded in control i.e., grafting with no leaf and node (14.71 cm, 30.86 cm, 12.11 leaves and 6148.47 cm³, at 240 DAG, respectively). Ram (1993) reported that graft success and survivability could improve when

leaves are retained with the rootstock below the point of union when the grafting position of rootstock is new flush and when the stem is pinkish green.

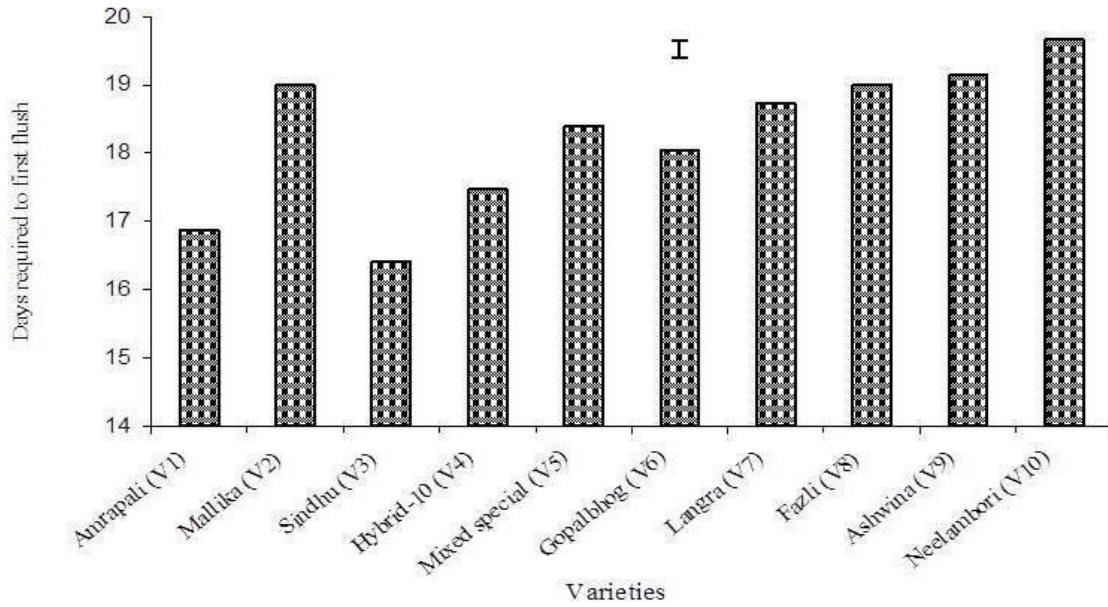


Figure 1
Effect of variety on days required to first flush.

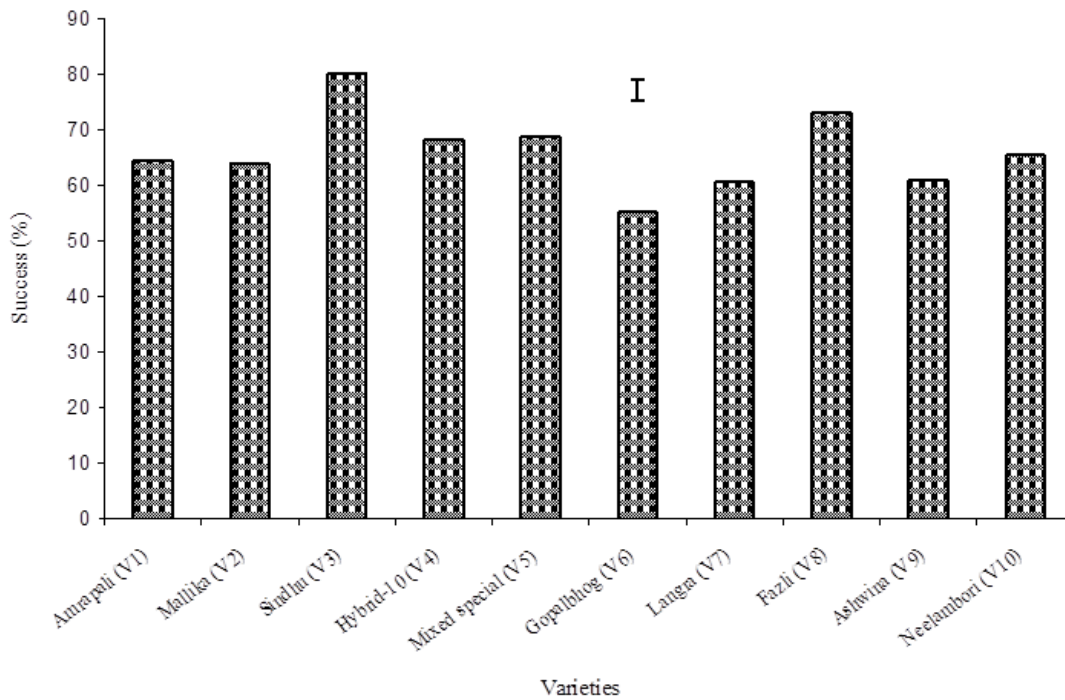


Figure 2
Effect of varieties on the percentage of graft success.

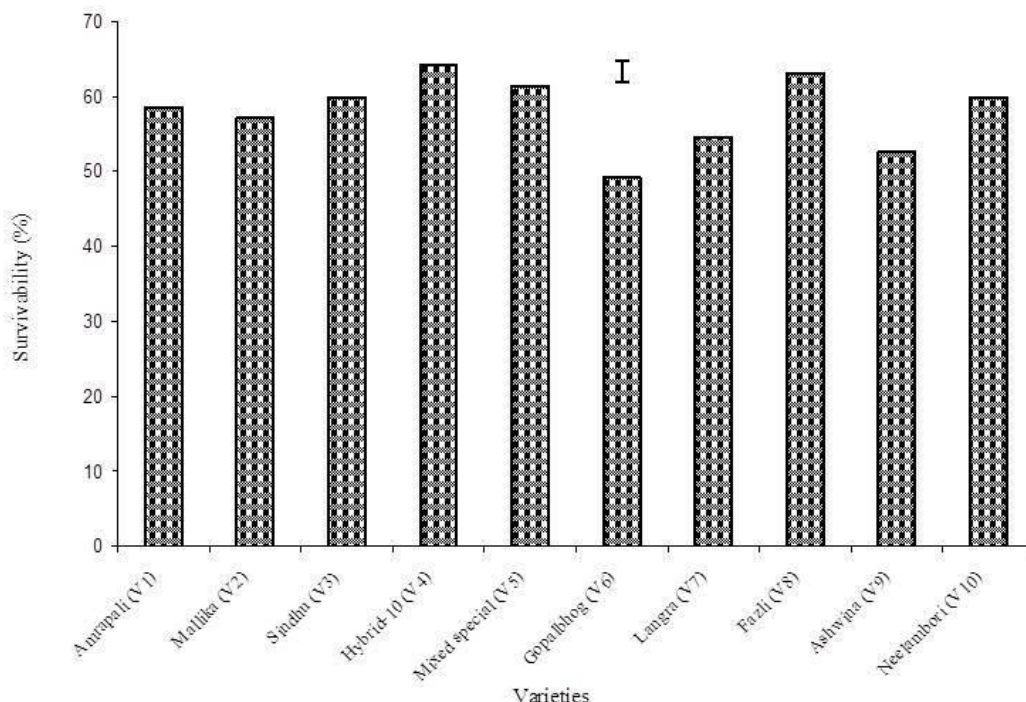


Figure 3
Effect of varieties on the percentage of graft survivability.

Table 1
Effect of varieties on stionic height at different days after grafting

Varieties	Stionic height (cm) at DAG								
	30	60	90	120	150	180	210	240	
Amrapali (V ₁)	41.08	43.17	43.48	43.63	44.30	44.53	49.98	53.09	
Mallika (V ₂)	42.37	43.50	43.85	44.32	44.73	45.86	49.04	51.77	
Sindhu (V ₃)	38.82	39.35	39.55	40.17	40.50	41.26	42.61	44.35	
Hybrid-10 (V ₄)	42.80	43.31	43.69	43.89	44.22	44.51	45.53	49.59	
Mixed special (V ₅)	40.70	41.24	41.50	41.77	41.98	42.10	44.53	48.22	
Gopalbhog (V ₆)	38.40	39.51	40.07	40.56	40.95	41.32	45.52	50.57	
Langra (V ₇)	40.72	42.85	44.07	44.67	45.24	28.40	50.69	53.18	
Fazli (V ₈)	44.79	43.34	43.75	44.38	44.56	48.34	50.91	52.63	
Ashwina (V ₉)	38.45	40.9	41.40	41.75	42.03	47.02	51.17	52.13	
Neelumbari (V ₁₀)	38.50	40.59	41.53	41.99	42.22	44.01	47.29	48.76	
LSD (0.05)	2.59	1.92	1.93	1.96	1.93	2.09	2.17	2.05	
(0.01)	3.46	2.54	2.57	2.62	2.58	2.78	2.90	2.73	

Table 2
Effect of varieties on number of leaves per graft at different days after grafting.

Varieties	Number of new leaves per graft at DAG								
	30	60	90	120	150	180	210	240	
Amrapali (V ₁)	6.59	6.59	6.59	7.33	7.79	8.89	17.06	21.58	
Mallika (V ₂)	6.96	7.26	7.48	8.16	8.16	10.47	16.78	21.88	
Sindhu (V ₃)	6.49	7.00	7.16	8.58	8.58	10.91	15.60	20.68	
Hybrid-10 (V ₄)	7.04	7.69	7.76	7.76	8.67	10.82	15.72	22.18	
Mixed special (V ₅)	7.67	7.67	7.92	8.18	8.30	8.30	12.87	16.77	

Gopalbhog (V ₆)	7.49	9.30	11.19	11.67	11.68	15.82	20.80	23.11
Langra (V ₇)	7.79	8.71	8.74	9.00	10.06	17.60	17.77	18.24
Fazli (V ₈)	6.35	6.68	7.71	7.71	7.73	15.04	16.93	17.56
Ashwina (V ₉)	7.54	8.17	8.40	8.67	8.85	16.06	17.20	19.18
Neelumbari (V ₁₀)	7.10	7.82	8.66	8.96	9.03	14.76	14.87	15.50
LSD (0.05)	1.01	1.15	1.06	1.38	1.66	2.20	2.61	2.29
(0.01)	1.35	1.54	1.14	1.84	2.21	2.93	3.48	3.08

Table 3
Effect of varieties on canopy volume at different days after grafting.

Varieties	Canopy volume (m ³) at DAG		
	180	210	240
Amrapali (V ₁)	13775.04	27079.52	36380.07
Mallika (V ₂)	17672.0	24073.67	30981.5
Sindhu (V ₃)	14926.61	17811.26	21686.18
Hybrid-10 (V ₄)	16512.89	20078.04	28598.0
Mixed special (V ₅)	14958.0	18368.89	24043.56
Gopalbhog (V ₆)	13119.22	17743.22	24862.28
Langra (V ₇)	23048.33	26554.0	29598.33
Fazli (V ₈)	22812.33	27221.67	27546.22
Ashwina (V ₉)	21265.56	22964.41	29680.56
Neelumbari (V ₁₀)	14404.00	19897.11	23354.56
LSD (0.05)	2923.18	3379.59	3907.70
(0.01)	3897.57	4506.11	5210.27

DAG = Days after grafting

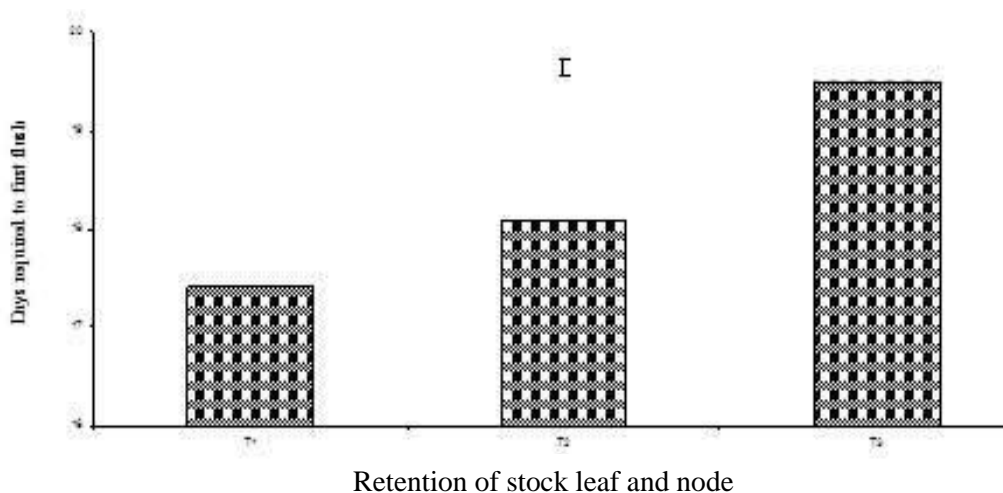


Figure 4
Effect of retention of stock leaf and node on days required to first flush.

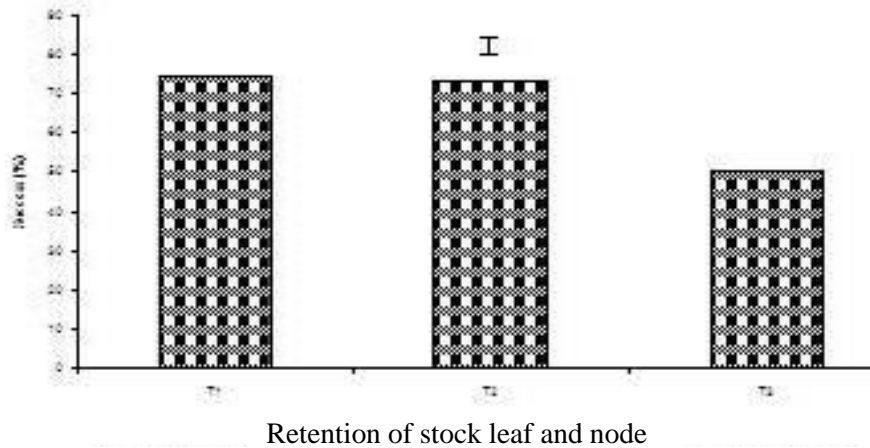


Figure 5
Effect of retention of stock leaf and node on percentage of success of graft.

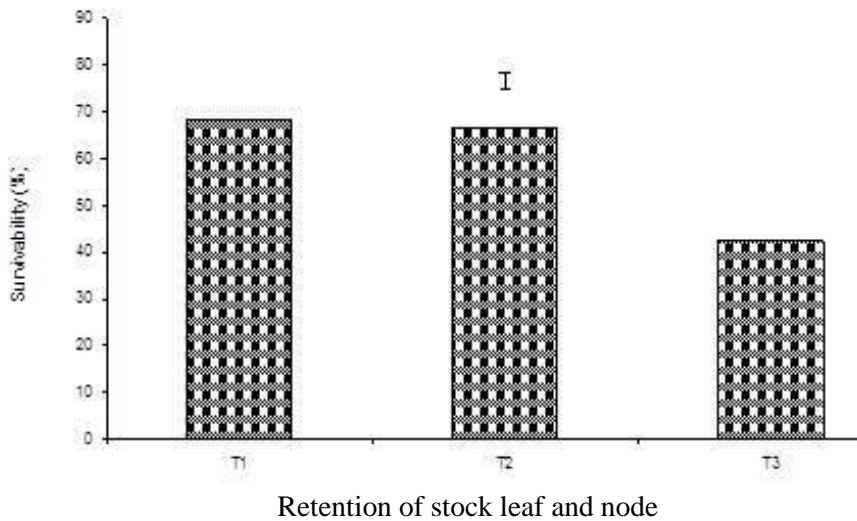


Figure 6
Effect of retention of stock leaf and node on stionic height at different days after grafting.

(T₁ = Grafting above the 2nd node
 T₃ = Control (grafting with no leaf and node)
 T₂ = Grafting above the 1st node)

Table 4
Effect of retention of stock leaf and node on stionic height at different days after grafting.

Retention of stock leaf and node	Stionic height (cm) at DAG							
	30	60	90	120	150	180	210	240
T ₁	50.70	52.44	53.03	53.52	54.0	56.61	60.60	64.70
T ₂	45.22	46.30	46.89	47.39	47.68	49.34	53.35	56.63
T ₃	26.67	26.59	26.95	27.22	27.54	28.25	29.22	30.86
LSD (0.05)	1.42	1.05	1.05	1.07	1.06	1.14	1.19	1.12
(0.01)	1.89	1.40	1.40	1.43	1.41	1.52	1.59	1.49

Table 5
Effect of retention of stock leaf and node on new leaf per graft at different days after grafting.

Retention of stock leaf and node	Number of new leaves per graft at DAG							
	30	60	90	120	150	180	210	240
T ₁	7.49	8.24	8.65	9.11	9.78	15.35	19.68	23.60
T ₂	7.83	8.30	8.70	8.95	9.22	13.99	19.29	23.29
T ₃	5.99	6.48	6.8	7.47	7.65	9.26	10.63	12.11
LSD (0.05)	0.554	0.633	0.581	0.757	0.911	1.26	1.43	1.25
(0.01)	0.738	0.843	0.775	1.01	1.21	1.68	1.91	1.67



Grafting above the 2nd node (T₁)



Grafting above the 1st node (T₂)



Control (grafting with no leaf and node) (T₃)

Figure 7.
Photographs showing different grafting positions.

Table 6
Effect of retention of stock leaf and node on canopy volume at different days after grafting.

Retention of stock leaf and node	Canopy volume (cm ³) at DAG		
	180	210	240
T ₁	27536.25	35376.58	43961.22
T ₂	20310.22	26587.19	32909.68
T ₃	4021.73	4573.77	6148.47
LSD (0.05)	1601.09	1851.07	2140.33
(0.01)	2134.79	2468.10	2853.78

T₁ = Grafting above the 2nd node
 T₂ = Grafting above the 1st node
 T₃ = Control (grafting with no leaf and node)
 DAG = Days after grafting

Table 7
Combined effect of varieties and retention of stock leaf and node on percentages of success and survivability and days required for first flush.

Treatment combinations		Percentage of success	Percentage of Survivability	Days required to first flush
Varieties	Retention of stock leaf and node			
Amrapali (V ₁)	T ₁	72.98	66.13	15.92
	T ₂	70.14	66.89	16.79
	T ₃	50.28	42.56	17.90
Mallika (V ₂)	T ₁	71.28	66.48	18.5
	T ₂	70.55	62.72	19.11
	T ₃	49.92	42.44	19.42
Sindhu (V ₃)	T ₁	93.58	83.56	15.69
	T ₂	87.12	75.67	15.93
	T ₃	59.66	50.33	17.61
Hybrid-10 (V ₄)	T ₁	75.84	71.33	16.61
	T ₂	75.67	70.22	17.50
	T ₃	53.44	51.22	18.30
Mixed Special (V ₅)	T ₁	75.69	71.22	17.21
	T ₂	79.26	71.18	18.17
	T ₃	51.29	41.89	19.84
Gopalbhog (V ₆)	T ₁	64.39	58.99	17.25
	T ₂	58.49	53.89	17.69
	T ₃	42.74	34.56	19.17
Langra (V ₇)	T ₁	71.14	67.56	18.19
	T ₂	67.56	58.78	18.48
	T ₃	51.0	41.72	20.0
Fazli (V ₈)	T ₁	82.74	75.55	18.19
	T ₂	82.33	71.36	18.81
	T ₃	54.09	42.41	19.25
Ashwina (V ₉)	T ₁	67.50	59.33	17.69
	T ₂	67.47	60.01	19.0
	T ₃	47.78	38.71	20.72
Neelumbori (V ₁₀)	T ₁	75.30	71.17	18.82
	T ₂	70.19	66.72	19.21
	T ₃	43.06	37.44	22.0
LSD (0.05)		2.42	1.26	0.656
(0.01)		3.23	1.68	0.875

T₁ = Grafting above the 2nd node
 T₂ = Grafting above the 1st node
 T₃ = Control (grafting with no leaf and node)
 DAG = Days after grafting

Combined effect of variety and retention of stock leaf and node

The combined effect significantly influenced on all the parameters (Table 7). The minimum days required to first flush and highest success and survival percentages were recorded in Sindhu (15.69 days, 93.58% and 83.56%, respectively) when grafting was done above the 2nd node. Whereas the maximum time required to first flush and the lowest success and survival percentages were recorded in Neelumbori (22.0 days) and Gopalbhog (42.74% and 34.56% respectively) when grafting was done at control (T₃). At 240 DAG, the highest scion length and stionic height were recorded in Langra (30.65 and 70.38 cm, respectively) where as the lowest results were recorded in Sindhu (12.49 and 27.58 cm, respectively). At 240 DAG, maximum number of new leaves were recorded in Mallika (27.89 leaves) and highest canopy volume were recorded in Amrapali (55468.33 cm³) when grafting was done above the 2nd node. The lowest number of new leaves were recorded in Sindhu (10.67 leaves) and lowest canopy volume was recorded in Ashwina (4008.33 cm³). From the above results, it is concluded that grafting above the 2nd node is suitable for the highest success, survivability and stionic growth for all varieties of mango.

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