



Effect of scion defoliation period and methods of grafting on success and survivability in mango

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Abstract

This study was conducted in order to investigate the effect of scion defoliation period and methods of grafting on the success and survivability of mango (var. Amrapali) at Bangladesh Agricultural University Germplasm Centre (BAU-GPC) of Fruit Tree Improvement Program (FTIP) of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh. The experiment consisted of four scion defoliation periods, viz., defoliation before 9, 6, 3 days of grafting and defoliation on the day of grafting and two grafting methods namely cleft grafting and whip grafting. The study was laid out in randomized complete block design with three replications. The results revealed that scions defoliated 9 days before grafting showed the highest success (91.59%) and survivability (88.75%) and took the lowest time for bud breaking and first leaf opening (11.10 days and 14.22 days, respectively) whereas the lowest success rate (85.82%) and survivability (83.60%) were observed when scion defoliation was performed on the day of grafting. In respect of grafting methods, higher graft success and survivability (89.68% and 86.89%, respectively) were found in cleft method, however, this method took longer time for bud breaking (11.92 days) and first leaf opening (15.90 days). The combined influence of scion defoliation period and grafting method exhibited the best performance on graft success and survivability when cleft grafting method was used with scion defoliated 9 days before grafting operation. Therefore the results of this investigation suggested that scions defoliated 9 days before grafting operation and cleft grafting method would be better for propagation of mango, yet the performance of cleft grafting with scion defoliated 6 days before grafting was also good with the hope of getting 85% success and survivability.

Key words: Mango, defoliation, cleft grafting, whip grafting, success, survivability

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Introduction

The mango (*Mangifera indica* L.) belongs to the family Anacardiaceae, which occupied a pre-eminent place amongst the fruit crops grown in Bangladesh. In Bangladesh, the present total production of mango fruits is only 945 thousand tons from an area of 51012 hectares with an average yield of 4.75 t/ha (BBS, 2013), which is very low as compared to that of other mango growing countries like India (8.95 t/ha) (Ghosh, 1998) and the Philippines (9.41 t/ha) (Espino and

Javier, 1989). The existing production of mango falls appreciably short to fulfil the national demand. Therefore improvement of yield potentiality through vegetative propagation is necessarily important to increase mango production in Bangladesh. Vegetative propagation could help to improve the regular bearing of mango. There are several mango varieties have been growing in Bangladesh. Among them Amrapali is a hybrid mango variety developed from Dashehari and

Neelum by the Indian Agricultural Research Institute (IARI) at Pusa, New Delhi, India. This high yielding variety used in the study is precocious, medium dwarf, regular and prolific in bearing and has good quality, fruits are medium sized, oblong shape, in orange red colour and fruits contain approximately 2.5-3.0 times more carotene than other varieties.

Mango can be propagated by both sexual (seed) and asexual (grafting) methods. However, the asexual method is desirable because it enables to retain the characteristics of the mother plant, to get flower and fruit earlier within 2-3 years, to remain initially relatively smaller with the benefit of more plants accommodation per unit area and to give the growers earlier fruit and more economic benefit over the seed propagated plants. The vegetative propagation through cleft and whip grafting are the easiest methods among the grafting methods. Cleft grafting has been successfully using as an efficient, economic and rapid method for the propagation of mango (Muzaffar and Kumar, 2011).

Success, survivability and growth of grafts depend on a number of factors including variety, methods and time of grafting, age of rootstock, scion defoliation period, scion length and environmental conditions (Hartmann *et al.*, 1997). The scion defoliation period has significant effect on the grafting success and survivability. El-Rouby *et al.*, (2009) observed the best result when scions were defoliated 8 days prior detachment. Nooruzzaman (2003) reported that cleft grafting was better than the veneer grafting in respect of success, survivability and growth of mango grafts and cleft grafting was easier than veneer grafting. Islam *et al.* (2004) conducted an experiment on grafting in mango at Bangladesh Agricultural Research Institute (BARI), Gazipur and reported that success percentage was higher (95%) in cleft grafting than veneer grafting (80%). Gupta *et al.* (1988) stated that splice (whip) method was the best (57%) followed by side and veneer grafting (46 and 40%). Considering the above facts, attempts were taken to find out the appropriate

scion defoliation period and grafting methods of mango to get higher percentage of graft success and survivability.

Materials and Methods

The experiment on the effect of scion defoliation period and grafting methods on the success and survivability of mango (var. Amrapali) was conducted at the Bangladesh Agricultural University Germplasm Centre (BAU-GPC) of Fruit Tree Improvement Program (FTIP) of the Department of Horticulture, Bangladesh Agricultural University, Mymensingh. Scion shoots were collected from healthy and vigorous mother plants of year round Mango (var. Amrapali) grown in the Germplasm Centre of BAU. The rootstocks were raised in polybag from the seeds of unknown mango variety. The two factorial experiment consisting of four scion defoliation periods, viz., defoliation before 9 days of grafting, defoliation before 6 days of grafting, defoliation before 3 days of grafting, defoliation on the day of grafting and two grafting methods, viz., cleft grafting and whip grafting was laid out in randomized complete block design with three replications.

Cleft grafting and whip grafting were performed following standard methods. The prepared grafts were shifted to the poly house and placed as per layout of the experiment and were maintained in good condition by removing off-shoots, polythene cap and polythene strip and controlling disease and pest. After 60 days the grafts were shifted to the normal open condition. The data were collected on the following parameters: Days required to bud breaking, days required to leaf opening, number of leaves per graft, graft height (cm), percentage of graft success and percentage of graft survivability. Days required for bud breaking and leaf opening were calculated from date of operation. Growths of the grafts (number of leaves per graft, graft height) were recorded at 30 days interval up to 90 days after grafting. The collected data on the different parameters of study were statistically analyzed and

calculated using MSTAT-C computer package program. The significance of differences between treatments means were compared by Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

Results and Discussion

Days required for bud breaking

Different scion defoliation period and methods of grafting had significant influence on the days required for bud breaking. Scions defoliated on the day of grafting operation took the highest time (11.93 days)

for bud breaking while it was the lowest (11.10 days) in scions defoliated before 9 days of grafting operation followed by (11.20 days) the scion defoliated before 6 days of grafting operation (Table 1). Among the two methods of grafting, whip method required the higher time (11.92 days) for bud breaking than cleft method (10.93 days) (Table 2). The scions defoliated on the day of grafting operation in whip method in combination took the highest time (12.66 days) for bud breaking whereas the scions defoliated 9 days before grafting operation in cleft method showed the lowest time (10.66 days) required for bud breaking (Table 3).

Table 1. Main effect of scion defoliation period on the days required for bud breaking, first leaf opening and number of leaves per grafts at different days after grafting (DAG) of mango.

Scion defoliation period	Days required for bud breaking	Days required for first leaf opening	Number of leaves per graft at DAG		
			30	60	90
D1	11.10	14.22	7.33	10.83	14.67
D2	11.20	14.85	7.17	9.33	13.00
D3	11.49	15.41	6.17	9.33	12.33
D4	11.93	16.20	5.17	8.17	12.17
LSD at 5%	0.27	0.24	0.12	0.53	0.66
LSD at 1%	0.37	0.33	0.17	0.74	0.91
Level of significance	**	**	**	**	**

** indicates significant at 1% level of probability, D1=Defoliation before 9 days of grafting, D2= Defoliation before 6 days of grafting, D3= Defoliation before 3 days of grafting, D4=Defoliation on the day of grafting.

Table 2. Main effect of grafting method on the days required for bud breaking, first leaf opening and number of leaves per grafts at different days after grafting (DAG) of mango.

Methods of grafting	Days required for bud breaking	Days required for leaf opening	Number of leaves per graft at DAG		
			30	60	90
M1 (Cleft method)	10.93	14.44	7.00	10.75	14.33
M2 (Whip method)	11.92	15.90	5.92	8.08	11.75
LSD at 5%	0.19	0.17	0.09	0.38	0.46
LSD at 1%	0.26	0.23	0.12	0.52	0.64
Level of significance	**	**	**	**	**

** indicates significant at 1% level of probability

Methods of grafting mango

Table 3. Combined effects of scion defoliation period and grafting method on the days required for bud breaking, first leaf opening and number of leaves per grafts of mango.

Scion defoliation period	Methods of grafting	Days required for bud breaking	Days required for first leaf opening	Number of leaves per graft at DAG		
				30	60	90
D1	M1(Clef method)	10.66	13.66	8.00	11.00	17.00
	M2 (Whip method)	11.53	14.78	6.67	10.67	12.33
D2	M1(Clef method)	10.66	14.04	8.00	11.00	14.33
	M2 (Whip method)	11.73	15.66	6.33	7.67	11.67
D3	M1(Clef method)	11.20	14.96	6.33	11.00	13.00
	M2 (Whip method)	11.77	15.86	6.00	7.67	11.67
D4	M1(Clef method)	11.20	15.10	5.67	10.00	13.00
	M2 (Whip method)	12.66	17.30	4.67	6.33	11.33
LSD at 5%		0.38	0.33	0.18	0.75	0.93
LSD at 1%		0.53	0.46	0.24	1.05	1.29
Level of significance		**	**	**	**	**

** indicates significant at 1% level of probability, D1=Defoliation before 9 days of grafting, D2= Defoliation before 6 days of grafting, D3= Defoliation before 3 days of grafting, D4=Defoliation on the day of grafting

Days required for leaf opening

The average time required for leaf opening of grafts was significantly influenced by the different scion defoliation periods and two different grafting methods. The highest time (16.20 days) required for leaf opening was found in the scions defoliated on the day of grafting operation while it was the lowest (14.22 days) in scions defoliated 9 days before grafting operation (14.85 days) (Table 1). The higher time (15.90 days) required for leaf opening was found in whip method while it was lower (14.44 days) in cleft method (Table

2). The scions defoliated on the day of grafting operation in whip method in combination took the highest time (17.30 days) for leaf opening whereas the scions defoliated 9 days before grafting operation in cleft method showed the lowest time (13.66 days) required for leaf opening (Table 3).

Number of leaves per graft

The data showed that the defoliation period had significant effect on the number of new leaves which were recorded at 30, 60 and 90 DAG. At 90 DAG, the highest number (14.67) of leaves was produced in the

grafts under scion defoliation before 9 days of grafting and the lowest (12.17) was in scion defoliation on the day of grafting (Table 1).

Different methods of grafting also had significant influence on the number of leaves per graft. After 90 days of grafting, the higher number of leaves (14.33) was recorded in case of cleft grafting method while the lower number of leaves (11.75) was found in whip grafting method (Table 2). The highest number of leaves (17.00) was found in the grafts that received the treatment combination of cleft method with the scion defoliated before 9 days of grafting while it was the lowest (11.33) for the treatment combination of whip method with the scion defoliated on the day of grafting (Table 3)

Height of the graft

Scion defoliation periods and methods of grafting had significant effects on the height of grafts at 30-90 DAG. The highest (51.17 cm) graft height was found in the grafts where scion was grafted with its defoliation before 9 days of grafting whereas the lowest (44.67 cm) was recorded in the grafts where scion was defoliated on the day of grafting (Table 4). Among the methods, the higher graft height (49.75 cm) was observed in the graft of cleft method and the lower graft height (45.58 cm) was found in the grafts of whip method (Table 5).

Table 4. Main effect of scion defoliation period on the graft height, percentage of graft success and survivability at different days after grafting (DAG) of mango.

Scion defoliation period	Graft height(cm) at DAG			Graft success (%)	Graft survivability (%)
	30	60	90		
D1	34.67	45.67	51.17	91.59	88.75
D2	33.17	43.67	48.00	89.91	86.33
D3	33.17	42.50	46.83	87.35	84.85
D4	31.50	39.67	44.67	85.82	83.60
LSD at 5%	0.67	0.86	0.75	0.21	0.30
LSD at 1%	0.93	1.20	1.04	0.27	0.42
Level of significance	**	**	**	**	**

** indicates significant at 1% level of probability, D1=Defoliation before 9 days of grafting, D2= Defoliation before 6 days of grafting, D3= Defoliation before 3 days of grafting, D4=Defoliation on the day of grafting.

Table 5. Main effect of methods of grafting on the graft height, percentage of graft success and survivability at different days after grafting (DAG) of mango.

Methods of grafting	Graft height(cm) at DAG			Graft success (%)	Graft survivability (%)
	30	60	90		
M1 (Cleft method)	33.58	44.58	49.75	89.68	86.89
M2 (Whip method)	32.67	41.17	45.58	87.65	84.87
LSD at 5%	0.47	0.61	0.53	0.14	0.22
LSD at 1%	0.66	0.85	0.73	0.19	0.30
Level of significance	**	**	**	**	**

** indicates significant at 1% level of probability

Methods of grafting mango

Considering both scion defoliation period and grafting method, the highest increase in graft height (54.00 cm) was found in the cleft method with the scion defoliated 9 days before grafting. On the other hand, the lowest increase in graft height (43.00 cm) was recorded with the scion defoliated in whip method on the day of grafting (Table 6).

Percentage of graft success

The success of mango grafts varied significantly due to the different scion defoliation periods and methods of grafting. The highest graft success (91.59%) was achieved in the grafts where scion was defoliated before 9 days of grafting and the lowest (85.82%) was in the grafts with scion defoliated on day of grafting operation (Table 4). The grafts from cleft method showed the higher graft success (89.68%) than the whip method (87.65%) (Table 5). While considering combined effect, the highest graft success (92.40%) was recorded from the grafts of cleft method with the scion defoliated before 9 days of grafting and the

lowest success (84.20%) was in whip method with the scion defoliated on the day of grafting (Table 6).

Percentage of graft survivability

There was significant variation in respect of graft survivability due to the effect of scion defoliation period and different methods of grafting. The highest graft survivability (88.75%) was recorded in the grafts where scion was defoliated before 9 days of grafting and the lowest (83.60%) was in the grafts with scion defoliated on the day of grafting (Table 4). The higher grafts survivability (86.89%) was obtained from the grafts of cleft method while the lower survivability (84.87%) was recorded in the grafts of whip method (Table 5). In case of interaction effect, the highest graft survivability (89.32%) was recorded from the grafts of cleft method with the scion defoliated before 9 days of grafting and the lowest survivability (82.50%) was in whip method with the scion defoliated on the day of grafting operation (Table 6).

Table 6. Combined effects of scion defoliation period and grafting method on graft height at different days after grafting (DAG), percentage of graft success and survivability of mango.

Scion defoliation period	Methods of grafting	Graft height(cm) at DAG			Graft success (%)	Graft survivability (%)
		30	60	90		
D1	M1(Clef method)	36.00	47.00	54.00	92.40	89.32
	M2 (Whip method)	33.33	44.33	48.33	90.78	88.18
D2	M1(Clef method)	33.33	46.33	50.00	92.40	89.32
	M2 (Whip method)	33.00	41.00	46.00	89.10	85.25
D3	M1(Clef method)	33.33	44.67	48.67	90.71	87.40
	M2 (Whip method)	33.00	40.33	45.00	86.51	83.56
D4	M1(Clef method)	31.67	40.33	46.33	87.44	84.69
	M2 (Whip method)	31.33	39.00	43.00	84.20	82.50
LSD at 5%		0.95	1.22	1.06	0.28	0.43
LSD at 1%		1.31	1.69	1.47	0.38	0.60
Level of significance		**	**	*	**	**

* & ** indicates significant at 5% & 1% level of probability, D1=Defoliation before 9 days of grafting, D2= Defoliation before 6 days of grafting, D3= Defoliation before 3 days of grafting, D4=Defoliation on the day of grafting.

Conclusion

From the results of this study it may be concluded that cleft grafting operation with the scion defoliated before 9 days of grafting would be the most suitable for the highest graft success, survivability and growth of mango grafts (var. Amrapali). It may also be noticed that grafting operation in mango can be performed with more than 85% success and survivability of grafts by the cleft and whip methods with the scion defoliated before 3 days of grafting operation.

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