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Effect of Age of Rootstock and Time of Grafting on the Success of Epicotyl Grafting in Jackfruit (*Artocarpus heterophyllus* L.)

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Abstract: The experiment was carried out at the orchard of jackfruit research project, Bangladesh Agricultural University, Mymensingh during the period from July 2000 to October 2001 to find out the effect of age of rootstock and time of grafting on the success of epicotyl grafting in jackfruit. The experiment consists of three ages of rootstock viz., 7, 14 and 21 days and seven month of grafting viz., August, September, October of 2000 and April, May, June, July of 2001. It was conducted in randomized complete block design with three replications. Age of rootstock and time of grafting had significant effect on all the parameters studied. The highest success (39.84%), the minimum time required to bud break (18.78 days) and the highest survival (34.41%) were found in 14 days old rootstock. In case of time of grafting, the highest success (49.55%) and survival (45.47 %) and the maximum growth of grafts were observed in the month of June. On the contrary, the lowest success (10.08%) and survival (13.92%) were found in April. The maximum time required to bud break was found in the month of October (24.79 days) while it was minimum in July (20.72 days).The treatment combination of 14 days old rootstock in the month of June produced the highest success (57.33%), the highest survival (53.71%) and the growth of grafts. Therefore, 14 days old rootstock and grafting in the month of June is the best for the propagation of jackfruit through epicotyl grafting.

Key words: Jackfruit (*Artocarpus heterophyllus* L.), epicotyl grafting, success

INTRODUCTION

Jackfruit (*Artocarpus heterophyllus* L.) is the national fruit of Bangladesh. It is one of the most popular and important fruit of Bangladesh. The acreage of jackfruit is about 26.72 thousand hectares with the production of 268 thousand tones annually (BBS, 2001). It is a cross pollinated fruit usually propagated through seeds (Samaddar, 1990). It is still considered as a difficult fruit species to propagate by vegetative means. The key reason is possibly due to its latex, which hinders the normal process of callus formation and ultimately hindering the graft union process. Different vegetative methods like budding and grafting were also practiced for the propagation of jackfruit, but the success of budding was low in most cases. It takes more time and difficult to prepare than other vegetative methods. The approach grafting also considered as slow, laborious and comparatively expensive. Recently the success of epicotyl grafting has been reveled by different authors (Jose and Velsalakumari, 1991 and Hossain, 1996). Grafting of scion on the germinating seedling referred as epicotyl grafting has been successfully using as an efficient, economic and rapid method for propagation of mango and other fruit trees. The advantage of the epicotyl grafting is that the germinating seedlings are in juvenile condition and the cells have the potentiality of quick differentiation and thus play a vital role in the success of graft union. The success of epicotyl grafting depends on different factors such as temperature, relative humidity, light, soil moisture, age of rootstock, time and method of grafting and the skill ness of the grafter. Considering the idea, an attempt has been undertaken to investigate the vegetative propagation of jackfruit through epicotyl grafting to determine the ideal time and age of rootstock, percentage of success and survival, days required to bud break and growth of grafts of epicotyl grafting of jackfruit.

MATERIALS AND METHODS

The experiment was conducted at the orchard of jackfruit research project, Bangladesh Agricultural University, Mymensingh during the period from July 2000 to October 2001 to find out the effect of age of rootstock and time of grafting on the success of epicotyl grafting in jackfruit. The experiment consists of three ages of rootstock viz., 7, 14 and 21 days and seven month of grafting viz., August, September, October of 2000 and April, May, June, July of 2001. It was conducted in randomized complete block design with three replications.

The poly bag of 12×8 cm size was filled with soil mixture; seedlings were raised in poly bag at the jackfruit research project orchard. A single seed was dibbled at 1 cm depth horizontally on 15 July 2000 and were continued at different successive days in order to get 7, 14 and 21 days old seedling at particular grafting time. Healthy, straight, strong and diseases free seedling having uniform growth and size attached with cotyledon were selected as a rootstock for epicotyl grafting. Scion were selected from healthy, diseases free vigorous and actively growing dormant shoot of 10-12 years old jackfruit trees. The scions were deep green and stout having 8 cm length. After selection of rootstock and scion, grafting operation was done in a shady place. The prepare grafts were then placed in a shade house to maintain high humidity and to protect the grafts from high rainfall and direct sunlight. Spraying of water, removal of water from the poly cap, sprouts, poly cap and polythene strip were done as when required. Data were collected at an interval of 15, 30, 45, 60, 75 and 90 days after bud break. The number of successful grafts was counted just after bud break and computed it by using the following formula:

$$\text{Percentage of graft success} = \frac{\text{Number of successful grafts}}{\text{Total no. of graftage done}} \times 100$$

The days required to bud break were counted from grafting to just after bud break from the scion. Percentage of survival was estimated at the end of 90 days by using the following formula-

$$\text{Percentage of survival} = \frac{\text{Total no. of graft success-Total no. of dead grafts}}{\text{Total no. of successful grafts}} \times 100$$

The height of the scion was calculated just after bud break at 15 days interval up to 90 days using the meter scale. Number of leaves per graft was recorded from 15 days after bud break and was continue up to 90 days at an interval of 15 days. The collected data were statistically analyzed to find out the significance difference between the treatments.

RESULTS AND DISCUSSION

Percentage of success: Age of rootstock significantly influenced on the success of epicotlyl grafting of jackfruit. The highest success (39.84%) was recorded with 14 days old rootstock followed by 7 days (33.39%) while it was the lowest (28.3%) with 21 days old rootstock. The highest success with 14 days old rootstock might be due to preservation of more food materials in cotyledon and actively growing stage of rootstock that enhance union in grafting. This result is in agreement with the findings of Jose and Velsalakumary (1991) who recorded that 29.5% success in epicotyl grafting of jackfruit using 5 days old rootstock and 61.67% using 15 days old rootstock. Percent success of epicotlyl grafting was influenced by different grafting time. The highest success (49.55%) was recorded in the month of June followed by July (43.87%) and August (38.83%). The minimum success was found in the month of April (19.08%), which was identical with the October (17.79%). The difference in the success might be due to the prevalence of varied climatic condition during grafting operation. This finding also corroborated with the result of Patel and Arnin (1976). There was significant combined effect of different age of rootstock and time of grafting on percent success. The highest success was found in June (57.33%) followed by July (51.91%) grafted onto 14 days old rootstock. The lowest success was in April (15.79%) preceded by October (16.28%) with 21 days old rootstock. Results are discussed in Table 1-6.

Days required to bud break: It was varied significantly depending on the different age of rootstock. Maximum time required to bud break (26.33 days) was with 21 days old rootstock followed by 7 days (22.04 days), it was probably due to the presence of more concentrated latex and hardiness of rootstock which hindered the graft union process, while it was minimum (18.78 days) with 14 days old rootstock. Grafting time has significant effect on days required to bud break. The long time required in the month of October (24.79 days) followed by September (23.07 days) and April (22.73 days), while it was the minimum in July (20.72 days) which was identical in June (21.22 days). In July, earlier bud breaking may be due to the prevailing favorable temperature and relative humidity. During October, late bud breaking was probably due to low temperature and low relative humidity. This finding is in agreement with the results of Azad (1999) who found that 21.8 and 23.2 days were required to bud break when grafted during the month of October and November, respectively. The combined effect of different age of rootstock and time of grafting on days required to bud break were found to be statistically significant. The maximum time required to bud break (28.93 days) was recorded from the combination of 21 days old rootstock and the month of October followed by September (27.05 days) and April (26.68 days) grafted onto same aged rootstock. The minimum days required to bud break in the month of July (17.3 days) which was more or less similar with the month of June (17.58 days), May (18.33 days) and April (18.91 days) grafted onto 14 days old rootstock.

Table 1: Effect of age of rootstock and time of grafting on the percentage success, days required to bud break and percentage survival of epicotyl grafting of jackfruit

Treatments	% Success	Days required to bud break	% Survival
Age of rootstock (days)			
7	33.39	22.04	29.17
14	39.84	18.78	34.41
21	28.30	26.33	24.31
LSD (0.05)		0.56	2.29
(0.01)		0.75	3.07
Time of grafting (month)			
April	10.08	22.73	13.92
May	36.01	22.27	30.08
June	49.55	21.22	45.47
July 43.87	20.72	40.77	
August	38.83	21.89	34.62
September	29.79	23.07	24.90
October	19.76	24.79	15.31
LSD (0.05)		0.86	3.50
(0.01)		1.15	4.69

Table 2: Combined effect of age of rootstock and time of grafting on the % success, days required to bud break and % survival of epicotyl grafting of jackfruit

Age of rootstock (days)	Time of grafting (month)	% Success	Days required to bud break	% Survival
7	April	18.79	22.60	13.76
	May	35.62	21.86	29.54
	June	48.91	21.02	46.50
	July	43.34	20.41	40.38
	August	38.22	21.19	34.09
	September	29.41	22.64	24.91
	October	19.43	24.57	15.19
14	April	22.26	18.91	16.28
	May	42.22	18.33	35.52
	June	57.33	17.58	53.71
	July	51.91	17.30	47.69
	August	46.23	18.96	40.83
	September	34.94	19.52	29.00
	October	23.57	20.87	17.86
21	April	15.79	26.68	11.71
	May	30.18	26.60	25.18
	June	42.40	25.06	36.21
	July	36.35	24.63	34.24
	August	32.05	25.52	28.95
	September	25.01	27.05	21.00
	October	16.28	28.93	12.90
LSD (0.05)		6.62	1.49	6.07
(0.01)		8.86	1.99	8.12

Percentage of survival: Age of rootstock has significant effect on the percentage of survival of epicotyl grafting of jackfruit. The highest survival (34.41%) was obtained from the 14 days old rootstock followed by 7 days (29.17%) and the lowest (24.31%) was from 21 days old rootstock after 90 days of bud break. The highest survival with 14 days old rootstock may due to retain of more food materials in cotyledon and at the same time the rootstock seedling are actively growing stage which may enhanced union of grafting. Percentage of survival also affected by different time of grafting. The highest survival (45.47%) was found in the month of June followed by July (40.77%) and August (34.62%). It was lowest in the month of April (13.92%), which was identical in the month of October (13.31%). June month gave the highest survival may be due to favourable temperature and relative humidity. Stone grafting in the warm humid month of June and July gave the highest survival (72-78%) was also reported by Gunjate (1989).

There was a significant combined effect of age of rootstock and time of grafting on the percentage of survival. The highest survival was recorded in the month of June (53.71%) followed by July (47.69%) grafted onto 14 days old rootstock. The lowest survival was obtained

Table 3: Effect of age of rootstock and time of grafting on the scion height in epicotyl grafting of jackfruit

	Scion height (cm) at different days after bud breaking (initial height = 8 cm)					
Treatments	15	30	45	60	75	90
Age of rootstock (days)						
7	8.81	9.42	10.95	12.25	13.24	14.53
14	8.87	9.69	11.43	12.98	14.09	15.63
21	8.73	9.41	10.51	11.73	12.43	13.77
LSD (0.05)	0.10	0.15	0.22	0.27	0.23	0.24
(0.01)	0.14	0.20	0.29	0.36	0.31	0.32
Time of grafting (month)						
April	8.51	9.00	10.55	11.90	13.12	14.34
May	8.75	9.42	11.36	12.45	13.40	15.06
June	9.42	10.20	12.16	13.73	15.40	16.95
July	9.15	10.00	11.39	13.17	14.28	15.81
August	8.93	9.65	11.00	12.54	12.78	14.48
September	8.46	9.29	10.35	11.89	12.45	13.51
October	8.40	8.98	9.91	10.55	11.34	12.34
LSD (0.05)	0.16	0.23	0.34	0.41	0.35	0.36
(0.01)	0.21	0.30	0.45	0.55	0.47	0.49

Table 4: Combined effect of age of rootstock and time of grafting on the growth of scion height in epicotyl grafting of jackfruit

Age of rootstock (days)	Time of grafting (month)	Scion height (cm) at different days after bud breaking (initial height = 8 cm) 15	30	45	60	75	90
7	April	8.54	8.95	10.46	11.86	12.98	13.94
	May	8.72	9.38	11.25	12.62	13.35	14.78
	June	9.42	9.95	12.02	13.68	15.20	16.85
	July	9.18	9.85	11.45	13.01	14.45	15.95
	August	8.95	9.52	11.23	12.24	12.48	14.35
	September	8.44	9.21	10.38	11.84	12.85	13.64
	October	8.41	8.95	9.88	10.46	11.35	12.20
14	April	8.54	9.22	10.95	12.38	13.75	14.75
	May	8.85	9.45	11.78	13.25	14.20	16.20
	June	9.55	10.48	12.56	14.24	16.25	18.75
	July	9.25	10.30	11.86	13.85	15.18	16.85
	August	9.02	9.89	11.54	13.27	14.00	15.23
	September	8.48	9.42	10.84	12.62	13.25	14.42
	October	8.40	9.05	10.44	11.25	12.00	13.18
21	April	8.45	8.84	10.24	11.46	12.62	14.32
	May	8.68	9.42	11.05	11.48	12.66	14.20
	June	9.30	10.13	11.91	13.26	14.75	15.25
	July	9.02	9.75	10.87	12.64	13.22	14.64
	August	8.82	9.54	10.21	12.12	11.85	13.86
	September	8.45	9.24	9.84	11.22	11.25	12.48
	October	8.39	8.94	9.42	9.94	10.66	11.65
LSD (0.05)		0.28	0.39	0.58	0.72	0.61	0.63
(0.01)		0.37	0.53	0.78	0.96	0.81	0.84

Table 5: Effect of age of rootstock and time of grafting on number of leaves per graft in epicotyl grafting of jackfruit

Treatments	Number of leaves graft^{-1} at different days after bud break					
	15	30	45	60	75	90
Age of rootstock (days)						
7	2.45	3.71	5.18	6.35	7.19	7.86
14	2.68	3.84	5.50	6.79	7.52	8.12
21	2.38	3.65	5.02	6.00	7.02	7.43
LSD (0.05)	0.07	0.08	0.05	0.07	0.08	0.08
(0.01)	0.10	0.10	0.06	0.09	0.11	0.11
Time of grafting (month)						
April	2.29	3.22	4.44	5.70	6.79	7.68
May	2.46	3.71	5.46	6.46	7.81	8.22
June	2.99	4.64	6.21	7.71	8.31	8.87
July	2.84	4.29	5.72	6.98	7.87	8.28
August	2.45	3.87	5.46	6.28	6.96	7.54
September	2.31	2.29	4.95	6.03	6.67	7.20
October	2.19	3.13	4.39	5.51	6.28	6.83
LSD (0.05)	0.11	0.12	0.07	0.10	0.13	0.12
(0.01)	0.15	0.16	0.10	0.13	0.17	0.17

Table 6: Combined effect of age of rootstock and time of grafting on the number of leaves per graft in epicotyl grafting of jackfruit

Age of rootstock (days)	Time of grafting (month)	Number or leaves graft^{-1} at different days after bud break					
		15	30	45	60	75	90
7	April	2.21	3.27	4.43	5.73	6.68	7.79
	May	2.29	3.78	5.36	6.49	7.58	8.00
	June	2.89	4.49	6.22	7.91	8.25	8.93
	July	2.77	4.10	5.71	6.68	7.91	8.75
	August	2.43	3.93	5.44	6.27	6.89	7.62
	September	2.34	3.30	4.95	5.95	6.66	7.10
	October	2.24	3.11	4.14	5.45	6.37	6.83
14	April	2.37	3.31	4.68	5.91	7.06	8.00
	May	2.56	3.55	5.77	6.58	8.31	8.82
	June	3.42	4.91	6.43	7.96	8.70	9.18
	July	3.24	4.41	5.94	7.74	8.03	8.47
	August	2.59	4.15	5.63	6.82	7.32	7.76
	September	2.33	3.34	5.12	6.61	6.92	7.46
	October	2.23	3.23	4.90	5.92	6.29	7.14
21	April	2.28	3.08	4.20	5.46	6.65	7.25
	May	2.52	3.80	5.25	6.30	7.53	7.83
	June	2.67	4.52	5.96	7.28	7.96	8.51
	July	2.50	4.36	5.51	6.52	7.68	7.63
	August	2.34	3.52	5.30	5.76	6.67	7.25
	September	2.26	3.22	4.78	5.53	6.43	7.04
	October	2.09	3.07	4.13	5.17	6.18	6.53
LSD (0.05)		0.20	0.20	0.13	0.17	0.22	0.22
(0.01)		0.26	0.27	0.17	0.23	0.30	0.29

in the month of April (11.71%) preceded by October (12.9%) grafted onto 21 days old rootstock.

Growth of scion height: There was a significant variation in scion height at different age of rootstock. At 90 days after bud break, the highest scion height (15.63 cm) was found with 14 days old rootstock followed by 7 days (14.53 cm) while it was the lowest (13.77 cm) with 21 days old rootstock. The highest scion height with 14 days old rootstock might be due to earliest bud breaking and better stionic relationship. On the other hand, the lowest scion height with 21 days old rootstock was probably due to late bud breaking. This finding also corroborated with the results of Dbar (1998). He observed that 15 days old rootstock produced 18.29 cm scion height after 120 days of seed graft. Grafting time also showed significant influenced on scion height. The maximum scion height (16.95 cm) was found in the grafts made in the month of June followed by July (15.81 cm), May (15.06 cm) and August (14.48 cm). The minimum scion height was recorded in the month of October (12.34 cm). June month gave the maximum scion height may be due to the earliest bud breaking and favourable climatic condition. It was similar with the results of Dhar (1998) who reveled that July operation produced taller graft (17.12 cm) in seed graft of jackfruit. The combined effect was also found to be significant. The highest scion height was found in the month of June (18.75 cm) grafted with 14 days old rootstock and the lowest was in the month of October (11.65 cm) grafted with 21 days old rootstock after 90 days of bud breaking.

Number of leaves per graft: Statistical significant variation was found in number of leaves at different ages of rootstock. At 90 days after bud break, the maximum number of leaves (8.12) was found with 14 days old rootstock and the minimum (7.43) was with 21 days old rootstock. The maximum number of leaves with 14 days old rootstock might be due to the earliest bud breaking. Grafting time significantly influenced on number of leaves per graft. The maximum number of leaves per graft was recorded in the month of June (8.87) after 90 days of bud breaking and the minimum was in the month of October (6.83). This result also similar with the finding of Dhar (1998) who found that grafting operation done in June produced 9.43 leaves after 120 days of grafting. The combined effect between age of rootstock and time of grafting was significant in respect of number of leaves per graft. The maximum leaves (9.18) was recorded in the month of June grafted onto 14 days old rootstock and the minimum (6.53) was in the month of October grafted onto 21 days old rootstock.

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