

Stionic-relationship for cleft grafting in exotic fruits of Rambutan

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Abstract: The experiment was carried out to investigate the best stock-scion combination for cleft grafting of rambutan from June, 2006 to April, 2007. The rootstock species were Litchi (*Litchi chinensis*) Longan (*Euphoria longan*) and Rambutan (*Nephelium lappaceum* L.). The experiment was laid out in randomized complete block design with six replications. The performances of the plants raised by cleft grafting were studied in respect of success, survivability and growth performance viz. days required to bud break and first flash, height and diameter of rootstock and scion, and canopy volume. In this experiment, rambutan scion onto rootstock of same variety showed the best results, in terms of success (55.83%), survivability (53%), and height of rootstock (14.84 cm) and scion (17.40 cm), whereas rambutan scion onto litchi rootstock gave success (41%), survivability (32.67%), height of rootstock (12.70 cm) and scion (16.95 cm). Combinations of the scion grafted onto the rootstock of the same cultivar gave the best performance in respect of success, survivability and morphological growth compared to other combinations.

Key words: Stock-scion combination, Cleft grafting, rambutan,

Introduction

Rambutan (*Nephelium lappaceum* L.) or hairy litchi is a delicious, juicy fruit of fairly good quality ranking second in respect to deliciousness than litchi and longan. Rambutan is indigenous to the Malay archipelago and has spread and grown in the tropical regions of south-east Asia, central America and Africa where the temperature and humidity are high enough the year round (Delabarre, 1989). The rambutan was introduced to Bangladesh 30 years ago with great perspectives for the future, but still is an exotic fruit due to a shortage of practical experience and of theoretical knowledge by both farmers and scientists, and due to inefficient marketing strategies. The most important obstacle was production of true-to type planting materials (Pohlan, 2005). Stionic relationship is most important factor for successful graft production. If the scion is from the dwarf plant and the rootstock is from a tall plant or vice versa, the graft union may occur but the growth of both the scion and stock may not be uniform. The non-uniform growth may affect the growth and development of the future plants, flowering, fruiting and ultimately on the total production (Hodgson, 1943; Gowder and Irulappan, 1970; Swamy *et al.*, 1972). A number of factors influence the performance of grafting. Among these proper handling, high humidity, low temperature, optimum mineral nutrition and selection of scion and rootstock are important.

There is a lot of scope to increase the production of this fruit in the country by improving newly introduced commercial varieties through the adoption of modern vegetative propagation method with proper stionic relationship. But the information or research work regarding this in Bangladesh is very much limited. Therefore, it is the time to look for appropriate stionic relationship and to obtain true-to-type planting materials, which is pre-requisite for strengthening these productions in Bangladesh. Considering the above facts the present investigation was undertaken to find out the best stock-scion combination for vegetative propagation of different fruits.

Materials and Methods

The experiment was conducted at the Germplasm Centre (GPC) of the FTIP (Fruit Tree Improvement Program), Department of Horticulture, Bangladesh Agricultural University, Mymensingh at June, 2006 to April, 2007. The study was made to investigate the performance of the plants raised by cleft grafting method of vegetative propagation with three different rootstocks. Treatments were -

R_1 = Plants raised by Litchi_{rootstock} + Rambutan^{scion} = (Li_r + Ra^s) combination

R_2 = Plants raised by Longan_{rootstock} + Rambutan^{scion} = (Lo_r + Ra^s) combination

R_3 = Plants raised by Rambutan_{rootstock} + Rambutan^{scion} = (Ra_r + Ra^s) combination

After grafting the plants were maintained in good condition by watering, manuring, weeding as and when necessary. Proper shades were provided with the help of bamboo chatai until grafts were in good growing condition, polythene bags were opened after every two days to remove the accumulated moisture inside them in case of cleft grafts. Data were recorded from the grafted plants during the period from June, 2006 to April, 2007. Data were statistically analyzed by the help of a suitable statistical package (MSTAT-C). The mean differences were evaluated finally by Duncan Multiple Range Test (DMRT) at 5% level of significance.

Results and Discussion

The results of the performance of the plants produced by cleft grafting with different stionic relations have been presented in this section. The results of the growth study have been presented on the success, survivability, heights and diameters of the rootstock and scion, canopy volume at 30, 60, 90, 120 and 150 days after planting the grafts in the field.

Canopy volume: The plants produced by cleft grafting through different stionic relationship was significantly influenced on the canopy volume (m³) of the plants from 30 days to 150 days after planting the grafts in the field except for at 30 days and 60 days due to the

slow growth character. The highest canopy volume (0.359 m^3) was found in the plants produced by grafting of rambutan scion onto the rambutan rootstock ($\text{Ra}_r + \text{Ra}^s$). The lowest (0.341 m^3) canopy volume was recorded in the plants produced by rambutan scion

onto litchi rootstock ($\text{Li}_r + \text{Ra}^s$) at 150 days after planting the grafts in the field (Table 1). The trend was highest in the cleft grafted rambutan scion onto the rambutan rootstock might be due to proper stionic relationship.

Table 1. Effect of stionic relationship on volume of canopy

Treatments	Canopy volume (m^3) at				
	30 days	60 days	90 days	120 days	150 days
($\text{Li}_r + \text{Ra}^s$)	0.005	0.082	0.087	0.288	0.341
($\text{Lo}_r + \text{Ra}^s$)	0.004	0.082	0.087	0.288	0.342
($\text{Ra}_r + \text{Ra}^s$)	0.005	0.082	0.188	0.295	0.359
LSD (0.05)	-	-	0.008	0.097	0.010
(0.01)	-	-	0.015	0.018	0.019
Level of significance	NS	NS	**	**	**

** Significant at 1% level ^{NS} Non significant Li_r = Litchi rootstock, Lo_r = Longan rootstock, Ra_r = Rambutan rootstock, Ra^s = Rambutan scion.

Success and survivability: Main effect of stionic relationship was significant on the percentage of success in graft union of rambutan by cleft grafting. The combination of rambutan scion onto rambutan rootstock ($\text{Ra}_r + \text{Ra}^s$) gave the highest (55.83%) of success in graft union and the lowest (41%) of success was obtained from the combination of rambutan scion onto Litchi rootstock ($\text{Li}_r + \text{Ra}^s$) (Table 2). The highest success of combination of rambutan scion onto rambutan was due to the excellent stionic relationship of the rootstock and scion which enhanced rapid graft

union process resulting highest success. Percentage of survivability was recorded at 150 days after planting (DAP) found to be highly significant. It was observed that the combination of rambutan scion onto rambutan rootstock ($\text{Ra}_r + \text{Ra}^s$), was shown maximum (53%) survivability and minimum survivability (32.67%) showed by the combination rambutan scion onto litchi rootstock ($\text{Li}_r + \text{Ra}^s$) (Table 2). This might be due to the excellent stionic relationship that increased the survivability through rapid and strong union process.

Table 2. Main effect of success and survivability, days required to 1st flash and bud break

Treatment	% of success	% of survivability	Days required to bud break	Days required to first flash	Height of rootstock (cm) at				
					30days	60 days	90 days	120 days	150 days
($\text{Li}_r + \text{Ra}^s$)	41.00	32.67	18.87	22.34	12.64	12.64	12.74	12.78	12.70
($\text{Lo}_r + \text{Ra}^s$)	50.83	40.33	15.22	20.11	13.12	13.21	13.30	13.55	13.39
($\text{Ra}_r + \text{Ra}^s$)	55.83	53.00	14.39	19.23	14.66	14.71	14.80	14.09	14.84
LSD(0.05)	8.97	5.29	0.518	0.721	0.64	0.70	1.18	0.90	1.18
(0.01)	16.66	9.75	0.956	1.331	1.17	1.29	2.17	1.67	2.17
Level of significance	**	**	**	**	**	**	**	**	**

** Significant at 1% level Li_r = Litchi rootstock, Lo_r = Longan rootstock, Ra_r = Rambutan rootstock, Ra^s = Rambutan scion.

Days required to bud break: The present study revealed that there was a significant effect on the days required to bud break. The earliest bud breaking (14.39 days) was found when rambutan scion was grafted onto rambutan rootstock ($\text{Ra}_r + \text{Ra}^s$), whereas rambutan scion onto litchi rootstock ($\text{Li}_r + \text{Ra}^s$) required considerably more time (18.87 days) (Table 2). The less time requirement to bud break for grafts of rambutan scion onto rambutan rootstock might be due to the inherent potentiality of the plants as it was observed from faster and vigorous growth of the combinations (Sutarto, I., H. Arwin and N.Suqiama. 2004).

Days required to first flush: The present study revealed that there was highly significant effect on the

days required to first flush. The earliest first flush (19.23 days) was found when scion rambutan scion was grafted onto rambutan rootstock ($\text{Ra}_r + \text{Ra}^s$), whereas rambutan scion onto litchi rootstock ($\text{Li}_r + \text{Ra}^s$) required considerably more time (22.39 days) (Table 2). The less time requirement to first flush for grafts of rambutan scion onto rambutan rootstock might be due to the inherent potentiality of the plants as it was observed from faster and vigorous growth of the combinations resulting the quick flashing (Sutarto, I., H. Arwin and N.Suqiama. 2004).

Height of the rootstock: The height of the rootstock was highly influenced by the stionic relationship from 30 to 150 days after planting the grafts in the field. The highest height of the rootstock was recorded (13.39

cm) in the plant produced by rambutan scion onto rambutan rootstock ($Ra_r + Ra^s$). The lowest height of the rootstock was recorded (12.70 cm) in the plants produced by the rambutan scion onto mango rootstock ($Ma_r + Ra^s$) at 150 days (Table 2). The highest height of the combination of rambutan scion onto rambutan rootstock possibly due to the compatibility of the rootstock and scion which enhanced rapid graft union process resulting highest growth of the plant.

Height of scion: The height of the scion was significantly influenced by the different stionic

relationship of rootstock and scion in the grafting of longan from 30 days to 150 days after planting the grafts in the field. The highest height of scion (17.40 cm) was recorded in the plants produced by grafting of rambutan scion onto rambutan rootstock ($Ra_r + Ra^s$) and the lowest (16.95cm) was recorded in the plants produced by rambutan onto litchi rootstock ($Li_r + Ra^s$) at 150 days after planting in the field (Table 3). The highest height of the cleft grafted plants might be due to the well growth scion to the varieties characteristics of the combination.

Table 3. Effect of stionic relationship on height and diameter of scion

Treatment	Height of scion (cm) at					Diameter of scion (cm) at				
	30 days	60 days	90 days	120 days	150 days	30 days	60 days	90 days	120 days	150 days
($Li_r + Ra^s$)	9.45	9.77	10.60	14.17	16.95	0.440	0.45	0.50	0.51	0.52
($Lo_r + Ra^s$)	9.42	9.73	10.58	14.48	17.38	0.462	0.47	0.52	0.53	0.55
($Ra_r + Ra^s$)	9.55	9.92	10.75	14.52	17.40	0.430	0.44	0.94	0.95	0.96
LSD(0.05)	-	0.23	0.19	0.41	0.68	0.026	0.009	0.009	0.026	0.075
(0.01)	-	0.41	0.37	0.76	1.26	0.048	0.016	0.017	0.048	0.138
Level of significance	NS	*	*	*	*	**	**	**	**	**

** Significant at 1% level * Significant at 5% level ^{ns} Non significant Li_r = Litchi rootstock, Lo_r = Longan rootstock, Ra_r = Rambutan rootstock, Ra^s = Rambutan scion.

Diameter of the scion: The diameter of scion was highly influenced by the different stionic relationship from 30 to 150 days after planting the grafts in the field. The plants produced by grafting at different stionic relationship showed differences in diameter of the scion. The highest diameter (0.96 cm) of the scion was recorded in the plants produced by grafting the rambutan scion onto the rambutan rootstock ($Ra_r + Ra^s$) and the lowest (0.52 cm) was in the plant produced by grafting of the rambutan scion onto the litchi rootstock ($Li_r + Ra^s$) at 150 days after planting the grafts in the field (Table 3).

Acknowledgements

The author wishes to extend his deepest and profound gratitude and indebtedness and thanks to the authority of Fruit Tree Improvement Project (FTIP), DH-BAU, funded by University Grants Commission (UGC) and Inter-cooperation of AFIP for logistic support.

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