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Effect of scion defoliation and stock leaf retention on the grafting success and survivability of Lime

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Abstract:

The present experiment was conducted at the Germplasm Centre (GPC) of the Fruit Tree Improvement Program (FTIP), Bangladesh Agricultural University, Mymensingh, during the period from June to October, 2013 to investigate the effects of scion scion defoliation and stock leaf retention on the success, survivability and growth of grafts in Lime (cv.BAU lime-1).The experiment consisted of two factors such as Factor A: four scion defoliation periods viz., defoliation 9 days before grafting, defoliation 6 days before grafting, defoliation 3 days before grafting and defoliation on the day of grafting

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and Factor B: retention of leaf on rootstock below graft union viz., rootstock with leaf and rootstock without leaf. The study was laid out in factorial experiment following Randomized Complete Block Design (RCBD) with three replications. The grafts were kept under observation in poly tunnel condition. Results revealed that highest graft success (90.50%) and survivability (89.36%) were observed when scions were defoliated 6 days before grafting and lowest graft success (77.83%) and survivability (77.67%) were observed when scions were defoliated on the day of grafting. In respect of retention of leaves on rootstock, the highest graft success (91.42%) and survivability (88.92%) were found when grafting was done on rootstock with leaves and lowest graft success (79.49%) and survivability (77.06%) were found when grafting was done on rootstock without leaves Therefore, grafting with scions defoliated 6 days before grafting on rootstock retaining leaves below graft union can be practiced for highest success and growth Lime.

Key words: Scion defoliation period, stock leaf retention, graft success; survivability, lime.

INTRODUCTION

Lime (*Citrus aurantifolia*) under the family Rutaceae is one of the important, popular and nutritious fruits in the world. Lime was probably originated in India and then spread to the Middle East and other tropical and sub-tropical countries (Salunkhe and Desai, 1984). It is found to grow in different parts of Bangladesh but it is cultivated in a limited scale in Chuadanga, Khulna, Barisal, Bagerhat, Borguna, greater Sylhet, Mymensingh and northern part of Bangladesh. Though citrus cultivation is getting popularity in Bangladesh, production area is not increasing simultaneously and production is not much higher. Only 55000 metric tons lime and lemon were produced in 4000 acres land during the year 2010-2011 (BBS, 2011).Citrus and citrus products are rich sources of vitamins,

minerals and dietary fiber that are essential for normal growth and development and overall nutritional wellbeing. Citrus has some medicinal values (Economics and Clay, 2006). BAU kagzi lebu-1 is a variety of lime. It bears fruits in clusters of 5-10 and yields 30% more than the normal Kagzi lebu. The fruits have 68% juice which is higher than normal lime. It is a year-round variety. The fruit is almost round. Average weight of fruit is 50-60 gm. External appearance of fruit is smooth and skin is very thin. Lime is mainly propagated by seed and air layering. In case of seed propagation, seedlings are not true-to-type with mother tree; due to juvenility factors, seedling trees do not usually bear fruit until they are nearly a decade old; and they are vulnerable to unfavorable soil conditions, diseases, and so forth. In case of air layering; there are many disadvantages such as adventitious roots are produced, which are weaker than the tap root system. Thus the resultant plant becomes poor, short lived and less yielder. It has been reported that cleft grafting is easier to use and more promising compared to other methods of grafting such as veneer and contact grafting (Muzaffar and Ajay, 2011). Success, survivability and growth of grafts depend on a number of factors including time and method of grafting, defoliation period of scion, age of the rootstock, leaf retention of rootstock etc. Among these defoliation period of scion and leaf retention on rootstock are important factors for success, survivability and growth of grafts (Dhakal and Huda,1987;Ram ,1993; Aftab,2004).Plant hormone known as auxin remains present in apical portion of twigs which inhibits lateral growth and promotes the growth of terminal bud only (Went,1928). Through defoliation and cutting the tip of the twigs; dormant lateral axillary buds present on selected branch are made into active condition and defoliation enhances the success of grafting (Reddy, 1986).Considering the above facts, the present study was undertaken to investigate

the effect of scion defoliation and stock leaf retention on the success and survivability of cleft grafting in lime.

MATERIALS AND METHODS

The present experiment was conducted at the 'BAU Germplasm Centre (GPC) of Fruit Tree Improvement Program (FTIP), Bangladesh Agricultural University, Mymensingh during the period from June to October, 2013. High yielding cultivar namely FTIP BAU Lebu-1(semi seedless) was used in this study. The rootstocks used in the experiment were raised in polybag from the lemon seeds of unknown variety. The scion shoots used, were collected from mother plants of lime (cv. BAU Lebu-1). The two-factor experiment consisting of 8 treatment combinations was laid out in Randomized Complete Block Design (RCBD) with three replications. For each treatment combination grafting operations were performed on twenty rootstocks of each plot of a block. Thus in total 4×2×3×10= 240 grafts were made. The experiment consisted of two factors, Factor A: scion defoliation period 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 Factor B: Stock leaf retention viz., Rootstock with leaves below graft union; Rootstock without leaves below graft union. The collected data on graft success and survibility were statistically analyzed to find out the significance of differences between the treatments and treatment combinations. The means of all the treatments were calculated and the analyses of variances (ANOVA) for all the characters were performed by 'F' variance test. The significance of differences between treatments means were compared by Least Significant Difference (LSD) test (Gomez and Gomez, 1984).

RESULTS AND DISCUSSION

Graft success:

The percentage of graft success was significantly (P<0.01) influenced by different scion defoliation periods of lime (Table 1). The highest graft success (90.50%) was achieved when grafting was done with the scion defoliated 6 days before grafting and the lowest graft success (77.83%) was recorded from scion defoliated on the day of grafting. Success is highest in case of pre-defoliated scion due to higher level of sucrose content in phloem sap leading its movement toward apex of the lateral shoots thereby, optimum level of increment in meristematic activity at bud level. The success percentage of grafts were responded significantly (P<0.01) due to the effect of leaf retention on rootstock. The higher graft success (91.42%) was obtained from rootstock with leaf while the lower graft success (79.49%) was recorded from rootstock without leaves (Table 2). The highest (91.42%) grafting success could be due to proper amount of reserved food supplied from leaves and other growth factors that are necessary to influence cambial activity and subsequent grafting success. The percentage of graft success was significantly (P<0.01) influenced by the interaction effect of scion defoliation period and stock leaf retention. The highest success rate (94.00%) was found when scions were defoliated 6 days prior to grafting operation and were grafted on the rootstocks having leaves below graft union while the lowest success rate (79.67%) was found when scion defoliated on the day of grafting was grafted with root stock without leaf below grafting union (Table 3).

Table 1. Main effect of scion defoliation period on the percentage of graft success and survivability

Scion defoliation period before grafting(days)	Graft success (%)	Graft survivability (%)
9	83.33	81.95
6	90.50	89.36

3	85.28	83.85
0	77.83	77.67
LSD at 5%	0.20	0.22
LSD at 1%	0.28	0.31
Level of significance	**	**

**= Significant at 1% level of probability

Table 2. Main effect of stock leaf retention on the percentage of graft success and survivability

Stock Leaf Retention	Graft success (%)	Graft survivability (%)
Stock with leaves	91.42	88.92
Stock without leaves	79.49	77.06
LSD at 5%	0.14	0.16
LSD at 1%	0.20	0.22
Level of significance	**	**

**= Significant at 1% level of probability

Graft survivability:

The scion defoliation period had significant (P<0.01) effect on graft survivability. The effects of scion defoliation periods on the percentage of graft survivability. The highest graft survivability (89.36%) was achieved when grafting was done with the scion defoliated 6 days before graft and the lowest graft survivability (77.67%) was recorded from scion the defoliated on the day of grafting (Table 1).

This might be due to having optimum level of bud swelling, rapid formation of callus tissue that allow translocation of vital chemical compounds between stock and scion. The influence of curing on growth parameters could be attributed to initiation of cambium activity which might have resulted from defoliation. The percentage of graft survivability was significantly (P<0.01) influenced by leaf retention on rootstock (Table 2).

The higher graft survivability (88.92%) of grafting was obtained from rootstock with leaves grafting while the lower graft survivability (77.06%) was recorded from the rootstock without leaves below graft union. This might be due to the cellular activities through rapid establishment of vascular

connection. the percentage of graft survivability was significantly (P<0.01) influenced by the interaction effect of scion defoliation period and stock leaf retention.

The combined effect was also significant. Grafting performed with the scion defoliated 6 days before grafting and root stock with leaves below graft union gave the highest graft survivability (90.33%) while the lowest (78%) was found when scions were defoliated on the day of grafting and were grafted on the root stocks without leaves below graft union (Table 3).

Table 3. Combined effect of scion defoliation period and stock leaf retention on the percentage of graft success and survivability

Stock leaf retention	Scion Defoliation Period before grafting (days)	Graft success (%)	Graft survivability (%)
Stock with leaves	9	89.67	87.00
	6	94.00	90.33
	3	89.67	79.90
	0	85.00	84.33
Stock with leaves	9	81.00	87.50
	6	85.39	80.33
	3	83.89	78.00
	0	79.69	86.98
LSD at 5%		0.29	0.31
LSD at 1%		0.40	0.44
Level of significance		**	**

**= Significant at 1% level of probability

CONCLUSION

From the results, it reveals that lime can be propagated by grafting using pre-cured scion and keeping leaves below grafting union with higher success and survivability of grafts. But for the highest percentages of success and survivability of grafts the cleft grafting could be done if scions are defoliated 6 days before grafting and leaves are kept on the root stock below grafting union.

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