

# Influence of Rootstock Age and Pre-Defoliation of Scion on the Success of Epicotyl Grafting of Mango

B. Upadhya, D. B. Baral, D. M. Gautam, S. M. Shrestha

## Abstract

*The present investigation in epicotyl grafting of mango was conducted during last week of July, 2012. The experiment was laid out in a two factors factorial Randomized Complete Block Design (RCBD). Mango seedlings of 5, 10, 15 and 20 days were grafted with un-defoliated and 5, 10 and 15 days pre-defoliated scion. Among different treatment combination, Days to first sprouting (9.6 days) and completion of sprouting (16.33 days) was minimum in the grafts of 15 days seedling age with 10 days pre-defoliated scion whereas maximum (16 days) and (22 days) was found in 5 days old seedlings with 0 days pre-defoliated scion. Maximum initial (86.7%) and final success (56.7%) of grafts were found in the grafts of 15 days old seedlings and 10 days pre-defoliated scion while it was found minimum (16.7%) and (6.7%) in the grafts of 5 days old seedlings and un-defoliated scion respectively. Fifteen days old*

*seedlings and 10 days pre-defoliated scion performed best for all growth parameters.*

**Key words:** Mango, propagation, epicotyl grafting

## 1. Introduction

Mango (*Mangifera indica*) is one of the leading fruit crops of Nepal and considered as the king of fruits. It covers 9% of total cultivated area and is ranked second among all fruit crops cultivated in Nepal (Gautam and Dhakal 1994). Annual production of mango in the country is 3, 28, 883 mt under total area of 40, 110 ha including productive area of 32, 228 ha (MOAD, 2011/12) mostly in the terai, low-hills, mid-hills and mountains regions.

Mango is a cross pollinated crop. Generally mango is commercially propagated through vegetative means due to its heterozygous nature. Due to increasing trend of mango cultivation, time demand of mango graft required to be fulfilled. Traub and Autcher (1934) first reported the

epicotyl grafting in mango is cost effective, easy to conduct, good success percentage with rapid multiplication of vigorous and healthy grafted seedlings (Patil *et al.*, 1991). Recently the success of epicotyl grafting has been revealed by different authors (Jose and Velsalakumari, 1991 and Hossain, 1996). Kulwal and Tayde (1989a) reported that this technique requires less time for propagation proved to be cheaper. The success of epicotyl grafting depends on different factors such as temperature, relative humidity, light, soil moisture, variety of scion, pre-defoliation of scion, length of scion, age of rootstock, time and method of grafting and the skills of the grafter. Ram and Sirohi, (1989) reported that the success of grafting depends upon season, age of rootstock and scion and cultivar. Alam *et al.*, (2006) got better results from Langra scion grafted onto 15 days old seedlings using cleft methods on 5, 10, 15 and 20 days old BARI Aam-1. Maity and Biswas (1980) reported that defoliated scion shoots always produced higher percentage of successful grafts than the un-defoliated shoots.

Considering the above mentioned idea, diverse result was observed but in Nepal condition very few or no work regarding epicotyl grafting has been

reported. Hence the present investigation has been undertaken with following objectives: a) To find out the effect of rootstock age on success of grafts in epicotyl grafting of mango b) To evaluate the effect of pre-defoliation of scion on success of grafts in epicotyl grafting of mango c) To study the interaction effect of rootstock age and pre-defoliation of scion on success of epicotyl grafting of mango.

## 1. Materials and methods

The experimental trail was conducted from June to November 2012 at horticulture department of IAAS, Rampur, Chitwan, Nepal. Ripe fruits of identical local mango variety were collected and seed stones were extracted by removing the cast aside of all fruits. Seed stones were kept in water for 24 hrs fermentation and washed with water and place under shade until they planted in planned ways. Poly bags were used with top soil and saw dust as the mixture for germination media in the ratio of 1:1. Seeds were then sown in 5 days interval in polybag with their basal end facing down and suture upwards. Germination of seed stones was taken place within 7-8 days after sowing. Two to four month old mature shoots from healthy

Dashehari mango tree with 0, 5, 10, 15 days pre-defoliated shoots were used as scion. Cleft method of grafting was followed to join rootstock and scion. There were 10 grafts in each treatment and replicated thrice. Altogether, there were 480 grafted plants for the experiment. Each grafted plants were covered with polythene cap to increase the level of humidity around the plant. Grafted plants were watered regularly with the fine rose can, just to keep the media moist and to maintain high humid atmosphere inside the glass house. Besides, grafts were sprayed with 0.2 percent Bavistin solution at 4 days intervals till the apical buds of the scion shoots forced into new growth in order to prevent fungal infection. Care had been taken to remove the sprouts on the rootstocks below the graft union during this period

### 3. Result and discussion

#### 3.1 Days to first sprouting

Days to first sprouting among the grafts varied significantly with respects to age of seedling. Minimum day to sprouting was coupled for the grafts of 15 days old seedling (12.50 days) (Table 1). The grafts of 20 days old seedlings took maximum days to first sprouting (13.67 days), which

was statistically similar to the grafts of 5 and 10 days of old seedlings (Table 1).

It was revealed that, the older seedlings required maximum days to sprouting (Alam *et al.*, 2006). This may be due to better union of stock and scion in 15 days old seedlings there by making the nutritional supply in required quantity easily. Kilany *et al.* (2012) reported that rapid formation of callus (parenchymatous) tissues allows translocation of vital biochemical compounds between stock and scion might be the reason for minimum days to sprouting whereas high temperature desiccating the young rootstock might be the reason for maximum days to sprouting in young seedlings (Kulwal and Tayde, 1989b)

The days to first sprouting among the grafts was significantly influenced by days to pre-defoliation of scion. Significantly, minimum day to sprouting was found in the grafts of 10 days pre-defoliated scion (11.17 days) (Table 1). The grafts of 0 days pre-defoliated scion took maximum days to sprouting (15.42 days) (Table 1). The minimum days of pre-defoliation of scion required maximum days to sprouting. The comparatively early sprouting in longer

period of defoliation may be due to higher meristematic activity at the bud level, which was apparent from their swellings (Patil *et al.*, 1984). Such observation was also made by Rao and kaul (1977) in veneer grafting of mango.

The interaction effect of seedling age and pre-defoliated scion in grafts of different treatment combinations was found significant. Days to first sprouting was minimum (9.6 days) in the grafts of 15 days seedling age with 10 days pre-defoliated scion whereas maximum (16 days) was found in 5 days old seedlings with 0 days pre-defoliated scion (Table 2).

### 3.2 Days to completion of sprouting

The completion of bud sprouting was significantly affected by the age of seedlings. The shortest period (18.83 days) to complete sprouting was required in the grafts of 15 days old seedlings which were statistically similar to the graft of 10 days old seedlings (Table 1). In contrary, the longest period (20 days) to complete sprouting was required in the grafts of 20 days old seedlings which were statistically at par to the graft of 5 and 10 days old seedlings (Table 1).

As the age of rootstock increases the days required for sprouting decreases. The early sprouting in older seedlings might be due to more mechanical fit of the two cambium layers and the proper hormonal level in the older tissue (Patil *et al.*, 1984). Presence of more concentrated latex and hardness of rootstock which hindered to the graft union process might be the reason for maximum days to complete sprouting in aged seedlings while working in Jackfruit (Pandiyani *et al.*, 2011) whereas high temperature desiccating the young rootstock might be the reason for maximum days to complete sprouting in younger rootstock (Alam *et al.*, 2006). It was also observed that days to first sprouting were significantly and positively correlated to days to completion of sprouting (Table 7).

Days to completion of bud sprouting was significantly affected by the days to pre-defoliation of scion. The shortest period (17.42 days) to complete sprouting was required in the grafts of 10 days pre-defoliated scion (Table 1). In contrary, the longest period (21.50 days) to complete sprouting was required by the grafts of 0 days pre-defoliated scion (Table 1).

Table 1. Effect of age of rootstock and pre-defoliation of scion on sprouting and success of the grafts in epicotyl grafting of mango at IAAS, Rampur, Chitwan, 2012

| Treatments                                 | Days to first sprouting | Days to completion of sprouting | Initial success (%) | Final success (%)   |
|--|-------------------------|---------------------------------|---------------------|---------------------|
| <b>Factor A (Rootstock age)</b>            |                         |                                 |                     |                     |
| 5 Days                                     | 13.58 <sup>a</sup>      | 19.58 <sup>a</sup>              | 23.33 <sup>d</sup>  | 12.50 <sup>d</sup>  |
| 10 Days                                    | 13.17 <sup>a</sup>      | 19.33 <sup>ab</sup>             | 46.67 <sup>c</sup>  | 24.17 <sup>c</sup>  |
| 15 Days                                    | 12.5 <sup>b</sup>       | 18.83 <sup>b</sup>              | 65.00 <sup>a</sup>  | 38.33 <sup>a</sup>  |
| 20 Days                                    | 13.67 <sup>a</sup>      | 20.00 <sup>a</sup>              | 56.67 <sup>b</sup>  | 33.33 <sup>b</sup>  |
| LSD  | 0.634**                 | 0.704*                          | 0.527**             | 0.461**             |
| SEm (±)                                    | 0.219                   | 0.243                           | 0.182               | 0.159               |
| <b>Factor B (Pre-defoliation of scion)</b> |                         |                                 |                     |                     |
| 0 Days                                     | 15.42 <sup>a</sup>      | 21.50 <sup>a</sup>              | 39.17 <sup>c</sup>  | 20.00 <sup>c</sup>  |
| 5 Days                                     | 14.00 <sup>b</sup>      | 20.17 <sup>b</sup>              | 45.83 <sup>b</sup>  | 26.67 <sup>b</sup>  |
| 10 Days                                    | 11.17 <sup>d</sup>      | 17.42 <sup>d</sup>              | 56.67 <sup>a</sup>  | 39.17 <sup>a</sup>  |
| 15 Days                                    | 12.33 <sup>c</sup>      | 18.67 <sup>c</sup>              | 50.00 <sup>b</sup>  | 22.50 <sup>bc</sup> |
| LSD  | 0.634**                 | 0.704**                         | 0.526**             | 0.461**             |
| SEm (±)                                    | 0.219                   | 0.243                           | 0.182               | 0.159               |
| CV (%)                                     | 5.75                    | 4.34                            | 13.18               | 20.41               |

CV: Coefficient of variation; LSD: Least significant difference; SEM ( $\pm$ ): Standard error; Means with in the column followed by the same letter(s) are not significantly different at 5% level of significance by DMRT

While working in pre-defoliation of scion (3, 5 and 7 days) in epicotyl grafting of mango, Patil *et al.* (1984) reported that minimum day to completion of sprouting in longer period of pre-defoliated scion might be due to maximum level of increment in meristamatic activity at the bud level that was apparent from their swelling. However delay sprouting in 15 days pre-defoliated scion might be due to utilization of stored food material within the mother tree itself. Furthermore, days to first sprouting were significantly and positively correlated to days to completion of sprouting (Table 7).

The interaction effect of age of rootstock and pre-defoliation of scion in relation to days to completion of sprouting was found significant. Period to completion of sprouting was minimum (16.33 days) in the grafts of 15 days old seedlings with 10 days pre-defoliated scion and maximum (22 days) in the grafts of 5 days old seedlings with 0 days pre-defoliated scion (Table 2). The level of sucrose content and metabolic activity in 15 days old rootstock and 10 days pre-defoliated scion might be in somewhat equal and optimum amount that's why early completion of sprouting taken place than other treatment combination. Abnormal quantities of starch accumulation on rootstock and scion create incompatibility in grafted plants.

Table 2. Interaction effect of age of rootstock and pre-defoliation of scion on sprouting and success of the grafts in epicotyl grafting of mango at IAAS, Rampur, Chitwan, 2012

| Treatments | Days to first sprouting | Days to completion of sprouting | Initial success (%) | Final success (%)   |
|------------|-------------------------|---------------------------------|---------------------|---------------------|
| A1D1       | 16.00 <sup>a</sup>      | 22.00 <sup>a</sup>              | 16.7 <sup>i</sup>   | 6.70 <sup>h</sup>   |
| A1D2       | 14.67 <sup>a</sup>      | 20.67 <sup>ab</sup>             | 26.7 <sup>hi</sup>  | 13.3 <sup>fgh</sup> |
| A1 D3      | 11.00 <sup>c</sup>      | 16.67 <sup>d</sup>              | 20.0 <sup>hi</sup>  | 20.0 <sup>efg</sup> |
| A1D4       | 12.67 <sup>b</sup>      | 19.00 <sup>c</sup>              | 30.0 <sup>gh</sup>  | 10.0 <sup>gh</sup>  |
| A2D1       | 15.00 <sup>a</sup>      | 21.00 <sup>a</sup>              | 40.0 <sup>fg</sup>  | 13.3 <sup>fgh</sup> |
| A2D2       | 13.33 <sup>b</sup>      | 19.33 <sup>bc</sup>             | 43.3 <sup>ef</sup>  | 23.3 <sup>def</sup> |
| A2D3       | 12.00 <sup>bc</sup>     | 18.33 <sup>c</sup>              | 53.3 <sup>cde</sup> | 33.3 <sup>cd</sup>  |
| A2D4       | 12.33 <sup>bc</sup>     | 18.67 <sup>c</sup>              | 50.0 <sup>def</sup> | 26.7 <sup>cde</sup> |
| A3D1       | 15.00 <sup>a</sup>      | 21.33 <sup>a</sup>              | 50.0 <sup>def</sup> | 36.7 <sup>c</sup>   |
| A3D2       | 13.00 <sup>b</sup>      | 19.00 <sup>c</sup>              | 60.0 <sup>bcd</sup> | 33.3 <sup>cd</sup>  |
| A3D3       | 9.667 <sup>d</sup>      | 16.33 <sup>d</sup>              | 86.7 <sup>a</sup>   | 56.7 <sup>a</sup>   |
| A3D4       | 12.33 <sup>bc</sup>     | 18.67 <sup>c</sup>              | 63.3 <sup>bc</sup>  | 26.7 <sup>cde</sup> |
| A4D1       | 15.67 <sup>a</sup>      | 21.67 <sup>a</sup>              | 50.0 <sup>def</sup> | 23.3 <sup>def</sup> |
| A4D2       | 15.00 <sup>a</sup>      | 21.67 <sup>a</sup>              | 53.3 <sup>cde</sup> | 36.7 <sup>c</sup>   |
| A4D3       | 12.00 <sup>bc</sup>     | 18.33 <sup>c</sup>              | 66.7 <sup>b</sup>   | 46.7 <sup>b</sup>   |
| A4D4       | 12.00 <sup>bc</sup>     | 18.33 <sup>c</sup>              | 56.7 <sup>bcd</sup> | 26.7 <sup>cde</sup> |
| LSD        | 1.269*                  | 1.408*                          | 1.053**             | 0.922*              |
| SEm (±)    | 0.439                   | 0.487                           | 0.365               | 0.319               |
| CV (%)     | 5.75                    | 4.34                            | 13.18               | 20.41               |

CV: Coefficient of variation; LSD: Least significant difference; SEm (±): Standard error; Means with in the column followed by the same letter(s) are not significantly

different at 5% level of significance by DMRT; A1- Five days old seedling, A2 – Ten days old seedling, A3 – Fifteen days old seedling A4 - Twenty days old seedlings,

D1 – Zero days pre-defoliated scion, D2 - Five days pre-defoliated scion, D3 - Ten days pre-defoliated scion, D4 – Fifteen days pre-defoliated scion.

### 3.3 Initial success

The initial success was significantly affected by age of rootstock. The highest initial success (65%) was recorded from the grafts of 15 days old seedlings (Table 1) whereas lowest (23.33%) was found in the grafts of 5 days old seedlings (Table 1).

Highest initial success in 15 days old seedling might be due to rapid formation of callus tissue than all other seedling age. Furthermore, preservation of more food material in cotyledon and actively growing stage of rootstock that enhance union might be another reason for highest initial success in 15 day old seedlings. Poon (2002) reported that maximum initial success (42.2%) was obtained in 14 days old seedling which was similar to this study. Alam *et al.*, (2006) also recorded highest initial success (64.44%) in 15 days old seedling.

The highest initial success (56.67%) was recorded from the grafts of 10 days pre-defoliated scion and was statistically

different to those other grafts of pre-defoliated scion (Table 1). Initial success was lowest in the grafts of 0 days pre-defoliated scion (39.17%), which was statistically different to those of all other pre-defoliated scion (Table 1).

Kumar *et al.* 2012 while working on curing of scion in guava (3 to 12 days) reported that the highest initial success in pre-defoliated scion of 9 day is probably due to higher level of sucrose content in the phloem sap leading its movement toward apex of the shoots thereby, optimum level of increment in meristamatic activity at the bud level that was noticeable from their swellings which support this results too.

The interaction effect of seedling age and pre-defoliation of scion in relation to days to completion of sprouting was found highly significant. Maximum initial success (86.67%) was recorded from 15 days old seedlings grafted with 10 days pre-defoliated scion. The grafts of 5 days old seedlings and 0 days pre-defoliated scion had minimum success (16.67%) (Table 1).

### 3.4 Final success

Final success of the grafts in epicotyl grafting of mango was significantly



affected by the age of rootstock. Maximum success (38.33%) was achieved from the grafts made with 15 days old seedlings followed by 20 days old seedlings (Table 1). Significantly, minimum success (12.50%) was obtained in the grafts of 5 days old seedlings (Table 1).

The above mentioned results might be due to high temperature, desiccating the young rootstock and undeveloped root system of aged seedlings having lesser reserve food material (Kulwal and Tayde, 1989b). The rapid formation of callus, greater formation of wound periderm and accumulation of resinous material along with lucid vascular continuity might be the reason for highest final success (Kilany *et al.*, 2012). Higher initial success leads to higher final success too. Reddy and Kohli (1989) recorded maximum success (66.66%) from 14 days old rootstocks in Alphonso. Also, Alam *et al.* (2006) revealed that maximum final success was obtained on 15 days old seedling followed by 20 days old seedling.

Maximum final success (39.17%) was achieved from the grafts made with 10 days pre-defoliated scions followed by 5 days pre-defoliated ones (Table 1).

Minimum final success was obtained in the grafts of 0 days pre-defoliated (20.0%) and 15 days pre-defoliated scion (22.50%) (Table 1). Dhungana *et al.* (1989) reported that highest percentage of survival (49.50%) was observed when scions were defoliated 10 days prior to epicotyl grafting compared to 15 days (47.50%) or 0 days pre-defoliation (33.50%) under Kerala condition. The maximum final success in graft of 10 day pre-defoliated scion was due to optimum level of bud swelling. Kumar *et al.* (2012) reported that the maximum graft success (84.00%) was recorded with 9 days pre-defoliated scion in guava plants.

In case of interaction, maximum success (56.67%) was achieved in the grafts of 15 days old seedlings with 10 days pre-defoliated scions which was statistically different from other treatments combination (Table 2). Pre-defoliated scion of 15 days on 15 days old seedlings has moderate success (46.67%). Minimum success (6.67%) was observed in the grafts of 0 days pre-defoliated scion with 5 days old seedlings (Table 2). The highest success in 15 days old seedlings and 10 days pre-defoliated scion might be due to equal and optimum level of metabolic activity in rootstock and

scion there by proper union of rootstock and scion taken place.

#### 4. Conclusion

Success of the graft was found better in the graft of 15 days old seedlings. In case of pre-defoliation of scion, 10 days pre-defoliated scion did the best. Interactive effect showed maximum success on the grafts of 15 days old seedlings and 10 days pre-defoliated scion.

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