



## Grafting methods and time in pomegranate (*Punica granatum*) under semi-arid agro-climatic condition of Maharashtra\*

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Pomegranate (*Punica granatum* L.) is one of the important fruit crops grown on commercial scale in Deccan Plateau of India and is gaining a lot of popularity worldwide in recent years owing to its high economic, nutraceutical and therapeutic values (Marathe *et al.* 2010). It is mainly propagated by air layering in Maharashtra, Karnataka and Andhra Pradesh. Unlike other perennial fruit crops, multi-stem training system is very common in pomegranate (Chandra *et al.* 2008). Recently, wilt has emerged as an important threat in major pomegranate growing belts of India and to combat this problem neither any standard grafting technique nor suitable rootstock is available. In fruit crops, wedge graft specifically offers very high graft success with greater stability than the other grafting techniques tried due to the instant full balance between the stock and the scion (Tabora and Atienza 2006, Selvi *et al.* 2008, Somkumar *et al.* 2009). But, this method was not tested in pomegranate especially for commercial cultivars. Therefore, an attempt was made to standardize grafting method and time in Bhagawa cultivar of pomegranate.

The present study was carried out for two consecutive years at the National Research Centre on Pomegranate, Solapur, Maharashtra during 2007–08 and 2008–09. Ten treatment combinations involving two grafting methods (wedge and tongue grafting) and five grafting dates (15 December, 30 December, 15 January, 30 January and 15 February) were tried. The treatments were arranged in completely randomized design with three replications. About 15 cm long leafless scion of 6–9 months of Bhagawa was used for grafting. One year old seedling of Phule Arkata, raised in polythene bags (25 cm × 15 cm) filled with soil, sand and FYM mixture in 1:1:1 ratio, was used as rootstock. In each treatment of a replication, 30 seedling rootstocks of pencil thickness (0.6–0.8 cm) having uniform growth were

used for grafting. After selection of scion, the rootstock was headed back at 15–17 cm height. The beheaded rootstock was then split open around 3.5–4.0 cm deep through the centre from the cut end of the rootstock with the help of grafting knife. A wedge shaped cut, slanting from both the sides (3.2–3.8 cm long), was made on the proximal end of scion. The scion stick was inserted into the split of the stock and pressed thoroughly so that cambium tissues of the rootstock and scion should come in contact with each other. However, tongue grafting was done as per the procedure described by Hartmann *et al.* (1997). Subsequently, the stock and scion combination was tied with the help of 150 gauge polythene strip, 2 cm in width and 25–30 cm in length. Immediately after grafting by both the methods, the graft was covered by 2.5 cm × 16 cm long white polythene cap and tied with thread at lower end. The grafts were kept in net house and the caps were removed 15–18 days after grafting (DAG). Finally, the grafts were transferred from the net house to open condition at 30 DAG. The wrapped polythene was removed at 90 DAG with the help of blade. Observations of grafted plants were recorded on plant height, scion length, diameter at graft union (lower, middle and upper part) at 3 and 6 months during 2007–08 and 2008–09. Per cent scion sprouting at 15 and 21 DAG and graft success (%) at 90 DAG was also recorded in both the years. Besides, some other biometric parameters like number of leaf and primary root/plant, length of longest root, primary root length, and biomass production/plant of one year old grafted plants were recorded during 2008–09. Meteorological data for December, January and February of both the years were recorded and used for interpretation of the result. The data were statistically analyzed as per standard procedure.

The pooled analysis of data indicated that scion sprouting per cent at 15 and 21 DAG was significantly influenced by grafting method and time in pomegranate (Table 1). In fact, the sprouting started between 8 and 12 DAG irrespective of treatments. Initially, the sprouting per cent was low that increased at 21 DAG in different treatments. Interestingly,

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the sprouting was significantly highest with wedge grafting done on 30 January at 15 (90.0%) and 21 (96.6%) DAG. In tongue grafting, except 30 January, other dates showed low sprouting at 15 and 21 DAG indicating poor callus production at grafted union of scion and rootstock. There was significant impact of grafting method and time on per cent graft success at 90 DAG (Table 1). Significantly highest graft success (85.83%) was noted with wedge grafting done on 30 January and it decreased on subsequent date (15 February) due to rise in day temperature and decrease in humidity. High wedge graft success on 30 January might be associated to quite conducive environment, especially optimum temperature (22.85-23.65 °C) and humidity (42.85-47.08%) that helped in production of more callus tissues in the grafts. Generally, graft healing process in pomegranate was completed within 70-80 DAG irrespective of treatments. However, tongue grafting gave poor graft success on different grafting dates as compared to wedge grafting. Even very high graft success (>

90%) with wedge grafting have been reported in fruit crops and proved to be very efficient method of grafting (Tabora and Atiednza 2006, Selvi *et al.* 2008, Somkumar *et al.* 2009). It is evidenced from the data that plant height and scion length were significantly influenced by different treatments at 3 and 6 months after grafting (Table 1). In general, wedge grafted plants of 15 December attained significantly higher plant and scion growth at 3 and 6 months. As far as leaf production/plant is concerned no clear cut response was recorded with respect to grafting method and time. But wedge grafting done on 15 and 30 December, 30 January and 15 February produced more number of leaves and almost similar trend was noticed with tongue grafting too.

The scion diameter at lower, middle and upper portion of the graft union indicated normal union in all the treatments. The diameter of graft union at lower and middle portion differed significantly at 3 and 6 months and their values ranged from 0.65-0.94 cm and 0.76-1.35 cm, respectively. A

Table 1 Effect of grafting method and time on scion sprouting, graft success, number of leaf, plant height and scion length (pooled data of two years)

| Treatment                      | Scion sprouting (%) |        | Graft success (%) | No. of leaf/plant* | Plant height (cm) |          | Scion length (cm) |          |
|--------------------------------|---------------------|--------|-------------------|--------------------|-------------------|----------|-------------------|----------|
|                                | 15 DAG              | 21 DAG |                   |                    | 90 DAG            | 3 months | 6 months          | 3 months |
| Wedge grafting on 15 December  | 76.67               | 90.00  | 62.5              | 252.87             | 61.93             | 85.33    | 46.23             | 62.87    |
| Wedge grafting on 30 December  | 12.50               | 22.33  | 30.83             | 198.87             | 55.47             | 82.47    | 36.97             | 53.88    |
| Wedge grafting on 15 January   | 15.00               | 54.17  | 44.17             | 161.67             | 46.23             | 76.07    | 37.23             | 53.00    |
| Wedge grafting on 30 January   | 90.00               | 96.67  | 85.83             | 248.13             | 55.49             | 67.43    | 40.24             | 52.31    |
| Wedge grafting on 15 February  | 18.33               | 31.67  | 52.50             | 259.00             | 47.33             | 56.33    | 40.40             | 49.50    |
| Tongue grafting on 15 December | 15.00               | 31.67  | 35.83             | 243.40             | 54.73             | 72.73    | 36.67             | 55.93    |
| Tongue grafting on 30 December | 20.83               | 35.00  | 27.50             | 208.55             | 55.49             | 72.29    | 40.24             | 53.00    |
| Tongue grafting on 15 January  | 14.17               | 30.83  | 35.00             | 210.00             | 45.01             | 53.43    | 34.42             | 48.00    |
| Tongue grafting on 30 January  | 72.50               | 75.83  | 60.83             | 159.00             | 46.81             | 56.67    | 37.17             | 41.09    |
| Tongue grafting on 15 February | 5.83                | 11.67  | 28.33             | 194.33             | 38.13             | 54.27    | 33.60             | 49.40    |
| CD (P=0.05)                    | 8.26                | 11.01  | 8.51              | 60.59              | 4.33              | 12.63    | 4.41              | 8.56     |

Table 2 Effect of grafting method and time on root parameters and biomass partitioning of one year old plants during 2008-09

| Treatments                     | No. of primary root/plant | Length of longest root (cm) | Primary root length (cm) | Scion dry weight (g) | Rootstock stem dry weight (g) | Root dry weight/plant (g) | Shoot dry weight/plant (g)* | Shoot/root ratio |
|--------------------------------|---------------------------|-----------------------------|--------------------------|----------------------|-------------------------------|---------------------------|-----------------------------|------------------|
| Wedge grafting on 15 December  | 30.47                     | 27.40                       | 19.40                    | 8.49                 | 4.24                          | 9.55                      | 12.73                       | 1.33             |
| Wedge grafting on 30 December  | 22.45                     | 30.47                       | 19.49                    | 8.90                 | 3.64                          | 8.41                      | 12.53                       | 1.49             |
| Wedge grafting on 15 January   | 20.27                     | 31.60                       | 18.36                    | 7.46                 | 3.51                          | 5.75                      | 10.98                       | 1.91             |
| Wedge grafting on 30 January   | 21.34                     | 26.87                       | 17.07                    | 8.14                 | 6.37                          | 11.91                     | 14.51                       | 1.24             |
| Wedge grafting on 15 February  | 20.00                     | 26.00                       | 13.04                    | 7.32                 | 5.16                          | 8.92                      | 12.48                       | 1.41             |
| Tongue grafting on 15 December | 16.53                     | 28.80                       | 19.15                    | 9.06                 | 4.47                          | 8.35                      | 13.53                       | 1.62             |
| Tongue grafting on 30 December | 20.06                     | 27.00                       | 16.56                    | 7.37                 | 4.57                          | 8.23                      | 11.95                       | 1.46             |
| Tongue grafting on 15 January  | 19.01                     | 22.80                       | 13.67                    | 6.37                 | 4.07                          | 6.91                      | 10.44                       | 1.6              |
| Tongue grafting on 30 January  | 16.32                     | 26.33                       | 18.24                    | 6.22                 | 4.41                          | 7.71                      | 10.63                       | 1.44             |
| Tongue grafting on 15 February | 18.24                     | 24.27                       | 13.33                    | 6.47                 | 4.65                          | 8.79                      | 11.12                       | 1.27             |
| CD (P=0.05)                    | 5.15                      | 4.23                        | 2.98                     | 1.37                 | 0.90                          | 2.11                      | 1.96                        | NS               |

critical observation of graft union revealed that the scion diameter at lower and upper portion of the union in various treatments was slightly thin than middle one (slightly swollen) owing to general healing phenomenon as noticed in woody perennials. Wedge grafting done on 30 January exhibited perfect and strong union in more than 80% grafts after 6 months of grafting as compared to 44% in tongue grafting, signify better scion-rootstock compatibility in wedge grafting.

Number of primary root, length of longest root and primary root length were significantly influenced by different treatments (Table 2). Primary root production was the highest (30.47) in plants grafted on 15 December by wedge grafting method. In general, wedge and tongue grafted plants of February month showed poor root development. However, when wedge grafting was done on 15, 30 December and 15 January produced longer tap root and primary roots owing to conducive environmental condition.

The dry weight of scion was found to be higher (8.14-9.06 g) in wedge grafted plants of December 15, 30 and January 30 and in tongue grafted plants of 15 December as compared to other treatments (Table 2). Interestingly, rootstock stem (6.37 g) and root dry weight (11.91 g) were significantly highest in wedge grafted plants of 30 January. However, the highest shoot dry matter production was recorded in wedge grafted plants of 30 January. Higher biomass production in wedge grafted plants of 30 January might be attributed to accumulation of more dry matter in root and shoot owing to better development of root and leaf in this treatment. Thus, from this study it may be concluded that wedge grafting in pomegranate can be done successfully in the last week of January under semi-arid conditions of Maharashtra.

#### SUMMARY

The experiment was conducted during 2007–08 and

2008–09 to standardize grafting methods and time in pomegranate. The scion sprouting was highest (96.67%) when wedge grafting done on 30 January at 21 days after grafting (DAG). Maximum graft success (85.83%) was recorded at 90 DAG with wedge grafting done on 30 January. The growth performance of wedge grafted plants was better with 15 December grafting. In general, the wedge grafted plants had better scion-rootstock compatibility than tongue grafting. Wedge grafting done on 30 January produced more shoot and root biomass owing to its better shoot and root development.

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