

## Research Article

# Performance of Grafts of Different Scion Varieties on Local Desi Rootstock of Mango (*Mangifera indica* L.) under Nursery Conditions

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**Abstract**

A field experiment was conducted at Punjab Agricultural University, Regional Research Station, Gurdaspur to study the "Performance of grafts of different scion varieties on the local desi rootstock of mango (*Mangifera indica* L.) under nursery conditions". Wedge grafting of different scion varieties was done in the end July to end-August by using different scion varieties viz. Rampur Gola, Chausa, Alphonso, Amrapali, Dusehri, Langra, Mallika, Benganpali, Malda and Totapari Red Small. The results of experiment revealed that an early initiation of sprouting of mango graft in 11-13 days was recorded with Dusehri scion followed by Amrapali and Langra scions. Grafting success (95.54%), survival (90.00%), scion growth (35.54cm), scion girth (15.95mm), number of leaves (24.50), primary root length (24.25cm), number of roots (42.35), primary root diameter (9.50mm), shoot fresh weight (25.35gm), shoot dry weight (9.25gm), root fresh weight (18.50gm) and root dry weight (12.52gm) were higher in Dusehri graft followed by Amrapali and Langra scion grafts. Rate of vegetative growth of grafted plants was excellent in Dusehri scion grafts. There was no incidence of nursery level mango malformation disease reported in all the scion grafts.

**Keywords:** Grafts, Mango, Rootstock, Scion, Wedge grafting

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Email: sukhi.rose@gmail.com,  
sukhi.rose@pau.edu**Introduction**

Mango (*Mangifera indica* L.) is an important fruit crop of India belongs to family Anacardiaceae and rightly known as the "King" of fruits owing to its attractive colour, excellent taste, exotic flavour, exemplary nutritive value and its delicacy for the table of rich as well as food for millions of poor people during summer. It is a tropical fruit originated from Indo-Burma region and grown almost all part of the world. In India, it is cultivated at sub-continent for well over 4000 years. [1] reported that mango genus *Mangifera* had its origin in the continental region of Burma, Thailand, Indo-China and Malaysia peninsula. Mango possessing the important position in tropical and subtropical region, between 23°North and South latitude. This fruit crop is widely grown in subtropical and tropical regions. India is the largest producer of mango and occupying an area of 2516 thousand hectares with an annual production of 18431.3 thousand metric tons [2]. It is extensively cultivated in Punjab, Haryana, Uttar Pradesh, Gujarat, Rajasthan, West Bengal, Maharashtra, Orissa, Andhra Pradesh, Karnataka and Tamil Nadu states of India.

In Punjab, it is mainly growing in submontaneous zones with an area of 6744 hectares with 119322 metric tonnes production [3]. Mango fruit contains 0.6% protein, fair amount of carbohydrates (11.8%), minerals like calcium, phosphorous and iron (0.3%). Its fruit is richest source of vitamin A (4800units), B<sub>1</sub>&B<sub>2</sub> (90mg) and vitamin C (13mg) per 100gm of pulp. Mango fruit is consumed at all its developmental stages [3].

Brined raw mango slices, various types of pickles and chutneys are the major products commonly made from raw mango[4]. Canned slices, beverages, fruit bars, nectars, syrups and aseptically packed pulp are the important processed products of ripe mango fruits [5]. Currently, various forms of mango products have good export market in South-East-Asia, Europe and USA. Raw tender mango is best suited for pickle production due to its high acidity, texture and characteristic typical mango flavour. Several formulated recipes with diversified taste, flavour, aroma and texture have been developed in India both for domestic and international markets.

Mango plants can be raised from seed (sexual method) or propagated vegetatively (asexual method).Mango propagation from seed, though easy and cheap, is unable to perpetuate characters of the parent tree, because most commercial varieties in India are cross-pollinated and monoembryonic. Such plants are not uniform in growth, yield

and fruit quality and it has long juvenile phase in comparison to vegetatively propagated fruit crops. Seed propagated plant also take more time to bear fruit. In case of asexual method, propagation is brought by the plant parts. The asexually or vegetatively propagated fruit plants are true to type, uniform in growth and fruit quality and take lesser time for fruiting.

In Punjab, mango is mostly propagated by vegetative method *viz.* side grafting and wedge grafting for commercial plantation which are more efficient and cheaper methods as compared to other methods of vegetative propagation. Propagation via wedge grafting technique of mango, the plants are ready for planting in about six months as compared to one year in side grafting technique. The performance of a compound horticultural tree is determined by both rootstock and the scion [6]. Most of the mango trees are grown in a commercial orchard or in kitchen garden usually grafted trees, each tree is made up of two parts; the rootstock, providing root system and the scion forming the tree canopy. Both of these parts play an equally vital role in the life of a tree. Grafting is a common and preferred vegetative propagation method for mango trees [7]. Furthermore, proper alignment of scion and rootstock cambium tissues could determine the graft success [8]. The rootstock has great influence on the vigour, longevity and productivity of the scion variety. Even the quality and composition of fruits also have been affected by it. A stock is called “seedling root stock” if it is grown from seed and “clonal roots stock” if it is grown from vegetative propagation. The present experiment was planned to study the grafting success of different scion varieties on the local desi variety of mango under nursery conditions.

## Materials and Methods

The present investigation on “Performance of different scion varieties on the local desi rootstock of mango under nursery conditions” was conducted at Punjab Agricultural University, Regional Research Station, Gurdaspur during the years 2014-15 and 2015-16.

### *Raising of rootstock*

To raise the rootstock nursery, fully riped desi mango fruits/stones were collected from disease free, healthy, well managed and actively growing mango trees of the adjoining areas of Gurdaspur and Pathankot districts in the month of July-August. The local rootstocks were sourced from one of the prominent model farmers in the area who managed them with recommended cultural practices. Local varieties are normally preferred as rootstocks because of their resistance to diseases and adaptability to local environmental conditions. Collected stones were washed with fresh water and treated with carbendazim 10gram in 10 litres of water. After drying, stones were sown in raised beds at 10cm×5cm spacing in vertical position in the month of August. These stones were germinated in 2-3 weeks and after germination, these seedlings along with stones were transplanted to the nursery beds when their leaves are brown in colour and expanded to one fourth of their normal size. At the time of transplanting, the tap roots of these seedlings were pruned by retaining most of the fibrous roots. These transplanted seedlings were regularly watered and protected from the frost during winter season. Seedlings resumed growth in the end of February or beginning of March and became graftable from March onwards.

### *Grafting technique*

Full grown one year old mango seedlings were grafted with wedge grafting in the end July to end-August by using different scion cultivars *viz.* Rampur Gola, Chausa, Alphonso, Amrapali, Dusehri, Langra, Mallika, Benganpali, Malda and Totapari Red Small. Three to four months old healthy scion sticks were selected and defoliated it about 7-10 days before grafting operation. Rootstock cut off just above the active growing point by keeping 3-4 leaves and make a 3-4 cm deep cut on the top of the rootstock. A wedge shape cut was made on the bottom of approximate 7.5 cm long scion stick, so that it can fit properly in the cut made on the rootstock. Scion stick was inserted into the cut portion of the rootstock and wrapped the graft firmly with plastic strip. New shoots from the graft union were regularly removed. The experiment was laid out in Randomized Block Design with 30 treatment combinations. All treatments were replicated thrice. Data was recorded on days taken for first sprouting, success (%), survival (%), scion girth (mm), scion growth (cm), number of leaves, primary root length (cm), number of roots, girth of primary root (mm), shoot fresh weight (gm), shoot dry weight (gm), root fresh weight (gm), root dry weight (gm), rate of

vegetative growth and malformation disease (%) of grafts were recorded and subjected to statistical analysis. The experimental data was analyzed with Randomized Block Design as described by [9].

## Results and Discussion

### *Days Taken to Bud Sprout and Success*

The varieties showed differences in time of first bud appearance. The highest level of sprouting (bud appearance) in all the scion varieties was observed between 11 to 26 days after grafting. Early initiation of sprouting of graft in 11-13 days was noticed in Dusehri grafts, it was par with Amrapali grafts (12-14days). Dusehri scion was also found better with respect to higher sprouting percentage (95.54%) (**Table1**) followed by Amrapali (88.72%) and Langra (84.75%) scion grafts. It might be due to vigorous growth nature in Dusehri. Wide variation in initiation of sprouting and sprouting percentage were observed in different scions due to its heterozygous nature. [10,11] in mango and [12] in cashew and [13] in citrus also observed similar results with respect to early sprouting and higher success percentage in their study. Hormonal imbalance between stocks and scion are involved in graft incompatibility. Phenolic compounds like flavonoids in the plant are also known to inhibit callus formation and growth. Callus growth is a prerequisite for union healing and graft establishment. The maximum number of grafts established at one month after grafting and its percentage were reported in Amrapali variety of mango as scion [14]. Thus present studies confirm the existence of genotypic differences. This type of results were previously noted by [15] and [16] and observed wide variation in sprouting percentage with different varieties of mango. An early initiation of sprouting in Langra was noted by [17].

**Table 1** Effect of different scion grafts on days to sprout, success, survival, scion girth, scion growth, number of leaves, primary root length and number of roots

| Scion variety      | Days to sprout | Success (%) | Survival (%) | Scion girth (mm) | Scion growth/length (cm) | Number of leaves | Primary root length(cm) | Number of secondary roots |
|--------------------|----------------|-------------|--------------|------------------|--------------------------|------------------|-------------------------|---------------------------|
| Rampur Gola        | 22-24          | 60.25       | 55.18        | 10.15            | 22.75                    | 13.00            | 13.25                   | 18.24                     |
| Chausa             | 17-19          | 74.65       | 70.00        | 11.25            | 23.86                    | 16.25            | 15.52                   | 23.36                     |
| Alphonso           | 16-18          | 82.50       | 75.35        | 11.35            | 24.25                    | 18.16            | 16.45                   | 25.46                     |
| Amrapali           | 12-14          | 88.72       | 82.22        | 13.50            | 30.35                    | 21.00            | 20.15                   | 35.55                     |
| Dusehri            | 11-13          | 95.54       | 90.00        | 15.95            | 35.54                    | 24.50            | 24.25                   | 42.35                     |
| Langra             | 15-17          | 84.75       | 80.50        | 12.65            | 26.00                    | 19.50            | 17.35                   | 28.16                     |
| Mallika            | 20-22          | 70.00       | 68.75        | 10.75            | 23.50                    | 15.30            | 15.12                   | 20.00                     |
| Beganpalli         | 21-23          | 66.56       | 62.50        | 10.50            | 23.00                    | 14.00            | 14.00                   | 19.12                     |
| Malda              | 24-26          | 44.45       | 40.45        | 9.75             | 20.50                    | 9.50             | 12.50                   | 16.15                     |
| Totapari Red Small | 23-25          | 50.00       | 45.75        | 10.00            | 21.15                    | 12.45            | 13.00                   | 17.00                     |
| CD(5%)             | -              | 5.02        | 2.88         | 2.96             | 2.63                     | 2.44             | 2.74                    | 2.44                      |

### *Survival*

Among the different varieties, Dusehri grafts ranked first with higher survival percentage (90.00) followed by Amrapali (82.22) and Langra (80.50) grafts in present investigation (Table1). Various workers *viz.*, [14, 15, 18-22] recorded different percentage of success with different varieties of mango. Generally, the survival ratio is related to different aspects concerning plant growth phase, size and cut characteristics [23]. Adopting the same grafting method, the survival ratio may be differ in relation to both rootstock and scion [24].

### *Number of Leaves*

Regarding varieties of mango, number of leaves per graft was significantly affected with different varieties. More number of leaves per graft was recorded with Dusehri graft (24.50) and followed by Amrapali (21.00) and Langra

(19.50) grafts (Table1). Number of leaves was found non-significant in different mango varieties [14]. However, [25, 26] and [14, 27] also recorded more number of leaves per plant with different varieties of mango in their studies.

### **Scion Girth**

During growth of grafted scion, the girth of scion graft was varied significantly in different mango scion varieties in present study. However, maximum value of girth of grafted scion was noted with Dusehri scion (15.95mm) followed by Amrapali (13.50mm) and Langra (12.65mm)scions (Table1). Higher number of photo-synthetically functional leaves resulted in better girth of the scion. But [14, 20] reported non-significant differences with three scion varieties of mango.

### **Height of Graft / Scion Growth (Length)**

Regarding varieties of mango, maximum height of grafts was recorded with Dusehri (35.54cm) followed by Amrapali (30.35cm) and Langra scion (26.00cm). Least height (20.50cm) of graft was noted with Malda variety (Table1). Increase in the number of leaves was mainly due to corresponding increase in the scion growth. Varietal difference in response to height of grafts in wedge grafting may be due to variations in their genetical make up influencing histological and physiological development within the scion shoots of similar age and growth in different ways. [20, 28, 29] obtained maximum height of grafts in Langra, Dusehri and Mulgoa varieties of mango respectively. Various research workers observed varied growth pattern with different varieties of mango. It may be due to their genetical make up and environmental condition. Vegetative growth was observed excellent in Dusehri scion graft union as compared to rest of scions.

### **Shoot Weight (Fresh and Dry Weight)**

Shoot fresh weight (18.50gm) and dry weight (12.52gm) were significantly higher in Dusehri grafts followed by Amrapali and Langra grafts (Table 2). It may be due to better vegetative growth of Dusheri grafts. The result also indicates that higher vegetative growth makes significant contribution to dry weight of seedlings as supported by [30] in cashewnut.

**Table 2** Effect of different scion grafts on primary root diameter, shoot fresh and dry weight, root fresh and dry weight, rate of vegetative growth and mango malformation disease

| Scion variety      | Primary root girth (mm) | Shoot fresh weight (gm) | Shoot dry weight (gm) | Root fresh weight (gm) | Root dry weight (gm) | Rate of vegetative growth | Malformation disease (%) |
|--------------------|-------------------------|-------------------------|-----------------------|------------------------|----------------------|---------------------------|--------------------------|
| Rampur Gola        | 4.25                    | 17.70                   | 11.80                 | 14.00                  | 7.47                 | Good                      | Nil                      |
| Chausa             | 5.00                    | 20.00                   | 14.55                 | 15.52                  | 9.40                 | Good                      | Nil                      |
| Alphonso           | 5.23                    | 21.00                   | 15.84                 | 15.83                  | 9.63                 | Very Good                 | Nil                      |
| Amrapali           | 7.50                    | 21.50                   | 17.05                 | 16.68                  | 10.40                | Very good                 | Nil                      |
| Dusehri            | 9.50                    | 23.35                   | 19.25                 | 18.50                  | 12.52                | Excellent                 | Nil                      |
| Langra             | 6.00                    | 21.18                   | 16.57                 | 16.18                  | 10.00                | Very good                 | Nil                      |
| Mallika            | 4.85                    | 19.35                   | 14.30                 | 15.34                  | 8.45                 | Good                      | Nil                      |
| Beganpalli         | 5.50                    | 18.68                   | 13.50                 | 14.17                  | 8.20                 | Good                      | Nil                      |
| Malda              | 3.75                    | 15.60                   | 10.07                 | 12.50                  | 7.00                 | Good                      | Nil                      |
| Totapari Red Small | 4.11                    | 16.50                   | 10.83                 | 13.50                  | 7.15                 | Good                      | Nil                      |
| CD (5%)            | 2.01                    | 2.28                    | 2.77                  | 2.27                   | 2.53                 | -                         | -                        |

### **Root Number, Root Length, Root Girth and Root Weight (Fresh and Dry weight)**

Root number (42.35), root length (24.25cm), root girth (9.5mm), root fresh weight (25.35gm), root dry weight (12.52gm) were significantly higher in Dusehri grafts followed by Amrapali and Langra grafts (Tables 1 and 2). It may be due better plant vigour of Dusehri scion. Good plant vigour leads to proper development of root system of a plant. Similarly [31] reported that root growth parameters like root length and root diameter had significantly higher

positive relationship with vigour indices in mango. Minimum root number (15.60), root length (12.50cm), root girth (3.75mm), root fresh weight (12.50gm) and root dry weight (7.50gm) were observed in Malda graft union.

### ***Mango Malformation Disease***

There was no incidence of mango malformation disease at nursery level in all graft combinations (Table 2).

### **Conclusion**

The experiment clearly demonstrated that different scion grafts could influence the seedling growth of mango. It was concluded that Dusehri scion graft by wedge grafting from end July to end-August performed best in terms of early sprouting, grafting success, survival, scion girth, scion growth, number of leaves, tap root length, number of roots, primary root diameter, shoot fresh weight, shoot dry weight, root fresh weight, root dry weight and vegetative growth followed by Amrapali and Langra scion grafts.

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