



Evaluation of different grafting techniques in mango varieties

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Abstract

Asexual propagation methods for fruit plants can determine the quality and quantity of yield produce. Different asexual propagating methods are used with various positive and negative effects in raising mango cultivars. Here in present study we evaluation different grafting techniques for producing better quality mango (*mangifera indica*.) cultivars. The experimental was laid out in two factors Randomized Complete Block Design (RCBD) with mango varieties (langra, fajve, doseve, begam Pali and shani khuda) and two Grafted methods (Side grafting and T- Grafting) as factors. The results depicted that all parameter for growth and development in mango grafted plants were significantly affected during the experiment for instance variety langra (V1) and side grafting. Showed significant result for all parameter studied that maximum days to sprouting (23.29), Shoot length (8.55 cm) and No of buds (10.33) were recorded in plants treated with variety Langra (V1). T-grafting produces more days to sprouting (24.44), No of leaves (21.73), Shoot diameter (3.97 mm) and No of buds (11.66). It can be concluded from the present findings that the T-grafting can improve the days to sprouting, No of leaves, shoot length, shoot diameter and No of buds of variety Langra (V1) of Mango under the agro. Climatic condition of Malakand.

Keywords: Shoot diameter, side grafting, T-grafting

Introduction

Mango (*Mangifera indica* L.) belongs to the family Anacardiaceae, which occupied a preeminent place amongst the fruit crops grown in Pakistan. It is one of the most important and oldest cultivated fruit crops, have been grown in India for at least 4000 years ago [16]. It is now widely spread throughout the tropics and sub-tropics regions. At present at least 94 countries produces mango. After banana and citrus it is the third most important crop of the tropics. The fruit occupies an important socio-economic position in Pakistan and south-east Asian countries. Mango is a National fruit of Pakistan, India and Philippines and also known as “King of fruits” and is originated from Indo-Burma region [21] and grown almost all part of the world. Nutritionally mango is rich in vitamin A, almost as rich as butter [10] also it has fair amount of vitamin C. the carotenoid pigments, β carotene (pro vitamin A) increase with ripening, whereas, vitamin C registered a sharp fall on ripening [5, 17] has reported the presence of folic acid (vitamin B) in green mangoes to an extent of 3.6 $\mu\text{g}/100\text{g}$. Vitamin B1 (Thiamine) and vitamin B2 (Riboflavin) range between 35-63 μg and 37-73 $\mu\text{g}/100\text{g}$ on fresh weight respectively [12]. has reported the composition of mango viz., total soluble solid (12.9-20.8%), total sugar (10.0-17.3%), non-reducing sugar (7.27-12.35%) on fresh weight basis.

The mango fruits can be used in all the stages vice immature, mature and ripe, because of its excellent flavours, attractive colour, delicious taste and nutritive value. Young and unripe fruits used for culinary purposes as well as for preparing pickle, chutney and anchor because of their acidic taste and nature. The ripe fruits being used for desert and also used for preparing several products like syrup, nectars, jams, squashes, jellies, custard powder, baby food, toffee etc. Flowering in mango is preceded by the differentiation of the flower bud in the shoots which varies with variety and the area where it is grown. Period of differentiation is

reported to be October-December depending upon the climatic conditions [4]. Mango inflorescence also arise from axillary buds quite frequently. Panicle is much branched, which may be male and hermaphrodite (andromonoecies). Rain and high humidity during flowering and fruit development reduces fruit yield. It is grown widely in warm frost free climate with a well-drained soil, dry winter season and temperature ranging from 24-27°C and the annual rainfall 400-3600mm are favourable for good production. it does not do well beyond a pH of 7.5 [10] with optimum pH being 5.5-7.5. Mango is widely grown throughout the world in different countries like Pakistan, India, China, Indonesia, Philippines, Brazil, and Bangladesh. The farmers generally use seed for mango propagation. Varietal purity cannot be maintained in plants raised from seed. The plants take 8-10 years for fruiting and the canopy of the plant becomes large which covers larger area [18]. Mango can be propagated by both sexual and asexual (vegetative) methods but the vegetative method is desirable because it enables to retain the characteristics of the mother plant, to get flower and fruit earlier, to remain initially relatively smaller with the benefit of more plants accommodation per unit area and it gives earlier and much higher economic returns. The technique of grafting in mango was practiced in Pakistan since ancient times. Now various methods of propagation such as veneer grafting, epicotyl grafting and side grafting are being adopted with varying degree of success in different regions of Pakistan. However, stionic relationship is an important factor for successful graft production. Though inarching, veneer grafting, side and T-grafting methods are commonly followed. Side grafting, also known as Nakamura method, was formerly popular [13, 11]. This method is supposed to be highly effective in mild weather in the absence of strong winds, intense heat and heavy rain [19], and success has also varied (50-100%) with different cultivars [15].

Various factors influence the success and survivability of mango grafts such as varieties, time of grafting operation, grafting method, growing conditions of grafts, defoliation period of scion, age of the scion, leaf and node retention on rootstock etc. Time of grafting operation has a great influence on the success of grafting in mango [20]. The primary aim of grafting is to produce true to type plants. Other factors may include reducing disease incidence, imparting vigour or dwarfing effect and including earlier maturity.

2. Materials and Methods

The present investigation entitled "Evaluation of different grafting techniques in mango varieties" was conducted during the year 2017 at the Jabban Research farm Khyber Pakhtunkhwa. The details of the technical programmer of work i.e., the experimental details, location, and techniques used during the course of investigation are described in this chapter:

2.1 Experimental site

The Research field is located at 34.56 °N, 71.96 °E, at an altitude of 454 m above sea level in the Malakand valley. Malakand is located about 1437 km north of the Indian Ocean, 156 km from river Kabul, 96 km from river Swat and has semiarid climate. The research farm is irrigated by the Dargai canal from the river Swat. Soil texture is clay loam, low in organic matter (0.87%), extractable phosphorus (6.57 mg kg⁻¹), exchangeable potassium (121 mg kg⁻¹), and alkaline (pH 7-8.5) and is calcareous in nature. The climate of the area is semiarid where the mean annual rainfall ranges (400 to 500 mm), 60-70% rainfall occurs in summer, while the remaining 30-40% rainfall occurs in winter.

2.2 Selection and preparation of scion

The scions of different five varieties were selected from 19 years old trees of mango orchard existing at the Research Farm. One to two months old shoots of current year, free from pest and diseases were selected. The selected shoots were defoliated seven days prior to grafting. Defoliation was done by clipping off the leaf blades with sharp secateurs leaving the petioles (1 cm length) intact. The scion shoots were severed from the mother tree with a sharp cut in the morning hours on the day of grafting. The length of scion sticks was kept to 8.0 cm.

2.3 Side grafting

Sloping cut $\frac{3}{4}$ -inch to 1 inch long at the base of the scion was made. The cut surface of the scion was inserted against the cut surface of the rootstock. The scion in place using a rubber grafting strip, tape, or grafting twine was hold. The entire graft area was sealed with warm grafting wax or grafting paint. The rubber was removing shortly after the union has healed.

2.4 T-grafting

By means of a grafting knife, a T-shaped slit was made in the trunk. Then, using the tip of the knife, the slit was carefully opened (the bark flaps must not be torn) and the scion was slid in and down so that cambial contact between the scion and the rootstock was optimum. Once the scion was placed, the binding of the graft was done immediately

to prevent any risk of tissue oxidation.

2.5 Irrigation

Plants were watered immediately after planting. Irrigation was done at 4 days interval (except summer, at 1-2 days interval).

Factor and their levels

Factor A: Varieties Factor B: Application Methods

| | |
|------------------------------|--------------------------------|
| V ₁ : Langra | M ₁ : Side Grafting |
| V ₂ : Fajve | M ₂ : T-Grafting |
| V ₃ : Doseve | |
| V ₄ : Begam Pali | |
| V ₅ : Shani khuda | |

Treatments and Combination

The experiment was consisting of the following treatments.

| | | |
|--|--|---|
| T ₁ = V ₁ M ₁ | T ₅ = V ₃ M ₁ | T ₉ = V ₅ M ₁ |
| T ₂ = V ₁ M ₂ T | T ₆ = V ₃ M ₂ T | T ₁₀ = V ₅ M ₂ |
| T ₃ = V ₂ M ₁ | T ₇ = V ₄ M ₁ | |
| T ₄ = V ₂ M ₂ | T ₈ = V ₄ M ₂ | |

2.6 Data parameters

The data were recorded on the following parameters

2.7.1 Days taken for sprouting

The number of days was counted for sprouting of the grafts from the individual plant of each treatment and average numbers of days taken for sprouting were calculated.

2.7.2 Number of leaves produced per grafts

Number of leaves per plant was recorded on individual plant of each treatment and average numbers of leaves were calculated.

2.7.3 No of buds

The number of buds was counted from the individual plant of each treatment and average numbers of buds were calculated.

2.7.4 Shoot Length (cm)

The Shoot Length will be recorded from the selected plants and the average Shoot Length per plant will be calculated.

2.7.5 Shoot Diameter (cm)

The Shoot diameter will be recorded from the selected plants and the average Shoot diameter per plant will be calculated.

2.8 Statistical analysis

The experiment was laid out in Factorial Completely Randomized Design (FCRD). The data obtained on various characters under study were analyzed statistically by using the method of analysis of variance.

3. Results and Discussion

The theme of the present study was to investigate the effect of different grafting methods of different varieties on the mango propagation. The experiment was conducted in the horticulture e farm, in Jabban farm dargai. The results so far obtained on days to sprouting, number of leaves, shoot length, shoot diameter and number of buds are presented below.

3.1 Days to sprouting

The data regarding effect of different grafting methods on days to sprouting of different varieties on the mango are mentioned in Fig-1, while the Analysis of Variance (ANOVA) is presented in Fig-1. The analysis of variance showed that the various grafting methods and varieties had significant effect on days to sprouting of mango. While the interaction in grafting methods and varieties are showed non-significant result. The mean value of different grafting methods of mango showed that more number (24.44) of days to sprouting was produced by (M₂) and minimum number (19.4) of days to sprouting was noticed in (M₁).

Data recorded for varieties in mentioned in Fig-4.1, which shows that the maximum number (23.29) of days to sprouting were produced in (V₁). While the minimum number (20.45) of days to sprouting were produced in (V₅). The results in this study showed that side grafting took less days to sprouting which indicating the efficiency of this method. They concluded that side grafting is more appropriate then cleft grafting as it took less time for sprouting. The results are also in line who found that propagation rate was more successful in case of side grafting in mango plants

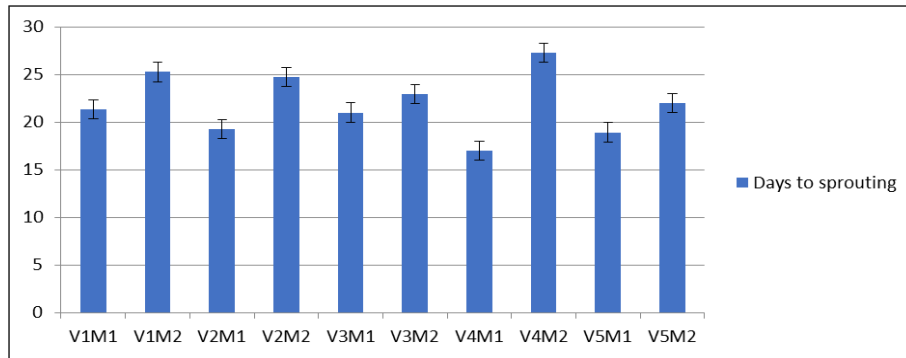


Fig 1: Effect of different grafting methods of different varieties on days to sprouting of mango (*Mangifera indica*L.).

3.2 Number of leaves

The data regarding effect of different grafting methods on No of leaves of different varieties of mango are mentioned in Fig-2, while the Analysis of Variance (ANOVA) is presented in Fig-2. The analysis of variance showed that the various grafting methods and varieties had significant effect on No of leaves of mango. While the interaction in grafting methods and varieties are showed also significant result. The mean value of different grafting methods of mango showed

That more number (21.73) of No of leaves was produced by (M₂) and minimum number (17.56) of No of leaves was noticed in (M₁). Data recorded for varieties in mentioned in Fig-4.2, which shows that the maximum number (27.74) of No of leaves were produced in (V₂). While the minimum number (14.16) of No of leaves were produced in (V₄). These results can be supported by the results of [9] who evaluated different grafting methods and found that side grafting causes more number of leaves and maximum leaf area when compared to top and cleft grafting.

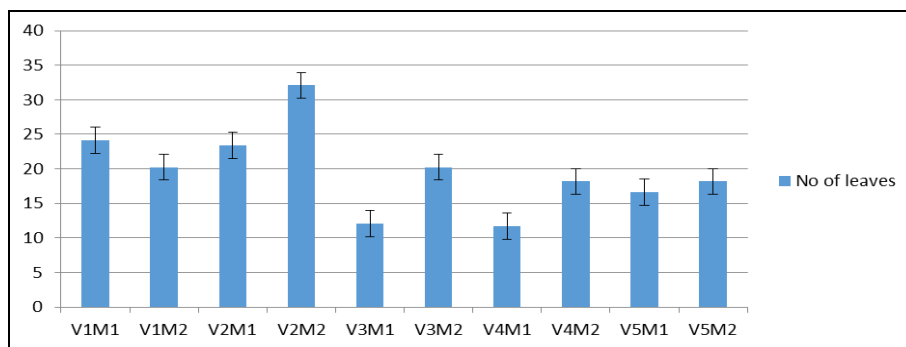


Fig 2: Effect of different grafting methods of different varieties on number of leaves of mango (*Mangifera indica*L.).

3.3 Shoot length

The data regarding effect of different grafting methods on shoot length of different varieties on the mango are mentioned in Fig-4.3, while the Analysis of Variance (ANOVA) is presented in Fig-3. The analysis of variance showed that the various grafting methods and varieties had significant effect on shoot length of mango. While the interaction in grafting methods and varieties are showed non-significant result. The mean value of different grafting methods of mango showed that more number (8.2) of shoot length was produced by (M₁) and minimum number (7.11)

of shoot length was noticed in (M₂). Data recorded for varieties in mentioned in Fig-4.3, which shows that the maximum number (8.55) of shoot length were produced in (V₁). While the minimum number (6.87) of shoot length were produced in (V₃). This result can be justify with the findings as compared different methods of vegetative propagation and found that side grafting method is producing significantly more shoot length as compared to rest of the methods. They reported that maximum shoot length was obtained when side grafting was done on mango plants.

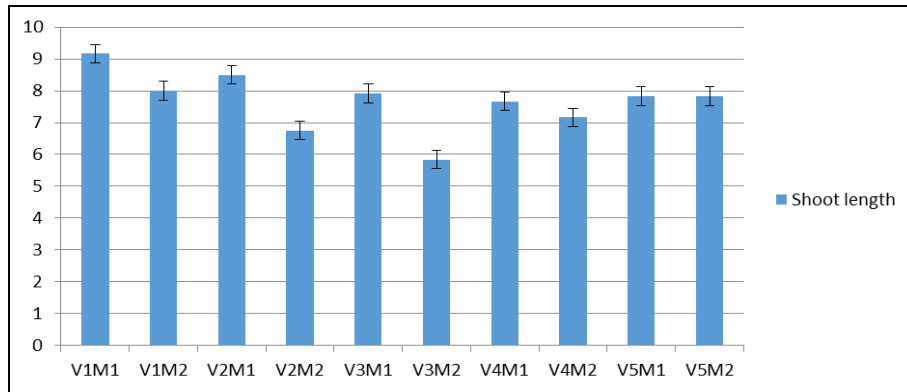


Fig 3: Effect of different grafting methods of different varieties on shoot length of mango (*Mangifera indica*L.).

3.4 Shoot diameter

The data regarding effect of different grafting methods on shoot diameter of different varieties on the mango are mentioned in Fig-4, while the Analysis of Variance (ANOVA) is presented in Fig-4. The analysis of variance showed that the various grafting methods and varieties had significant effect on shoot diameter of mango. While the interaction in grafting methods and varieties are showed

non-significant result. The mean value of different grafting methods of mango showed that more number (3.97) of shoot diameter was produced by (M₂) and minimum number (3.57) of shoot diameter was noticed in (M₁). Data recorded for varieties in mentioned in Fig-3, which shows that the maximum number (4.05) of shoot diameter were produced in (V₄). While the minimum number (3.33) of shoot diameter were produced in (V₃).

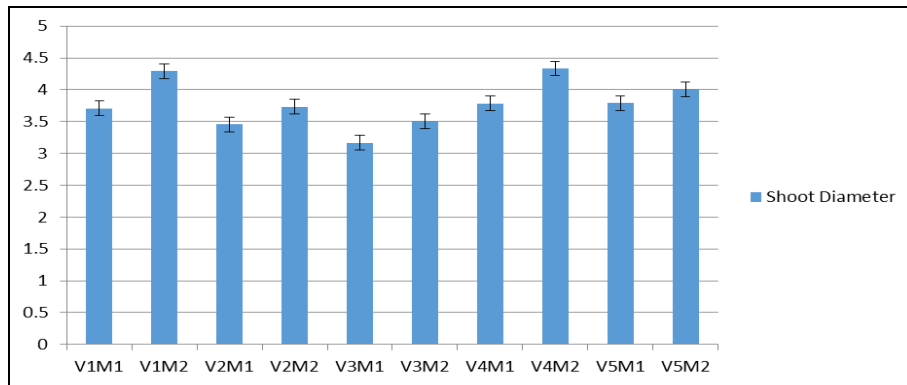


Fig 4: Effect of different grafting methods of different varieties on shoot diameter of mango (*Mangifera indica*L.).

3.5 No of buds

The data regarding effect of different grafting methods on number of buds of different varieties on the mango are mentioned in Fig-4.5, while the Analysis of Variance (ANOVA) is presented in Fig-5. The analysis of variance showed that the various grafting methods and varieties had significant effect on shoot diameter of mango. While the interaction in grafting methods and varieties are showed non-significant result. The mean value of different grafting methods of mango showed that more number (11.66) of number

of buds was produced by (M₂) and minimum number (9.41) of number of buds was noticed in (M₁). Data recorded for varieties in mentioned in Fig-4.3, which shows that the maximum number (10.33) of number of buds were produced in (V₁). While the minimum number (8.33) of number of buds were produced in (V₃). They conducted a study for the evaluation of best method for the propagation of fruit trees. They tested different methods of grafting and budding and found that among grafting the best results for all growth parameters including the number of buds were obtained in case of side grafting.

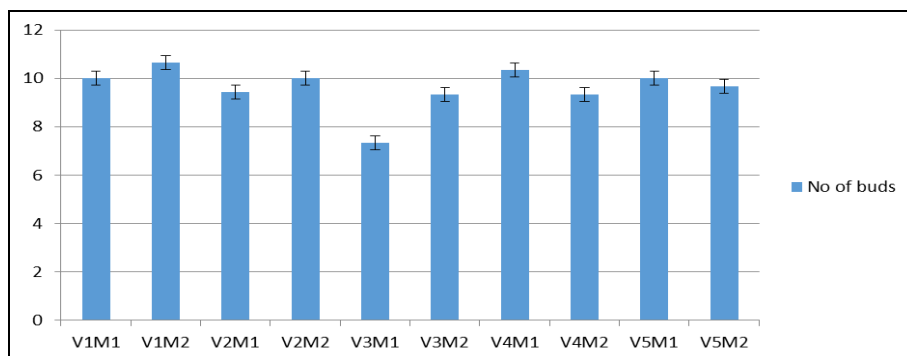


Fig 5: Effect of different grafting methods of different varieties on number of buds of mango (*Mangifera indica*L.).

4. Conclusion

Following conclusions were made from the findings of this research. T-grafting techniques are better performed than the Side grafting techniques in terms of increasing No of leaves, shoot diameter and No of buds of mango. Higher variety langa are better than the other varieties i.e (fajve, doseve, begam pali and shani khuda) of mango (*mangifera indica*). The present study considered that the T-grafting techniques in mango and variety langa are recommended for improving mango (*mangifera indica*.) No of leaves, shoot length, shoot diameter and No of buds.

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