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Study of standardization of grafting techniques in pomegranate (*Punica granatum* L.) in Northern Dry zone of Karnataka

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Abstract

Pomegranate is mainly propagated by air layering. Recently, wilt has emerged as a major threat to pomegranate in Maharashtra, Karnataka and Andhra Pradesh. Presently, neither any standard grafting techniques nor suitable rootstock is available by which the wilt problem could be controlled. With this background an investigation entitled “Study of Standardization of grafting techniques in pomegranate (*Punica granatum* L.) in Northern Dry Zone of Karnataka” was carried out at Main Horticultural Research and Extension Centre (MHREC), UHS, Bagalkot (Karnataka) during 2018- 2019.

The study included Twelve grafting techniques as treatments viz., T₁: softwood grafting on 15th June, T₂: softwood grafting on June 30, T₃: softwood grafting on 15th July, T₄: softwood grafting on 30th July, T₅: softwood grafting on 15th August, T₆: softwood grafting on 30th August, T₇: tongue grafting on 15th June, T₈: tongue grafting on 30th June, T₉: tongue grafting on 15th July, T₁₀: tongue grafting on 30th July, T₁₁: tongue grafting on 15th August, T₁₂: tongue grafting on 30th August. The results revealed that the treatment T₃ (softwood grafting on 15th July) proved to be the most effective in increasing sprouting percentage (58.33%) at 150 DAG, grafting success was 75% at 60 DAG, scion length was 57.00 cm at 150 DAG and plant height was 71.71 cm at 150 DAG. With respect to scion diameter T₄ recorded the maximum scion diameter 6.83 cm at 150 DAG. Number of leaves per graft was recorded maximum in T₆ (125.25) at 150 DAG. When compared between softwood and whip/tongue grafting method in Pomegranate, softwood grafting was more effective with respect to sprouting percentage, grafting success, shoot length and scion diameter.

Keywords: Softwood grafting, tongue grafting

Introduction

Pomegranate (*Punica granatum* L.) belongs to the family Lythraceae, with a chromosome number 2n=18. It is one of the ancient and highly praised favourite fruits. It is commonly called as “friendship fruit”. It is an important commercial fruit preferred by the consumer all over the world for its sweet- acidic taste, fine dessert quality and excellent blend. The fruit is also popular due to the organoleptic characteristics of the arils (i.e. the seeds), nutritional and therapeutic values for its usefulness in cancer, indigestion and leprosy cure. The total area under this fruit crop at present accounts to 2.34 lakh hectare with an annual production of 2865 thousand metric ton (NHB data 2018-19). Maharashtra is the leading producer of pomegranate in India which contributes more than 75% of the total area and production followed by Karnataka and Andhra Pradesh. Pomegranate is mainly propagated by air layering in Maharashtra. Recently, wilt has emerged as a major threat to the pomegranate industry in Maharashtra, Karnataka and Andhra Pradesh. Presently, neither any standard grafting techniques nor suitable rootstock is available by which the wilt problem could be controlled. However, Kar *et al.* (1989) ^[5] reported the possibility of top working in wild pomegranate using side veneer grafting. Looking into this whole issue, an attempt was made to evaluate the vegetative propagation of pomegranate by grafting (softwood and whip/tongue grafting).

Materials and Method

Experiment was conducted at Division of Fruit Science, MHREC, University of Horticultural Sciences, Udyanagiri, Bagalkot, which comes under Northern dry zones of Karnataka (zone 3) located at 16° 46 North latitude, 74°59 East longitude and at an altitude of 533 meters above the mean sea level. Two grafting method (softwood and tongue grafting) was used in the month of June, July and August at every fourth night interval.

The experiment was laid out in complete randomized block design with twelve treatments and three replications under shade net condition. Observation on sprouting percentage was recorded at 30, 60, 90, 120 and 150 days after grafting, grafting success percentage was recorded at 60 days after grafting and scion length was recorded at 30, 60, 90, 120 and 150 days after grafting. The data was statistically analyzed using Fischer's method of analysis of variance techniques.

Results

Among the different treatments, the maximum sprouting percentage (58.33%) was recorded in T₃ (softwood grafting on 15th July) at 150 DAG and minimum sprouting percentage (12.5%) was recorded in T₉ (whip and tongue grafting on 15th July) at 150 DAG (Table 1.)

With respect to grafting success, the maximum grafting success percentage (75%) was recorded in T₃ (softwood grafting on 15th July) at 60 days after grafting (Table 2). The minimum grafting success percentage (12.50%) was recorded in T₉ (whip and tongue grafting on 15th July) (Table 2.)

Shoot length (cm) was recorded max (57.00 cm) in T₃ at 150 DAG. However at 60 DAG, the maximum shoot length (25.66 cm) was recorded in T₅ (softwood grafting on 15th August). The minimum shoot length was recorded in treatments where whip and tongue grafting was done (Table 3.)

The maximum scion diameter (6.83 mm) was registered in T₄ (softwood grafting on 30th July) at 150 DAG and the minimum scion diameter (6.10 mm) was recorded in T₁₂ (whip and tongue grafting on 30th August) Table 4.

Discussion

Significantly, the maximum sprouting percentage (58.33%) (Table 1.) of pomegranate grafts was recorded in T₃ (softwood grafting) whereas in tongue and whip grafting lesser sprouting was recorded (12.5%) after 150 DAG. The results indicate that both the method and season had profound effect on sprouting percentage of pomegranate grafts. This could be attributed to high humidity and high temperature prevailed during this period. The high temperature and high humidity had profound effect on graft intake (Hartman and Kester, 1986) [3]. The results of present investigation are supported by Patil *et al.* (2010) [10], Sonawane *et al.* (2012) [11] and the reason for lower sprouting percentage in tongue and whip grafting might be due to the fact that scion and stocks

are not interlocked properly resulting in less intimate contact of both scion and stock resulting in no callus formations. Similar result was reported by Hussain *et al.* (2016) [4].

Grafting success (%) was significantly influenced by the grafting methods (Table 2). The maximum grafting success (%) was recorded in T₃ (75%) when softwood grafting method was practiced. Whereas minimum grafting success (%) was recorded in T₉ (12.50%) when whip and tongue grafting was practiced. It is due to the optimum temperature and relative humidity, which are the two major factors which plays a greater role in the grafts union formation. Higher humidity prevents scion from desiccation and thus helps in maintaining cell turgidity and help in quick callus formation between stock and scion during July month. Similarly Ghosh *et al.* (2010) [2] noticed, higher grafts success during July (72%) in softwood grafting in sapota, Nitish *et al.* (2019) [9] also observed higher grafting success percentage in the month of July (80.00%) in softwood grafting, Patil *et al.* (2010) [10] recorded the highest grafting success (63.33%) in softwood grafted plants in sapota.

Significant increase in shoot length (cm) was recorded in T₃ (57.00) at 150 DAG and minimum shoot length was recorded in T₁₁ (45.16). It is evident from (Table 3.) that softwood grafted plants gave maximum shoot length compare to whip/tongue grafted plants. It might be due to higher humidity and higher temperature inside the shade net which leads to higher metabolic activity of cells which leads to extension of growth of scion. These findings are correlated to the findings of Sonawane *et al.* (2012) [11] in carambola, Nitish *et al.* (2019) [9] in sapota, Patil *et al.* (2010) [10] in sapota where they reported the maximum scion growth in softwood grafting done in July month.

It is clear that softwood grafting gave highest scion diameter (6.83 cm) (Table 4.) compared to tongue and whip grafting (6.10 cm) this might be due to higher carbohydrates accumulation due to early growth, more number of leaves in softwood grafted plants. And during July month temperature and humidity was also favourable for the grafts to grow. This result is in conformity with the findings of Patel *et al.* (2010) [10] in mandarin where they recorded the maximum scion diameter in softwood grafted plants during July month. Similarly, Hussain *et al.* (2016) [4] in chestnut reported that scion diameter was minimum for tongue and whip grafting.

Table 1: Effect of grafting on sprouting percentage (%) at different days after grafting

Treatment	Sprouting percentage (%) at DAG				
	30	60	90	120	150
T ₁	25.00 (30.00)	33.33 (35.17)	29.17 (32.59)	29.16 (32.59)	25.00 (29.49)
T ₂	33.33 (35.17)	33.33 (35.17)	33.33 (35.17)	33.33 (35.17)	33.33 (35.17)
T ₃	54.17 (47.41)	75.00 (60.54)	62.50 (52.24)	58.33 (49.82)	58.33 (49.83)
T ₄	12.50 (20.70)	25.00 (30.00)	25.00 (30.00)	25.00 (30.00)	25.00 (30.00)
T ₅	37.50 (37.76)	37.50 (37.76)	37.50 (37.76)	37.50 (37.76)	37.50 (37.76)
T ₆	50.00 (45.00)	54.17 (47.41)	50.00 (45.00)	45.83 (42.58)	45.83 (42.59)
T ₇	0.00	0.00	0.00	0.00	0.00
T ₈	0.00	0.00	0.00	0.00	0.00
T ₉	16.67 (23.80)	12.50 (20.70)	12.50 (20.70)	12.50 (20.70)	12.50 (20.70)
T ₁₀	0.00	0.00	0.00	0.00	0.00
T ₁₁	41.67 (40.17)	54.17 (47.41)	54.17 (47.41)	54.16 (47.41)	54.17 (47.47)
T ₁₂	41.67 (40.17)	37.50 (37.76)	33.33 (35.17)	33.33 (35.17)	33.33 (35.17)
S.Em±	1.43	2.12	1.84	1.80	2.13
CD 5%	4.18	6.22	5.39	5.27	6.25

Table 2: Grafting success at 60 DAG

Treatment	Grafting success (%)
T ₁ : softwood grafting on June-15	33.33 (35.17)
T ₂ : softwood grafting on June-30	33.33 (35.17)
T ₃ : softwood grafting on July-15	75.00 (60.54)
T ₄ : softwood grafting on July-30	25.00 (30.00)
T ₅ : softwood grafting on August-15	37.50 (37.76)
T ₆ : softwood grafting on August-30	54.17(47.41)
T ₇ : whip and tongue grafting on June-15	0.00 (0.00)
T ₈ : whip and tongue grafting on June-30	0.00 (0.00)
T ₉ : whip and tongue grafting on July-15	12.50 (20.70)
T ₁₀ : whip and tongue grafting on July-30	0.00 (0.00)
T ₁₁ : whip and tongue grafting on August-15	54.17 (47.41)
T ₁₂ : whip and tongue grafting on August-30	37.50 (37.76)
S. E m±	2.12
CD 5%	6.22

Values in the parenthesis are arcsine value

DAG - Days after grafting

Table 3: Effect of grafting on shoot length at different DAG

Treatment	Shoot Length (cm) at DAG				
	30	60	90	120	150
T ₁	16.62	21.01	33.43	39.34	48.15
T ₂	15.36	19.81	30.73	39.66	49.15
T ₃	17.58	21.50	41.51	45.20	57.00
T ₄	17.30	21.25	29.85	36.18	52.53
T ₅	12.78	25.66	28.09	34.16	45.22
T ₆	15.76	22.42	28.59	44.62	50.76
T ₇	0.00	0.00	0.00	0.00	0.00
T ₈	0.00	0.00	0.00	0.00	0.00
T ₉	12.73	18.53	27.00	31.80	43.07
T ₁₀	0.00	0.00	0.00	0.00	0.00
T ₁₁	9.93	20.82	29.87	36.24	45.16
T ₁₂	15.73	20.75	25.66	35.23	48.85
S. E m±	0.70	1.00	1.28	2.16	2.25
CD 5%	2.07	2.93	3.76	6.34	6.59

DAG - Days after grafting

Table 4: Effect of grafting on scion diameter at different days after grafting

Treatments	Scion diameter (mm) at DAG				
	30	60	90	120	150
T ₁	5.63	5.83	6.07	6.33	6.45
T ₂	5.72	6.09	6.33	6.46	6.77
T ₃	6.18	6.22	6.29	6.47	6.56
T ₄	6.74	6.38	6.45	6.82	6.83
T ₅	5.66	5.93	6.29	6.44	6.66
T ₆	5.69	5.78	5.98	6.16	6.23
T ₇	0.00	0.00	0.00	0.00	0.00
T ₈	0.00	0.00	0.00	0.00	0.00
T ₉	6.08	6.19	6.27	6.38	6.47
T ₁₀	0.00	0.00	0.00	0.00	0.00
T ₁₁	5.54	5.74	5.80	6.02	6.42
T ₁₂	5.58	5.48	6.06	6.03	6.10
S. E m±	0.13	0.19	0.07	0.10	0.11
CD 5%	0.38	0.55	0.19	0.30	0.32

DAG - Days after grafting

Conclusion

The present findings indicated that grafting could be practiced for pomegranate propagation. With respect to all the parameters studied, it can be concluded that the softwood grafting performed on 15th July gave the best result under shade net condition, Hence, softwood grafting can be used as commercial method of propagation by utilising the rootstocks resistant to wilt and other important diseases like pomegranate wilt.

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