International Journal of Agricultural Sciences ☞ DOI:10.15740/HAS/IJAS/17-AAEBSSD/204-209
Volume 17 | AAEBSSD | 2021 | 204-209 ■ ISSN : 0973-130X Visit us : www.researchjournal.co.in

RESEARCH PAPER

Effect of scion age and kinetin on success rate of softwood grafting in mango cv. Kesar

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Abstract : The present investigation entitled "effect of scion age and kinetin on success rate of softwood grafting in mango cv. kesar" was carried out at Hi-Tech Horticulture Park, Department of Horticulture, Junagadh Agricultural University, Junagadh during the year 2020-21. The treatments comprised of eight level of scion age (S) *viz*., S_1 = 90-100 day old scion, S_2 =100-110 day old scion,S_3 = 110-120 day old scion,S_4 =120-130 day old scion,S_5 =130-140 day old scion,S_6 = 140-150 day old scion,S_7 = 150-160 day old scion,S_8 = 160 -170 day old scion and three level of kinetin (K) *viz*., K_1 = kinetin 200 ppm, K_2 = kinetin 250 ppm, K_3 = kinetin 300 ppm. The experiment was laid out in Completely Randomized Design (CRD) with Factorial concept comprising twenty four treatment combinations with three replications. The result indicated that among scion age minimum number of days required for emergence of sprout (11.04) was recorded in S_8 with highest success rate (77.00, 75.81, 75.81 and 75.81 %) were recorded, respectively, at 30, 60, 90 and 120 DAG in S_5, minimum mortality (16.08, 24.19, 24.19 and 24.19 %) were recorded in S_5 at 30, 60, 90 and 120 DAG, respectively. Maximum survival (83.92, 75.81, 75.81 and 75.81 %) were recorded in S_5 at 30, 60, 90 and 120 DAG, respectively.

Key Words : Mango, Softwood grafting, Scion age, Kinetin

View Point Article : Kumawat, Shankar Lal, Karetha, K.M., Jangid, Rakesh and Solanki, Dhirender P.S. (2021). Effect of scion age and kinetin on success rate of softwood grafting in mango cv. Kesar. *Internat. J. agric. Sci.*, **17** (AAEBSSD) : 204-209, **DOI:10.15740/HAS/IJAS/17-AAEBSSD/204-209.**

Article History : Received : 21.07.2021; **Revised :** 25.07.2021; **Accepted :** 01.08.2021

INTRODUCTION

Mango (*Mangifera indica* L.) is the most popular fruit crop in the orient particularly in India, where it is considered as the best choice among all indigenous fruits. Mango is the most important commercially grown fruit crop. In India it's tropical and sub- tropical region and ever-green fruit crop which is considered as national fruit. It belongs to the botanical family Anacardiaceae and is origin of Indo- Burma region. Mango is claimed to be the most important tropical fruit and has been thought as 'king of all fruits' because of its attractive appearance and owing to its taste, attractive aroma and captivating flavor the very pleasant taste. The fruit is consumed as raw for pickle purpose or ripe fruit as dessert purpose. Good mango cultivars contain 20 per cent of total soluble solids content. It is an important fruit for fresh consumption as well as input for processing industries. Ripe mangoes contain moderate level of vitamin C, are

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rich in vitamin A, vitamins B_1 and B_2 and many essential minerals (Mukherjee and Litz, 2009). The protein content is generally a little higher than that of other fruits except the avocado. Mangoes are also a fairly good source of thiamine and niacin and contain some calcium and iron (Griesbach, 2003). It's excellent delicious taste and nutritive value.

Mango cultivars are classified into two types: monoembryonic and polyembryonic. Monoembryony seed is the emergence of one and only one seedling from a seed. The former when propagated from seed do not come true to type, whereas the latter breeds true. Furthermore, the most important cultivars of mango in the world are monoembryonic. Polyembryonic mango varieties, produce two or more plants of nucellar origin from single seed (Maheshwari and Rangaswamy, 1966). Hence, there is an urgent need to propagate them vegetatively (Majumder, 1988).Grafted mango plants are take a shorter time to start flowering and produce fruits. More plants can be accommodated per unit of land as trees grafted on a dwarfing rootstock grow less vigorously. Given the many mango varieties available, farmers have good opportunities to graft desired varieties with great market and domestic consumption potential. With more advantages of softwood grafting over traditionally practiced inarch grafting, it necessitates to replace inarch grafting with softwood grafting and it is the most popular method in mango which can be standardized commercially with suitable season for every part of the country. So, farmers get the trust worthy true-to-type elite planting materials in very affordable rates in short duration (Majumder, 1988).

Plant growth regulators are the most important factors for successful plant regeneration. In tissue culture, cytokinins play a crucial role as promoters of cell division and act in the induction and development of meristematic centers leading to the formation of organs, mainly shoots (Peeters*et al*., 1991). The success of a graft union is dependent on the formation of a callus bridge between the cut surfaces of the scion and stock, followed by the formation of a working vascular cylinder linking the scion and stock (Mathad*et al.,* 1991). However there has been kinetin application in mango grafts. Thus, the present investigation "Effect of scion age and kinetin on success rate of softwood grafting in mango cv. Kesar" was carried out to find out the best scion age and kinetin treatment to increase the success rate of softwood grafting in mango.

MATERIAL AND METHODS

The present investigation was carried out at Hi-Tech Horticulture Park, Department of Horticulture, JAU, Junagadh during the year 2020-21. The treatments comprised of eight level of scion age (S) *viz*., S_1 = 90-100 day old scion, S_2 =100-110 day old scion, S_3 = 110-120 day old scion, S_4 =120-130 day old scion, S_5 =130-140 day old scion, S_6 = 140-150 day old scion, S_7 = 150-160 day old scion, S_8 = 160 -170 day old scion and three level of kinetin (K) *viz*., K_1 = kinetin 200 ppm, K_2 = kinetin 250 ppm, K_3 = kinetin 300 ppm. The experiment was laid out in Completely Randomized Design (CRD) with Factorial concept comprising twenty four treatment combinations with three replications. Junagadh is situated in South Saurashtra Agro-climatic region of Gujarat state. Geographically, this place is situated at 21.5p N latitude and 70.5p E longitude with an altitude of 60 meters above the mean sea level and 75- 85kilometers away from Arabian Sea Coast on western side at the foothill of the mount Girnar. The grafting operation was done on 3 month old mango (cv. Rajapuri) rootstock seedlings.

Tagging of scion on mother tree:

We selected new branches on the tree for tagging. Tagging of scion was done on 16th March to 25th march for 160 -170 days old scion, 26th March to4thApril for 150-160days old scion, 5th April to 14th April for 140-150 days old scion, 15th April to 24th April for 130-0140 days old scion, 25th April to 4th May for 120-130 days old scion, 5th May to 14thMay for 110-120days old scion, 15th May to 24th May for 100-110 days old scion and 25thMay to 3th Jun for 90-100 days old scion Non-flowered terminal or lateral shoots with pencil thickness, greenish brown coloured mature and healthy scions were collected from Kesar variety of mango trees at Fruit Research Station, Sakkarbaug.Department of Horticulture. JAU, Junagadh. Defoliation of scion on mother tree was done at 8-10 days prior to grafting. The petiole stubs dried up and dropped off when touched leaving a healed scar of defoliated scion sticks at this stage indicated that scion was ready for grafting. Unsprouted scion sticks with well-developed buds were detached from the selected mother tree in the morning on the day of grafting.

Method of softwood grafting:

Rootstock was headed at around 40 cm height from ground. A 4- 5 cm vertical cut was given in the centre of headed seedling to insert scion. Slant cut is given in both

the sides of lower part of scion stick to make V- wedge shaped end which can fit into the slit made in rootstock. The cut was made before dipping in the kinetin. The scion stick was inserted into the vertical slit. The graft union should be as close as possible to ensure that the cambium layers of stock and scion were in perfect contact with each other. Then the graft union was tied tightly with the plastic wrapping film. The grafted plants were kept open field.

Observations recorded:

The observations taken were *viz.,* Days required for emergence of sprout (Days), Success rate (%), Mortality (%) and Survival percentage (%). Except for days required for emergence of sprout, all other parameters were recorded at 30, 60, 90 and 120 DAG. Various characters under study were statistically analyzed by using analysis of variance technique for Completely Randomized Design (CRD) with Factorial concept as described by Panse and Sukhatme (1985). Success rate, mortality and survival percentage were calculated by following formula:

$$\text{Success rate} = \frac{\text{No. of grafts sprouted}}{\text{No. of total plants grafted}} \times 100$$

$$\text{Mortality} = \frac{\text{No. of failed grafts}}{\text{No. of total plants grafted}} \times 100$$

$$\text{Survival percentage} = \frac{\text{No. of grafts remained alive}}{\text{Number of total plants grafted}} \times 100$$

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Days required for emergence of sprout (Days):

The result indicates that the number of days required for emergence of sprout were significantly minimum number of days required for emergence of sprout (11.04) was noted in S_8 (160-170 day old scion) which was at par with S_3.While maximum number of days required for emergence of sprout (14.62) was noted in S_5 (130-140 day old scion). Which is early emergence of sprout is an important character which positively coincides. Early emergence of sprout in scion age could be due to abundant accumulation of carbohydrates and other food material after defoliation. Easily uptake nutrient could have induced early sprout emergence in the grafts. These results are similar obtained by Ghule*et al.* (2017), in guava. Bodkhe and Rajput (2010) in jamun, Savani (2009) in mango

Dipping of scion in kinetin solution has also

Table 1: Effect of scion age and kinetin on number of days taken for emergence of sprout and success rate (%) of soft wood grafting in mango cv. kesar

Sr. No.	Treatments	Days taken for emergence of sprout	Success rate			
			30 DAG	60 DAG	90 DAG	120 DAG
A. Age of scion						
S_1	90-100 day old scion	13.87	54.87	43.60	38.21	32.86
S_2	100-110 day old scion	13.91	50.30	44.70	37.80	30.90
S_3	110-120 day old scion	13.18	45.80	38.63	33.15	29.42
S_4	120-130 day old scion	13.83	58.14	50.99	47.06	40.67
S_5	130-140 day old scion	14.62	77.00	75.81	75.81	75.81
S_6	140-150 day old scion	13.96	59.98	52.42	45.90	38.99
S_7	150-160 day old scion	14.00	55.47	54.14	53.63	48.41
S_8	160-170 day old scion	11.04	63.27	53.35	46.83	28.88
S.Em. +		0.32	1.56	1.16	1.58	1.73
C.D. at 5 %		0.91	4.45	3.31	4.49	4.91
B. Kinetin						
K_1	Kinetin 200 ppm	13.59	58.98	51.45	47.45	42.13
K_2	Kinetin 250 ppm	13.17	60.56	53.15	48.53	44.78
K_3	Kinetin 300 ppm	13.89	54.27	51.01	45.84	38.31
S.Em. +		0.20	0.96	0.71	0.97	1.06
C.D. at 5 %		0.56	2.73	2.02	2.75	3.01

significantly decreased the minimum number of days required for emergence of sprout (13.17) were taken for sprout emergence in scions treated with K_2 (kinetin 250 ppm)which was at par with K_1 (Kinetin 200 ppm) While maximum number of days for sprout emergence (13.89) was taken in kinetin 300 ppm (K_3). It might be due to the effect of kinetin which induced the cell division and differentiation process and resulted in proliferation of callus at the graft union. Early generation of callus tissues at graft union led to link the xylem and phloem tissues of stock and scion which resulted to start the water and nutrient transport to scion and enhanced the sprouting of bud. These results are similar obtained byBandita and Bikram (2017) in Banana.

Success rate (%):

Success rate has also prime importance because death of grafts after sprouting is the serious problem. Results revealed that there was a significant influence of scion age on success rate. Highest success rate (77.00, 75.81, 75.81 and 75.81 %) at 30, 60, 90 and 120 DAG, respectively were noted in S_5 (130-140 day old scion). While lowest success rate (45.80, 38.63, 33.15 and 29.12 %) at 30, 60, 90 and 120 DAG, respectively were noted in S_3 (100-110 day old scion). Scion may be attributed to the soft and prevailing in 130-140 day old scion which prevents the desiccation of tender callus tissue arising at the graft union. Low success rate in 100-110 day old scion might be due to new tender shoot and less food material storage as compared to other scion age. Similar results have been obtained by Singh *et al.* (2018) in mango.

The kinetin also had significant influence on success rate. Highest success rate (60.56, 53.15, 48.53 and 44.78 %) at 30, 60, 90 and 120 DAG, respectively were noted in K_2 (Kinetin 250 ppm) which was at par with K_1 at 30, 60, 90 and 120 DAG. Lowest success rate (54.27, 51.01, 45.58 and 38.31 %) at 30, 60, 90 and 120 DAG, respectively were noted in K_3 (Kinetin 300 ppm). Kinetin belong to the growth promoting hormone group. Cytokine can promote cell division, cell enlargement and formation of vascular connections in plant (Due to the enhanced callus formation, quick phloem regeneration, and increased nutrient transport to the scion from rootstock). Eventually these kinetin might have increased callusing rate at graft joint region which leads to formation of xylem and phloem operation system resulting in high success rate. Even though kinetin at higher concentration have produced low success rate. It might be due to detrimental effect on callus formation as well as vascular connection of stock and scion. Similar results were obtained by Kose and Guleryuz (2006) in grape, Mathad *et al.* (1991) in

Table 2 : Effect of scion age and kinetin on mortality and survival % at 30, 60, 90 and 120 DAG

Sr. No.	Treatments	Morality				Survival			
		30 DAG	60 DAG	90 DAG	120 DAG	30 DAG	60 DAG	90 DAG	120 DAG
A. Age of scion									
S_1	90-100 day old scion	34.89	47.97	61.24	72.22	65.11	52.05	38.76	27.78
S_2	100-110 day old scion	35.59	46.45	62.21	74.94	64.44	53.57	37.80	25.06
S_3	110-120 day old scion	36.03	54.17	62.69	77.78	63.99	45.88	37.31	22.24
S_4	120-130 day old scion	18.89	48.43	61.86	69.16	81.16	51.60	38.14	30.86
S_5	130-140 day old scion	16.08	24.19	24.19	24.19	83.92	75.81	75.81	75.81
S_6	140-150 day old scion	20.58	40.25	55.47	69.44	79.46	59.80	44.53	30.56
S_7	150-160 day old scion	16.80	39.16	50.99	65.28	82.98	60.90	49.02	34.72
S_8	160-170 day old scion	18.08	40.40	50.79	63.89	82.17	59.63	49.21	36.11
S.Em. +		1.27	1.93	1.42	2.71	2.25	1.43	2.08	1.83
C.D. at 5 %		3.62	5.48	4.04	7.71	6.40	4.08	5.93	5.22
B. Kinetin									
K_1	Kinetin 200 ppm	24.95	42.63	55.10	65.10	75.03	57.39	44.37	34.90
K_2	Kinetin 250 ppm	22.33	42.48	50.10	63.27	78.03	57.55	49.91	36.74
K_3	Kinetin 300 ppm	26.57	42.77	55.31	65.47	73.16	57.27	44.69	34.54
S.Em. +		0.78	1.18	0.87	1.66	1.38	0.88	1.28	1.12
C.D. at 5 %		2.22	NS	2.47	NS	3.92	NS	3.63	NS

mango.

Mortality (%):

The result indicated that among scion age significantly that minimum mortality (16.08, 24.19, 24.19 and 24.19 %) at 30, 60, 90 and 120 DAG, respectively were noted in S_5 (130-140 day old scion) which was at par with S_4,S_6. S_7 and S_8 at 30 DAG. Maximum mortality (36.03, 54.17, 62.69 and 77.78 %) at 30, 60, 90 and 120 DAG, respectively were noted in S_3 (110-120 day old scion). This might be attributed that new callus tissue arising out of the cambial region consists of thin walled turgid cells which easily desiccated and die off due to according to scion maturity.

Kinetin had significant at 30 and 60 DAG. While non–significant was observed at 60 and 120 DAG. Minimum mortality (22.33 and 50.10 %) at 30 and 90 DAG, respectively were noted in K_2 (Kinetin 250 ppm) which was at par with K_1. Maximum mortality (26.57 and 55.31 %) at 30 and 90 DAG, respectively were noted in K_3 (Kinetin 300 ppm). This might be to that kinetin dose can protect such cells in the cambial region of the graft union. The mortality of graft will depend on the formation of Cambium Bridge between scion and stock and formation of vascular tissues *viz*., Phloem and Xylem. The polar movement of plant growth regulator from leaves to roots induces continuous vascular tissues along the flow of cytokinin and auxin.

Survival percentage (%):

Scion age had a significant influence on the survival percentage of grafts maximum survival (83.92, 75.81, 75.81 and 75.81 %) at 30, 60, 90 and 120 DAG, respectively were noted in S_5 (130-140 day old scion) which was at par with S_4, S_6, S_7 and S_8 at 30 DAG. Minimum survival (63.99, 45.88, 37.31 and 22.24 %) at 30, 60, 90 and 120 DAG, respectively were noted in S_3 (110-120 day old scion). This might be due to that presence of enough carbohydrate and other food material in the best scion age and the accumulated food material was mobilized for new growth which in turns high meristematic activity in scion. The similar kind of result were recorded by Karna and Varu (2017) in mango.

Kinetin had observed significant at 30, 90 at DAG. While non –significant was observed at 60 and 120 DAG. Maximum survival (78.03 and 49.91%) at 30 and 90 DAG were noted in K_2 (Kinetin 250 ppm) which was at par with K_1. Minimum survival (73.16 and 44.69%) at 30 and 90 DAG, respectively were noted in K_3 (Kinetin 300 ppm). This might be due to ability of kinetin at suitable concentration to stimulate rapid callusing and early contact of cambial layers, which enable the graft to heal quickly and make a strong union ultimately leading to better strength and faster growth. Hence success rate was higher. Moreover, during growth period, kinetin at suitable concentration can enhance shoot growth which can increase the quality of grafts and reduces mortality in grafts. This similar result is obtained by Ratan*et al*. (1987), Keny (2005) Banchongrat (1988) in mango.

Conclusion :

From the results of present investigation, it is concluded that 130-140 days old scion with 250 ppm kinetin solution (S_5K_2) gave better performance in parameters like number of days taken for emergence of sprout, success rate, less mortality and maximum survival (%) were observed found effective with respect superior in enhancing parameters.

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