

Research Paper

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Effect of season on softwood grafting in carambola (*Averrhoa carambola* Linn)

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ABSTRACT : The present investigation entitled effect of season on softwood grafting in carambola (*Averrhoa carambola* Linn) was conducted during 2009-2010 at the Department of Horticulture, College of Agriculture, Dapoli. The experiment consisted of 6 treatments (months), which were replicated 4 times and laid out in Randomized Block Design. The results indicated that June to August months recorded maximum sprouting (90 %), survival (87.50 %), minimum days for initiation (15.75 days) and completion (18.75 days) of sprouting and maximum vegetative growth *i.e.* sprout length (3.63 cm) and number of leaflets (23.05) at 90th DAG.

KEY WORDS : Carambola, Season, Softwood grafting

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Carambola/Kamrakh or Star fruit (*Averrhoa carambola* L.) is a curious, attractive fruit of the Oxalidaceae family. Carambola is an important fruit of warm tropics and sub tropics region of world. Carambola is native of Indonesia and Malaysia. In India, it is distributed in Uttar Pradesh, Assam, West Bengal, Madhya Pradesh, Bihar, foot hills of Tamilnadu and other tropical areas. It is also observed in Konkan region of Maharashtra.

The carambola is a fruit of immense utility. Since existing plantations of carambola are of seedling types, they need further improvement. Carambola is often propagated through seeds. The seeds have low viability and hence should be sown fresh. After cleaning and drying the seeds, they should be sown on raise beds. The seedlings are transplanted to individual bags and allowed to harden. When seedlings are to serve as rootstock, they should be at least one year old, on which grafting can be taken up. As seedling type is heterozygous, the seedlings are unlikely to produce fruit which closely resemble to mother tree. It is known for producing variable progeny which fruit in about four years of planting. Grafted plants on the other hand, commence fruiting after about 10 months of planting (Singh, 1963).

The softwood grafting however, a suitable and easy method has not been practiced yet, which can be practiced year around with availability of suitable scion stick and rootstock for grafting. The research work entitled effect of season on softwood grafting in carambola (*Averrhoa carambola* Linn) had been undertaken with objectives to study optimum season for softwood grafting in carambola.

RESEARCH METHODS

An experiment, on the effect of season on softwood grafting in carambola (*Averrhoa carambola* Linn) was conducted during the year 2009-2010 at the Department of Horticulture, College Of Agriculture, Dapoli, Dist. Ratnagiri. The experiment was conducted to find out the influence of season on success of softwood grafting in carambola. The grafting was performed on the 15th of every month, starting from March 2010 to August 2010 which act as a treatment T₁ (March, 2010), T₂ (April, 2010), T₃ (May, 2010), T₄ (June, 2010), T₅ (July, 2010) to T₆ (August, 2010). The observations on percentage success, sprouting, survival and growth parameters such as sprout length, number of leaflets were recorded at an interval of 15 days up to a period of two months. For experiment

purpose ten grafts were prepared in each treatment, which was replicated four times.

The experiment was laid out in randomized block design with 6 treatments and 4 replications. The seeds were separated from pulp and washed thoroughly in running water. Then they were immersed into 200 ppm GA₃ solution for 12 hours. As the seeds have low viability, they were sown immediately on raised beds. Then they were covered with 1 cm thick layer of F.Y.M. and soil in the ratio of 1:1 proportion. These seedlings were then transplanted in the polythene bags of 18 x 22 cm size containing potting mixture of soil and F.Y.M. in the ratio of 3:1. The healthy vigorous seedlings having 25 to 30 cm height with 0.30 to 0.35 cm thickness at the collar region with 50 per cent green apical softwood were considered for grafting operation. The terminal growth of 3 to 4 months age with dark green colour having a thickness of about 0.5 cm was used as scion stick. Defoliation was done seven days before actual grafting operation for better success. The top portion of the fresh growth developed on the stock plant was decapitated with knife keeping about 8.0 cm fresh stem. Then a top portion of seedlings was carefully split vertically in 'V' shape up to 3 cm length. The scion of about the same thickness as that of stock was selected having a length of 10 cm. The wedge of scion was inserted into 'V' shaped slit of stock and secured firmly with 1.5 cm wide and 45 cm long, 200 gauge thickness white transparent polythene strip. The softwood grafting operation was performed by the method described by Amin (1974). The newly prepared grafts were then kept in shade and watered regularly at an interval of 4 to 5 days.

The prepared grafts were covered from top by polythene bags 36 cm x 30 cm size keeping its knot below the graft joint. The bag was retained on the graft for one month or till sprouting was observed in the graft. The observations on percentage success, survival percentage, days required for initiation of sprouting were recorded on graft. The growth observations such as length of sprouted scion shoot, number of leaflets per scion shoot were recorded at 30th day and thereafter at an interval of 15th days up to a period of two

months. The data recorded on percentage success, survival percentage, days required for initiation of sprouting, length of sprouted scion shoot, number of leaflets per scion shoots for a period two months at 15 days interval were statistically analyzed in Randomized Block Design using standard method of analysis (Panse and Sukhatme, 1995).

RESEARCH FINDINGS AND DISCUSSION

The mean sprouting percentage of carambola softwood grafts showed significant variation due to different treatments of time of grafting (months) in the year 2009-10 (Table 1 and Fig. 1). The mean maximum sprouting (90.00%) was recorded in T₅ (July) which was statistically at par with T₆ (August) treatment as (87.57%). The period of rainy months *i.e.* June-August recorded higher sprouting as compared to non-rainy months. The results indicated that season had profound effect on sprouting of carambola softwood grafts. The maximum sprouting of carambola softwood graft during June to August could be attributed to high humidity and high temperature prevailed during period. The high temperature and high humidity had profound effect on graft intake (Hartman and Kester, 1997). The results of present investigation are supported by Haldankar *et al.* (1999) and Khandekar *et al.* (2006) in nutmeg.

The mean survival percentage of carambola softwood grafts showed significant differences due to different treatments of time of grafting in the year 2009-10 (Table 1 and Fig. 1). The mean maximum survival (87.50%) was recorded in T₅ (July) which was statistically at par with T₆ (August) treatment as (82.50%). The mean minimum survival (37.50%) was recorded in T₃ (May) treatment. The per cent higher level of survival of carambola softwood grafts in June to August might be attributed to high humidity and high temperature (Hartman and Kester, 1997). High temperature during dry period as well as low temperature inhibits callus formation. It was further reported that temperature had profound effect on formation of callus tissue (Hartman and Kester, 1997). The results analogous to these findings have been reported by

Table 1 : Effect of time of softwood grafting on sprouting (%), survival (%), days required for initiation and completion of sprouting in carambola

Treatments	Sprouting (%)	Survival (%)	days required for sprouting	
			Initiation	Completion
T ₁ (March)	57.50 (49.39)	55.00 (47.94)	17.75	21.75
T ₂ (April)	55.00 (47.94)	47.50 (43.55)	17.50	21.50
T ₃ (May)	42.50 (40.61)	37.50 (37.66)	19.25	24.00
T ₄ (June)	67.50 (55.44)	62.50 (52.49)	19.25	24.50
T ₅ (July)	90.00 (74.14)	87.50 (69.53)	16.00	20.25
T ₆ (August)	87.50 (75.05)	82.50 (68.78)	15.75	18.75
Mean	57.09	53.33	17.58	21.79
S.E. ±	4.76	3.94	0.83	0.85
C.D. (P=0.05)	14.34	11.88	2.51	2.57

Table 2 : Effect of time of soft wood grafting on sprout length (cm) and number of leaflets in carambola

Treatments	30 DAS		45 DAS		60 DAS		75 DAS		90 DAS	
	Sprout length (cm)	Number of leaflets	Sprout length (cm)	Number of leaflets	Sprout length (cm)	Number of leaflets	Sprout length (cm)	Number of leaflets	Sprout length (cm)	Number of leaflets
T ₁ (March)	1.13	5.30	1.72	8.40	2.32	12.60	2.90	15.80	3.48	19.20
T ₂ (April)	1.14	5.70	1.76	9.15	2.30	12.80	2.89	16.80	3.49	20.25
T ₃ (May)	1.15	4.35	1.74	7.20	2.32	10.95	2.88	16.00	3.43	19.85
T ₄ (June)	1.15	5.35	1.74	9.00	2.32	12.80	2.84	16.75	3.43	20.70
T ₅ (July)	1.20	6.05	1.80	10.45	2.44	14.50	3.01	18.30	3.63	21.60
T ₆ (August)	1.21	6.35	1.82	11.00	2.39	14.80	2.96	18.60	3.58	23.05
Mean	1.16	5.51	1.76	9.20	2.35	13.07	2.91	17.04	3.50	20.77
S.E. \pm	0.01	0.26	0.01	0.29	0.01	0.33	0.02	0.34	0.03	0.27
C.D. (P=0.05)	0.04	0.80	0.03	0.90	0.03	1.00	0.08	1.03	0.10	0.83

DAS- Days after sprouting

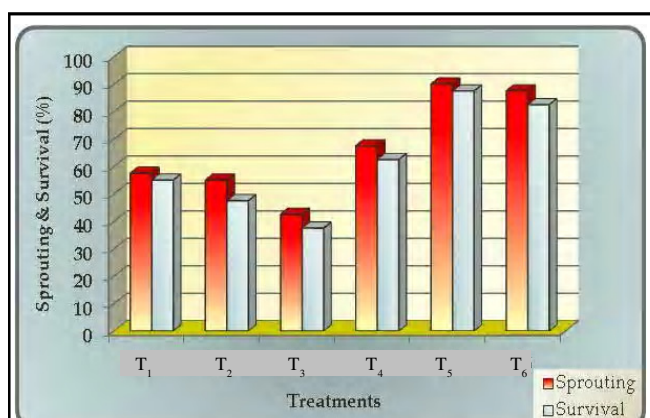
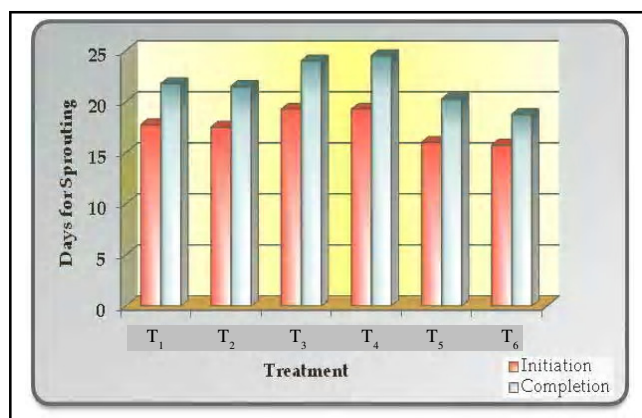
Swamy and Melanta (1994) in jackfruit, Shukla *et al.* (2000) in cashew.

It is evident from the data that days required for initiation of sprouting were significantly influenced different treatments of time of grafting (Table 1 and Fig. 2). The mean minimum days required for initiation of sprouting (15.75) was recorded in T₆ (August) treatment, which was significantly superior over rest of the treatments under study. However, the mean maximum days required for initiation of sprouting (19.25) was recorded in T₃ (May) and T₄ (June) treatments. The results analogous to these findings have been reported by Singh *et al.* (2007) in jamun. The data on days required for completion of sprouting have been presented in Table 1. The mean minimum days required for completion of sprouting (18.75) was recorded in T₆ (August) treatment, which was statistically at par with T₂ (April) (21.5), T₁ (March) (21.75) and T₃ (May) as (24.00). However, the mean maximum days required for completion of sprouting (24.5) was recorded in T₄ (June) treatment. This appeared to be due to favourable season *i.e.* temperature and humidity during this period. (Hartman and

Kester, 1997).

The data pertaining to mean sprout length as affected by different treatments (months) have been presented in Table 2. The mean sprout length increased gradually with the advancement of growth *i.e.* 30th to 90th DAS in all the treatments. The sprout length differed significantly due to effect of different treatments (months). The mean maximum sprout length (1.21) at 30 DAS was recorded in T₆ (August month) treatment, which was at par with T₅ (July month) treatment as (1.20 cm). While, the minimum sprout length was (1.13 cm) observed in T₁ (March) treatment. While mean maximum sprout length (3.63 cm) at 90 DAS was recorded in T₅ (July month) treatment, which was at par with T₆ (August month) treatment as (3.58 cm). While, the minimum sprout length at 90 days was (3.43 cm) observed in T₃ (May) and T₄ (June) treatments, respectively. These findings are correlated to the findings of Panicker (1986) in mango softwood grafts.

The data pertaining to average number of leaflets as affected by different treatments of time of grafting (months) have been presented in Table 2. The average number of leaflets

**Fig. 1 : Effect of time of grafting on sprouting and survival of carambola softwood graft****Fig. 2 : Effect of time of softwood grafting on days for initiation and completion of carambola softwood grafts**

increased gradually as the growth period advanced 30th to 90th DAS irrespective of treatment. The number of leaflets differed significantly due to different treatments of time of grafting (months). The mean maximum number of leaflets (6.35) at 30 DAS was recorded in T₆ (August month) treatment, which was at par with T₅ (July month) treatment as (6.05) and T₂ (April month) as (5.70). However, the minimum number of leaflets was (5.30) observed in T₁ (March) treatment, while maximum number of leaflets at 90 DAS was recorded in T₆ (August month) treatment as (23.05), which was significantly superior over T₂, T₃, T₄ and T₅ (April, May, June and July months, respectively) as (20.25, 19.85, 20.7 and 21.6) treatments. While, the minimum number of leaflets (19.2) was observed in T₁ (March) treatment.

The results of the present investigation indicated that season had profound influence on success of softwood grafting in carambola. Better results on sprouting and survival in June, July and August months may be because of high humidity, less fluctuation in the temperature throughout the period. High humid conditions appeared to be necessary for rapid proliferation of callus leading to speedy healing of graft union in carambola. Fluctuation in weather conditions during period of grafting might be responsible for variation in the results obtained in the different months.

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