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Effect of Grafting Methods on Graft Success and Graft Survival of Kari Ishada Selections

Sampath, P. M.[*], Nagesh Naik[1], Swamy G. S. K.[2], Nithin Kumar C. J.[3], Manjunatha Gowda D. C.[4] and Chongtham Allalay Devi[5]

[*]Department of Fruit Science, College of Horticulture UHS Campus, G.K.V.K (Post), Bangalore-560 065, Karnataka, India

[2]Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi, University of Horticultural Sciences, Bagalkot, Karnataka, India

[3] Department of Fruit Crops, Horticulture College and Research Institute, Periyakulam, TNAU

[4] Department of vegetable science, College of HorticultureUHS Campus, G.K.V.K (Post), Bangalore-560 065, Karnataka, India

[5]Department of Fruit Science, Indira Gandhi Krishi Vishwa Vidyalaya, Raipur, Chattisgarh

*Corresponding Author E-mail: sampathhort@gmail.com

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ABSTRACT

An investigation on "Grafting studies of the selections of Kari Ishada mango cultivar" was carried out in department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi during the year 2015-16. Ten Kari Ishada selections were vegetatively propagated through two different grafting methods viz., stone and softwood grafting. The graft success of stone grafting (62.00 %) was best for the Kari Ishada selections. 'KIS-15' (75.00 %) had the highest graft success and the lowest was obtained in 'KIS-7' (40.00 %). Stone grafting was best for graft survival (66.75 %) while softwood grafting got least survival (57.39 %). There was non significant difference among the Kari Ishada selections and their interaction with the grafting methods for the graft survival. However, the graft survival was lowest in 'KIS-7' (50.42 %) and highest in 'KIS-15' (69.15 %).

Key words: *Kari Ishada, Softwood grafting, Stone grafting, Graft success, Graft survival.*

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most important fruit crops of Anacardiaceae family that consists of dicotyledonous trees and shrubs. It is the most important fruit crop in India having socio-economic significance. Owing to the delicious quality of fruit and richness in vitamins and minerals, it is known as 'King of fruits'.

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Ancient Indians valued mango not merely for its sentiment or religious consideration, but they realized its importance in economics and cultural life of the society. Muslim Kings-Nawabs promoted the practice of planting best mango varieties. The long period of domestication of mango is well evidenced from its mention in ancient scripture. Ain-I-Akbari, an encyclopaedia written during the period of 1590 AD amply gives the understanding of mango of that period[10].

In perennial trees like mango, asexual propagation like grafting renders preservation of the variations that might be accumulated through mutations which offers scope for the selection of good clones within a cultivated variety[4]. The graft success varies depending on the genotype of scions and the grafting methods. In the present study, ten selections of Kari Ishada were vegetatively propagated through the two different grafting methods *viz.*, stone grafting and softwood grafting.

MATERIAL AND METHODS

An investigation on "Grafting studies of the selections of Kari Ishada mango cultivar" was carried out department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi during the year 2015-16. The selections were made among the trees of the Kari Ishada cultivar grown in Ankola and Kumta taluks of Uttara Kannada district based on the morphological and quality parameters. The scions of ten such selections were brought to the nursery of the college and were studied for their grafting behaviour. The effect of the grafting methods and genotype of the scion were studied. The grafting methods used in the present study are stone grafting and softwood grafting.

Design: Factorial Completely Randomized Design (FCRD) with two factors

Factor 1: Grafting methods (2 types: Softwood grafting and stone grafting)

Factor 2: Kari Ishada selections (10 selections : 'KIS-3', 'KIS-4', 'KIS-7', 'KIS-11', 'KIS-13', 'KIS-15', 'KIS-17', 'KIS-24', 'KIS-25', 'KIS-27').

Treatments

T_1 : 'KIS-3' stone grafting
T_2 : 'KIS-4' stone grafting
T_3 : 'KIS-7' stone grafting
T_4 : 'KIS-11' stone grafting
T_5 : 'KIS-13' stone grafting
T_6 : 'KIS-15' stone grafting
T_7 : 'KIS-17' stone grafting
T_8 : 'KIS-24' stone grafting
T_9 : 'KIS-25' stone grafting
T_{10} : 'KIS-27' stone grafting
T_{11} : 'KIS-3' soft wood grafting
T_{12} : 'KIS-4' soft wood grafting
T_{13} : 'KIS-7' soft wood grafting
T_{14} : 'KIS-11' soft wood grafting
T_{15} : 'KIS-13' soft wood grafting
T_{16} : 'KIS-15' soft wood grafting
T_{17} : 'KIS-17' soft wood grafting
T_{18} : 'KIS-24' soft wood grafting
T_{19} : 'KIS-25' soft wood grafting
T_{20} : 'KIS-27' soft wood grafting
*KIS : Kari Ishada Selection

The scions were grafted on local rootstock with two replications per treatment and ten grafts per replication were studied with 400 total number of grafts.

Seven to ten days old seedlings of local variety were used as rootstocks for stone grafting and the one year old seedlings of local variety were used as rootstocks for soft wood grafting. The healthy scions of pencil size thickness were collected from the particular mother trees from Ankola and Kumta and were brought to Kittur Rani Channamma College of Horticulture, Arabhavi for grafting. The scions were transported in the ice box after rolling them in the wet newspaper. These scions were grafted the next day after their separation from the mother plant. Stone grafting and softwood grafting are the two grafting methods used in the experiment. The grafting was done in the month of August in the year of 2015.

For stone grafting, seven to ten days old seedlings of the local variety were used as

rootstocks. The thickness of scion and the rootstock was matched and the transverse cut was given on the rootstock at about 5 cm from the base. After this, a longitudinal cut of 4 to 5 cm length was given on the rootstock. The top of the rootstock appeared like the letter 'V'. A scion of about 9-10 cm length and the same thickness as that of the rootstock was selected. The lower end of the scion was cut into gently sloping wedge of about 3 to 4 cm by removing the bark and a little wood from the two opposite sides. The wedge shaped scion thus prepared was carefully inserted into the 'V' shaped slit of the stock and secured firmly with 1.5 cm wide and 35 cm long, 200 gauge white transparent polythene strip. The scions were covered with small transparent polythene strip to avoid contamination or desiccation of the scions by creating humidity near and above the union region. This polythene strip also maintains the temperature and helps for graft union. Soon after grafting, the grafts were kept in shade house.

For the softwood grafting one year old seedlings of the local variety were used. At about 15-20 cm height, a transverse cut was given on the rootstock. The girth of rootstock in that region is almost equal to that of the scion. After this, a longitudinal cut of 4 to 5 cm length was given on the rootstock and then the scion was inserted after which procedure was continued as in stone grafting.

Those grafts in which scion had sprouted and remained alive without shriveling after 60 days of grafting were noted and percentage of graft success was worked out.

$$\text{Graft success} = \frac{\text{Number of grafts alive}}{\text{Total number grafts}} \times 100$$

Survival percentage of the grafts was calculated after 90 days of grafting by the following formula and expressed in percentage.

$$\text{Graft survival} = \frac{\text{Number of grafts alive}}{\text{Total number of successful grafts}} \times 100$$

The data on various characters were subjected to Fisher's method of analysis of variance and the interpretation of data as given by Panse and Sukhatme[12]. The level of significance used for 'F' and 't' tests was p=0.05. Critical difference (CD) values were calculated whenever the 'F' test was significant.

RESULTS AND DISCUSSION

The graft success in stone grafting (62.00 %) was significantly high than that found in softwood grafting (53.50 %) which is presented in table 1. Likewise, the success of stone grafting was reported to be 64.44 per cent[2]; 63.33 per cent[5]; 65.00 per cent[23] and 69.00 per cent[22]. In softwood grafting, the similar success of 56.86 per cent was reported by Krishna.

Higher success of stone grafting might be due to stronger and complete union of epicotyl grafted bud before sprouting. The preservation of more food material in cotyledon and actively growing stage of rootstock that enhance the graft union might be the reason for greater success in stone grafting. The equal and optimum level of metabolic activity in rootstock and scion enables proper graft union and the better success of stone grafting[23]. The moderate temperature and high relative humidity are major factors related to success of grafts[7]. The better growth of cambium in scion and rootstock in favourable climate helped for the higher success in stone grafting[22]. The congenial temperature (28.50 ^{o}C), high relative humidity (88.30 %) and good amount of

shower (51.5 mm) received during the month of August has resulted in higher success in stone grafting (Table 1).

The graft success among Kari Ishada selections ranged from 40.00 per cent in 'KIS-7' to 75.00 per cent in 'KIS-15' (Table 1). Similarly, graft success varied from 36.66 per cent in 'Kesar' to 59.99 per cent in 'Totapuri'[21]. The variation in graft success may be attributed to the differences in endogenous phenolic components in the genotypes. The interaction of Kari Ishada selections and grafting methods got the graft success in the range of 35.00 per cent in softwood grafting of 'KIS-7' to 85.00 per cent in stone grafting of 'KIS-15' (Table 1). These findings are in confirmation with Reddy *et al*[18]., Prashanth *et al*[15]., Alam *et al*[2]., Prajapati *et al*[14]., and Ram *et al*[16].

The variation in graft success might be due to the compatibility of different selections with rootstocks which is affected by the method of grafting. Maiti and Biswas[8] opined that variation in the graft success among different genotypes may be due to the genetic makeup influencing histological and physiological development within the grafts. The histological studies by Abd El-Zaher[1] illustrated that, graft anatomical features of Jackfruit varied according to grafting types and the compatibility between scions and rootstocks that correlated with the grafting success percentage. The highest graft success in 'KIS-15' in the present study may be due to greater formation of wound periderm. The graft union is initially formed by rapidly dividing callus cells originating from the scion and rootstock, which later differentiate to form the vascular cambium and associated vascular system[9].

The highest graft survival of 66.75 per cent was recorded in stone grafting and lowest survival of 57.39 per cent was recorded in softwood grafting (Table 1). There was non-significant differences among Kari Ishada selections and their interaction with grafting methods for the graft survival. However, graft survival ranged from 50.42 per cent in 'KIS-7' to 69.94 per cent in 'KIS-27' whereas, the interaction showed the range of 45.83 per cent in softwood grafting of 'KIS-7' to 76.39 per cent in stone grafting of 'KIS-15' (Table 1). In agreement to these findings, the survival per cent of 66.66 per cent[19]; 79.80 per cent[20]; 76.67 per; 50.55 per cent[22] and 70.00 per cent[13] was reported in stone grafting of mango. Graft survival range of 76.35 per cent in 'Arka Puneeth' to 83.29 per cent in ''Amrapali''[21] and 61.18 per cent in 'Local-3' to 76.29 per cent in 'Kesar'[14] was reported in mango.

Production of new xylem and phloem permits the vascular connection between scion and rootstock, which in turn results in the graft survival. The spaces in graft union region between the two graft partners lead to good connection that consequently could pass water and nutrients through the callus area towards the upper scion for feeding it to stay alive[11]. The non significance in graft survival among the Kari Ishada selections and their interaction with the grafting method is probably due to the greater temperature fluctuations between day and night in October (Table-II). Xylem and phloem might not have conducted the water and nutrients efficiently. Due to stress condition, the xylem lumen becomes narrow which hinders the translocation of water and nutrients. High rate of transpiration and low humidity adversely affect the survival of grafts[17]. As a result of higher temperature, desiccation of the rootstock causes lesser reserve food material[6]. The enlarging leaf surface on scion shoots will end up with little or no water to offset the moisture that is lost by transpiration. The scion quickly becomes desiccated and dies thus causing low survival[3].

Table 1: Effect of grafting methods on graft success and graft survival of Kari Ishada selections

	Graft success (%)			Graft survival (%)		
Selections	**Grafting method**		**Mean (Selections)**	**Grafting method**		**Mean (Selections)**
	Stone grafting	**Softwood grafting**		**Stone grafting**	**Softwood grafting**	
KIS-3	65.00 (53.78)	65.00 (53.78)	**65.00 (53.78)**	53.57 (47.05)	61.90 (51.92)	**57.74 (49.49)**
KIS-4	65.00 (53.78)	40.00 (39.23)	**52.50 (46.51)**	69.05 (56.21)	50.00 (45.00)	**59.52 (50.61)**
KIS-7	45.00 (42.12)	35.00 (36.22)	**40.00 (39.17)**	55.00 (47.88)	45.83 (42.37)	**50.42 (45.13)**
KIS-11	65.00 (53.78)	50.00 (45.00)	**57.50 (49.39)**	69.05 (56.21)	60.00 (50.77)	**64.52 (53.49)**
KIS-13	50.00 (45.00)	40.00 (39.23)	**45.00 (42.12)**	70.83 (57.31)	62.50 (52.50)	**66.67 (54.93)**
KIS-15	85.00 (67.50)	65.00 (53.78)	**75.00 (60.64)**	76.39 (60.94)	61.90 (51.92)	**69.15 (56.43)**
KIS-17	55.00 (47.88)	55.00 (47.88)	**55.00 (47.88)**	73.33 (59.09)	63.33 (52.75)	**68.33 (55.92)**
KIS-24	45.00 (42.12)	45.00 (42.12)	**45.00 (42.12)**	67.50 (55.38)	55.00 (47.88)	**61.25 (51.63)**
KIS-25	75.00 (60.11)	65.00 (53.78)	**70.00 (56.95)**	59.82 (50.67)	46.43 (42.95)	**53.13 (46.81)**
KIS-27	70.00 (57.10)	75.00 (60.11)	**72.50 (58.61)**	72.92 (59.07)	66.96 (54.96)	**69.94 (57.02)**
Mean (Grafting method)	**62.00 (52.32)**	**53.50 (47.11)**		**66.75 (54.99)**	**57.39 (49.30)**	
	Grafting method (G)	**Selections (S)**	**Interaction (GxS)**	**Grafting method (G)**	**Selections (S)**	**Interaction (GxS)**
S.Em ±	**1.38 (0.84))**	**3.09 (1.88)**	**4.38 (2.67)**	**2.26 (1.37)**	**5.04 (3.06)**	**7.05 (4.33)**
C.D at 5%	**4.10 (2.50)**	**9.16 (5.58)**	**12.95 (7.89)**	**6.68 (4.05)**	**NS**	**NS**

NS=Non Significant.

Graft success and graft survival was recorded on the 60th and 90th day after grafting, respectively.

Values in parenthesis are arc sign transformation data.

Table 2: Meteorological data recorded during the period of experimentation (April 2015 to March 2016 at Agricultural Research Station), Arabhavi for the year 2015-2016)

Month	**Rainfall (mm)**	**Temperature (^{o}C)**		**Relative humidity (%)**
		Maximum	**Minimum**	
	2015-2016	2015-2016	2015-2016	2015-2016
April 2015	22.6	36.8	20.2	82.1
May	93.8	38.0	22.7	85.5
June	20.9	31.4	21.2	85.5
July	19.9	31.1	20.7	84.5
August	51.5	30.9	19.9	88.3
September	66.9	31.9	18.9	89.4
October	99.0	34.6	18.3	89.9
November	24.3	30.9	14.8	87.7
December	5.4	32.6	14.0	91.3
January 2016	0.3	31.5	10.4	88.9
February	1.1	35.9	14.5	91.7
March	6.4	37.3	16.3	84.3

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