

## RESEARCH ARTICLE

### Studies on standardization of propagation methods of some minor fruit crops in India

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**Abstract:** Most of the minor or underutilized fruit crops are mainly propagated by seeds, resulting long gestation period, inferior fruit quality and low fruit yield. In most of the regions of India, standard method for vegetative multiplication of elite genotype of minor fruits is not available. With a view to standardize the vegetative propagation method and time of operation, an investigation was made on jackfruit (*Artocarpus heterophyllus*), carambola (*Averrhoa carambola*), fig (*Ficus carica*) and star goose berry (*Phyllanthus acidus*), under red and laterite zone condition of West Bengal. For standardizing the method, inarching was practiced for jackfruit, grafting and air layering for carambola, grafting and ground layering for fig and air layering for star gooseberry in different months under red and laterite zone condition of West Bengal.

The results from two consecutive years of investigation for each crop, revealed that inarching on 20<sup>th</sup> July recorded highest success (80%) with maximum field establishment (70%) of detached plants of jackfruit. It was also noted that 90 days would be required from date of operation to date of detachment of successful inarched plants. In carambola, grafting on seedlings rootstock resulted in highest success of 100 % with good graft growth when operation was made during rainy season *i.e.* 30<sup>th</sup> June to 15<sup>th</sup> August while 60 % success with 50 % field establishment of detached layered was achieved in case of air layer-

ing done on 15<sup>th</sup> June only. In case of fig, highest success of 50 % with good graft growth was recorded when grafting was made on 15<sup>th</sup> and 30<sup>th</sup> June on local fig rootstock while cent percent success with 50-60 % field establishment was noted in ground layering done during 1<sup>st</sup> July to 15<sup>th</sup> July. In star gooseberry, 50 % rooting success in air layering was achieved with cent percent field establishment of detached layered when layering was made on 30<sup>th</sup> July.

**Keywords:** Propagation, standardization, Jackfruit, carambola, fig, star goose berry.

## INTRODUCTION

There are number of common minor fruit crops which are not only important in one country but also other countries. At present, the minor or underutilized fruit crops are gaining importance due to their significant role in human health, nutrition, medicinal and therapeutic uses, income security and ecological balance. It is established fact that to harness the maximum efficiency from a crop cultivation, use of genuine planting material is the foremost requirement. Due to heterozygous nature of fruit crops, use of vegetatively propagated planting material is the scientific practices (Singh and Singh, 2006; Singh and

Singh 2007). However, in most of the under-utilized fruit crops, availability of clonal planting material of a recommended cultivar is the major bottle neck for their cultivation. In most of the underutilized fruit crops, vegetative method for commercial multiplication, has not been standardized suited to a specific agro-climatic zone. The red and laterite zone of West Bengal, an eastern state of India, where climate is dry and sub-tropical, is found to be suitable for growing most of the minor fruit crops of arid and semi-arid in nature. Among them, Jackfruit (*Artocarpus heterophyllus*), Carambola (*Averrhoa carambola*), Fig (*Ficus carica*) and Star gooseberry (*Phyllanthus acidus*) are important. As no attempt has been made earlier to standardize the propagation method of above mentioned minor fruit crops in the red and laterite zone of the state, an investigation was therefore made in this direction.

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## MATERIALS AND METHODS

The experiment was conducted in a nursery of provide farm at Jhargram in Paschim Medinipur district of West Bengal during the year 2010 and 2011. In jackfruit, 'inarching method' of propagation was practiced during 15<sup>th</sup> June to 30<sup>th</sup> August. One year old rootstocks were used for inarching and 100 shoots were used for the purpose, which were replicated three times following Randomized Block Design (RBD).

In carambola, grafting was made during 30<sup>th</sup> June to 28<sup>th</sup> February while air-layering was done during 15<sup>th</sup> June to 15<sup>th</sup> September; taking 100 number in each case which was replicated five times following RBD. In each replication 20 shoots were taken either for grafting or air layering. For grafting, one year rootstocks were used while for air layering 8-12 month old mature shoots of pencil thickness were taken. Air layering was made by removing 2cm wide ring of bark followed by

used of rooting media like decomposed soil and covering it with 100 gauge thick white polythene on the day of ringing (removal of bark). The rooted air layered shoots were detached when roots were clearly visible.

In fig, grafting was made on one year old local fig seedlings during 15<sup>th</sup> June to 30<sup>th</sup> September while ground layering was practiced during 1<sup>st</sup> July to 30<sup>th</sup> September. For ground layering, healthy branches of lower portion of the plant were taken. For grafting 100 seedlings were taken and for ground layering 50 shoots were used. The experiment was designed as RBD with three replications.

In star apple, only air layering was done during 20<sup>th</sup> June to 20<sup>th</sup> September, taking 50 shoots of 8 months old in each month which was replicated three times following R.B.D. In each fruit crop, elite genotype of respective crop is used as scion material.

Observations on success of different methods and field establishment of layered or grafted plants, time taken for detachment in air-layer or inarched plants were made 90 days after grafting or planting the air layered or inarched plants in the nursery (Singh and Singh, 2006; Singh and Singh 2007).

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## RESULTS AND DISCUSSION

Results presented in Table 1 clearly indicated that success in various months during the monsoon period varied significantly. Highest success (80.0%) with maximum field establishment (70.0%) of detached plant was observed on 20<sup>th</sup> July operation. Srinivasan (1970) also advocated inarching for multiplication of jackfruit under Kerala (India) condition. 'Soft-wood grafting' which is now one of the popular methods of vegetative propagation of many fruit and tree species, reported the results of poor bud take (30-40%) in spite of taking different environments

**Table 1:** Effect of season on success of inarching in Jackfruit\*

Date of Operation (Treatments)	Total number made	Success (%)	Field establishment (%)	Time taken for detachment (Days)
15 <sup>th</sup> June	100	40 (39.23)	50 (45.00)	105
30 <sup>th</sup> June	100	40 (39.23)	50 (45.00)	105
10 <sup>th</sup> July	100	35 (36.27)	50 (45.00)	100
20 <sup>th</sup> July	100	80 (63.43)	70 (56.79)	90
30 <sup>th</sup> July	100	50 (45.00)	60 (50.77)	85
10 <sup>th</sup> August	100	50 (45.00)	50 (45.00)	80
20 <sup>th</sup> August	100	30 (33.21)	50 (45.00)	80
30 <sup>th</sup> August	100	0 (0.00)	0 (0.00)	-
C.D. at 5%	-	6.8	5.2	-

Figures in the brackets are angular transformed values. \*Average of 2 years data.

**Table 2:** Effect of season on success of grafting in carambola\*

Time of grafting (Treatments)	Total number made	Success (%)	Height (cm)	Leaf number
30 <sup>th</sup> June	100	100 (88.19)	42	130
15 <sup>th</sup> July	100	100 (88.19)	28	52
30 <sup>th</sup> July	100	100 (88.19)	35	74
15 <sup>th</sup> August	100	100 (88.19)	32	75
15 <sup>th</sup> September	100	90 (71.57)	30	71
30 <sup>th</sup> September	100	80 (63.43)	28	78
15 <sup>th</sup> October	100	50 (45.00)	22	90
30 <sup>th</sup> October	100	90 (71.57)	17	93
15 <sup>th</sup> November	100	100 (88.19)	18	98
30 <sup>th</sup> November	100	70 (56.79)	15	45
15 <sup>th</sup> December	100	80 (63.43)	20	50
30 <sup>th</sup> December	100	100 (88.19)	25	55
30 <sup>th</sup> January	100	50 (45.00)	12	60
15 <sup>th</sup> February	100	70 (56.79)	16	45
28 <sup>th</sup> February	100	60 (50.77)	18	60
C.D. at 5%				

Figures in the brackets are angular transformed values. \*Average of 2 years data.

**Table 3:** Effect of season on success of air layering in carambola\*

Time of operation (Treatments)	Success (%)	Time taken for separation (days)	Number of roots/layer	Length longest root (cm)	Field establishment (%)
15 <sup>th</sup> June	60 (50.77)	100	9.5	6.8	50 (45.00)
15 <sup>th</sup> July	30 (33.21)	95	10.0	7.0	50 (45.00)
15 <sup>th</sup> August	20 (26.57)	90	6.0	4.0	0.0 (0.00)
15 <sup>th</sup> September	0 (0.00)	-	-	-	-
C.D. at 5%	5.8	-	1.8	1.6	6.5

Figures in the brackets are angular transformed values. \*Average of 2 years data.

**Table 4:** Effect of season on success of grafting in fig\*

Time of Operation (Treatments)	Total number made	Success (%)	3 months after grafting	
			Shoot length (cm)	Number of leaves
15 <sup>th</sup> June	100	50 (45.00)	17.2	8.0
30 <sup>th</sup> June	100	50 (45.00)	14.0	6.0
15 <sup>th</sup> July	100	50 (45.00)	8.0	4.0
30 <sup>th</sup> July	100	50 (45.00)	4.0	4.5
15 <sup>th</sup> August	100	30 (33.21)	8.0	7.0
30 <sup>th</sup> August	100	35 (36.27)	21.0	6.4
15 <sup>th</sup> September	100	20 (26.57)	9.5	6.2
30 <sup>th</sup> September	100	20 (26.57)	9.0	9.0
C.D. at 5%	-	6.5	2.4	1.8

Figures in the brackets are angular transformed values. \*Average of 2 years data.

(Selvi *et al.*, 2008). Inarching on 20<sup>th</sup> July not only resulted in highest field establishment but also it took less time (90 days) as compared to the operation made on 15<sup>th</sup>, 30<sup>th</sup> June or 10<sup>th</sup> July. Highest success obtained on 20<sup>th</sup> July may be due to prevailing temperature and high humidity coupled with frequent rainfall which resulted in good union between the scion and mother stock. In carambola, grafting was found to be the better as

compared to air layering (Table 2 and 3) as higher grafting success (80 to 100%) for longer duration (from 30<sup>th</sup> June to 30<sup>th</sup> September) was recorded. Cent percent success with good graft growth, in terms of height of sprouted shoot and leaf number, was recorded when grafting was made during 30<sup>th</sup> June to 15<sup>th</sup> August. Higher grafting success with better graft growth was attributed to congenial temperature and frequent rainfall resulted in maintaining high atmospheric hu-

**Table 5:** Effect of season on success of ground layering in fig\*

Time of Operation (Treatments)	Success (%)	Time taken for detachment	Field estab- lishment (%)	Plant growth of the detached layered in the nursery	
				Height (cm)	Number of leaves
1 <sup>st</sup> July	100 (88.19)	90	50 (45.00)	15	10
15 <sup>th</sup> July	100 (88.19)	90	60 (50.77)	17	12
1 <sup>st</sup> August	80 (63.43)	90	60 (50.77)	12	8
15 <sup>th</sup> August	70 (56.79)	90	60 (50.77)	6	4
1 <sup>st</sup> September	100 (88.19)	90	100 (88.19)	3	2
30 <sup>th</sup> September	50 (45.00)	100	50 (45.00)	3	3
C.D. at 5%	7.8	-	6.8	2.2	1.9

Figures in the brackets are angular transformed values. \*Average of 2 years data.

**Table 6:** Effect of season on success of air layering in star gooseberry\*

Time of op- eration (Treatments)	Success (%)	Time taken for detach- ment	Field estab- lishment (%)	Plant growth of the detached layered in the nursery	
				Height (cm)	Number of leaves
1 <sup>st</sup> July	100 (88.19)	90	50 (45.00)	15	10
15 <sup>th</sup> July	100 (88.19)	90	60 (50.77)	17	12
1 <sup>st</sup> August	80 (63.43)	90	60 (50.77)	12	8
15 <sup>th</sup> August	70 (56.79)	90	60 (50.77)	6	4
1 <sup>st</sup> September	100 (88.19)	90	100 (88.19)	3	2
30 <sup>th</sup> September	50 (45.00)	100	50 (45.00)	3	3
C.D. at 5%	7.8	-	6.8	2.2	1.9

Figures in the brackets are angular transformed values. \*Average of 2 years data.

midity which consequently had a favourable effect on cambium activity for better graft-union.

Highest success (60%) with field establishment (50%) in air layering was observed when operation was made on 15<sup>th</sup> June i.e. at the time of on-set of monsoon (Table 3). Air layering in carambola may be practiced in the situation where seedling rootstocks are not available. Earlier results on air layering in carambola, by removing 2 cm wide ring of

bark, 7 days ahead of ringing / or etiolation for 7 days before layering resulted in poor rooting success of 20-30 % only (Ghosh *et al.*, 2010).

The fig is mainly propagated by cuttings in India and abroad (Mukhopadhyay, 2005) and little information is available on other methods of propagation. Although high percentage of rooting (85-100%) is reported from the works of abroad (not in India) (Mukhopadhyay, 2005) but less rooting (25-

30%) was experienced in cuttings (Unpublished) under red and laterite zone condition of West Bengal. It was observed that 50 % grafting success was achieved when operation was made during June-July later it declined (Table 4). The highest shoot length (17.2 cm) with maximum number of leaves (8.0) was observed in the 15<sup>th</sup> June.

Ground layering in fig was found to be the best method of propagation (Table 5) with 100 % success on 1<sup>st</sup> July, 15<sup>th</sup> July and 1<sup>st</sup> September. Field establishment of the detached layered was 50 to 60 % in case of July - August operated layered while it was 100 % in 1<sup>st</sup> September operated layered. Best graft growth (17 cm height & 12 leaves) was recorded from the 15<sup>th</sup> July operated layered. Ground layering in fig was considered to be better due to higher success as well as field establishment as compared to grafting.

Star gooseberry is mainly propagated by seeds and cuttings (Kishore *et al.*, 2007). It was found that layering on 30<sup>th</sup> July, gave highest success (50%) with cent per cent field establishment of detached layered (Table 6) which may be due to congenial climatic condition during operation and detachment.. Air layering before 30<sup>th</sup> July or after 20<sup>th</sup> August resulted poor success. First fortnight of August was the congenial time for air layering in star goose berry under red and laterite zone condition of West Bengal.

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## CONCLUSION

It is concluded that inarching on 20<sup>th</sup> July was the best for multiplication of jackfruit. In carambola, grafting of scion on seedling root-stock during rainy season *i.e.* 30<sup>th</sup> June to 15<sup>th</sup> August was the most congenial period for maximum success and field establishment of grafts. Ground layering during 1<sup>st</sup> July to 15<sup>th</sup> July was the best for multiplication of fig as

compared to grafting. In star gooseberry, air layering on 30<sup>th</sup> July was found to be the best.

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