

**STUDIES ON INSITU AND INPOT SOFTWOOD GRAFTING OF  
MANGO AS AFFECTED BY PERIOD OF GRAFTING  
( Mangifera Indica L. )**

**BY**  
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1992**



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AFFECTIONATELY DEDICATED TO MY

DEAR PARENTS

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CANDIDATE'S DECLARATION

I hereby declare that the entire work embodied in  
this dissertation or any part thereof, has not  
been previously submitted by me for a  
degree of any University.

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C E R T I F I C A T E

Mr. Bhimrao Bajirao Bangar has satisfactorily prosecuted his course of research for a period of not less than one academic year and that the dissertation entitled "STUDIES ON INSITU AND INPOT SOFTWOOD GRAFTING OF MANGO AS AFFECTED BY PERIOD OF GRAFTING Mangifera indica) submitted by him is the result of original research work and is of sufficiently high standard to warrant its presentation to the examination. I also certify that the dissertation or part thereof has not been previously submitted by him for a degree of any University.

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Date 22 July, 1972



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(Guide)

## CERTIFICATE - II

This is to certify that the dissertation entitled  
 "STUDIES ON INCITU AND IN FOLI SOFTWOOD GRAFTING OF MANGO  
 (Mangifera indica) AS AFFECTED BY PERIOD OF  
 GRAFTING submitted by Shri P.R WAGHARE to Marathwada  
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## 1. INTRODUCTION

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Mango undoubtedly deserves to be the national fruit of India. In area, production, nutritive value and popularity of appeal no other fruit can compete with it. It is the favourite fruit of all parts of India and has been repeatedly acclaimed as the "King of fruits". The Moyal Emperor Babar called it the choicest fruit of Hindustan. The paisely design, which is dominant design in our hand printed fabrics, represent a mango fruit and is considered to be a symbol of India in Foreign countries.

The mango is one of the most ancient fruits of India. It was established in India in the pre-christian era. Its cultivation in India is estimated at more than 4000 to 6000 years old. In the Ramayana and Mahabharata forests and gardens of mango have been mentioned. It has been held in high esteem by the Hindus. Its blossoms are used for worship of goddess Saraswati and festoons of mango leaves are strung doorways on auspicious occasion. Its common vernacular name 'Aam' means "the common". It is not only common throughout India but is also the fruit of common people. Its name Amra used in Sanskrit literature has been used as suffix to mark distinction and adoration for people and things. The Amar Kosh written in the Buddhist times by Amar Sinha contains an immortal eulogy of this luscious fruit.

India is the only country where truly wild forests of mango are found in Assam and the adjoining Chittagong hills. No other country can surpass India in the number of mango varieties and the richness of their flavours. The climate of India is ideally suited to its cultivation and it is found growing in every nook and corner of the country except at altitudes above 3000 feet.

The juicy sucking varieties are consumed in large quantities. Mango is also made into pickles, preserves, mango powder and chutneys of all sorts. The juice of mango fruit is dried in sun in the form of solid sheet called mango leather. Mango-fool, refreshing drink is made by mixing mango pulp with milk and sugar. It is an outstanding source of vitamin - A (4800 I.U.) and good source of vitamin C. The mango is also considered to have some medicinal properties. The ripe fruit is fattening, diuretic and laxative. The kernel is effective against diarrhoea and asthma. Raped and sugared pulp is given to patients of cholera and plague. The bark is source of resin and gum. The wood is used as timber and leaves as fodder. Thus mango tree is fully utilised in India.

Botanically mango belongs to family Anacardiaceae to which also belong the cashewnut and pistachion. The cultivated mango belongs to species Mangifera indica Wild mango forests of this species and Mangifera sylvatica are

found in Assam. The mango is grown in almost all states of India. In India, mango area is 10.64 lakh ha. with production of 93.38 lakh tones, while in Maharashtra mango is cultivated on 35,400 ha. with production of 1,94,700 tones.

The propagation of plants is fundamental occupation of mankind. Civilization may have started when ancient man learned to plant and grow kind of plants which fulfilled nutritional needs for himself and his animals. As civilization advanced he added to the variety of plants not only additional food crops but also those which provided fibres, medicines, recreational opportunities and beauty. From the great diversity and variation in plant life, he has been able to select kind of plants useful to his welfare.

Much progress in plant improvement was made long before the modern period of plant breeding. Our cultivated plants originated mainly by three methods, some kind of plants selected from wild species, some arose as hybrid and some plants occurred naturally as manstrosties. Consequently there has been a process of invention and discovery of techniques for plant propagation. Most cultivated plants either will be lost or will revert to less desirable forms unless they are propagated under controlled conditions that preserve their unique characteristics. Through history, as you know, of old times became available, the development of

techniques to preserve them had to be learned. Conversely, as new advances in propagation techniques developed, the number of plants that became available for cultivation increased.

Plant propagation is controlled reproduction of plants so as to perpetuate selected individual or the group of individuals which is having specific value to man. There are two basic types of propagation - (a) sexual, (b) asexual. Seed propagation is sexual except in case of apomixis and this propagation generally causes variation in seedlings. The various vegetative methods like layering, cutting, grafting and budding are asexual which gives true to type progeny as that of parents.

The origin of grafting can be traced back to ancient time. There is evidence that the art of grafting was known to the Chinese at least as early as 1000 B.C. During the days of Roman Empire grafting methods was very popular and methods were precisely described in the writings of that era. By the sixteenth century the cleft and whip grafts were in wide spread use in England and it was realised that the cambium layer must be matched, although the nature of cambial tissue was not then understood and appreciated. Whittier (1821) described 119 methods of grafting and discussed changes in growth habits due to grafting.

So grafting is an art of joining two or more parts together, in such a manner that they unite and

their growth as single plant. The different methods of graftings are matching, side grafting, whip grafting, cleft grafting and stone grafting. Grafting is necessary -

- i. When other methods are not successful,
- ii. To obtain pest and cold resistant plant, **and**
- iii. To convert inferior variety into superior one
- iv. To modify the growth of fruit plant

Softwood grafting in mango is successful than veneer grafting and apical grafting. In softwood grafting, wedge shaped scion piece of 10-15 cm long is inserted into bifurcated root stock and joint is tied by rubber bands. The present experimental entitled, "Effect of softwood grafting and in pots softwood grafting of mango as compared with cleft grafting," was undertaken with following objectives -

- i. To find out suitable period for softwood grafting in mango
- ii. To find out suitable period for softwood grafting in mango
- iii. To find out suitable period for softwood grafting in mango
- iv. To find out suitable period for softwood grafting in mango
- v. To find out suitable period for softwood grafting in mango

The results of the present experimental are as follows -

- i. The grafting was successful in mango, **and**
- ii. The grafting was successful in mango, **and**
- iii. The grafting was successful in mango, **and**
- iv. The grafting was successful in mango, **and**
- v. The grafting was successful in mango, **and**

## 2. REVIEW OF LITERATURE

As far as the fruit industry is concerned, the best suited method of propagation to the particular crop and climate is very needful for its development. Since mango is also one of the important fruit crop of India as well as of some other countries of the world. Many of the workers made a vast research to find out the proper method of its propagation which will help to establish the orchards. Some important work related to the present investigation is reviewed here.

### 2.1 Method of grafting:

Pinhereio et al (1970) studied different grafting methods in mango. Their study includes cleft, whip, tongue and side grafting. They found the cleft method as superior to all other methods of grafting. The cleft grafting had given 97.1% success then followed by whip method (88.9%). The other methods of grafting and shield budding proved unsatisfactory.

Singh and Srivastava (1980) studied double grafting in mango. They grafted scion of cultivar Dashehari on rootstock using interstock of cultivar Bapakkai. Inarching, veneer and softwood grafting were carried out in March, July and September. The best results were obtained with inarching and softwood grafting both in July.

Gaur N.V.S. (1984) compared the success of various methods of grafting like inarching, veneer grafting, stone grafting and softwood grafting. He proved that softwood gave highest success and was most economical than other three methods.

Singh et al (1986) studied different grafting methods carried out from mid April to mid September on one year old seedlings with four to five months old scion defoliated ten days prior to grafting. The highest success of veneer, modified veneer and softwood grafting was observed in mid June were 96.6%, 100% and 100% respectively.

Tayde et al (1988) observed the success of different grafting methods by using the cultivar pairi. They reported that softwood grafting during July to September gave higher success (70 to 100%) than veneer or stone grafting. Also observed that survival after nine months and scion growth had maximum by softwood grafting as compared to other methods. Higher mortality of young stone grafts showed unsuitability of stone grafting under Akola condition.

## 2.2 Effect of period:

Prasad et al (1973) studied the propagation of mango by veneer grafting patch budding for judging the suitability of different periods. They observed the maximum success 92 to 96% during the month of July by veneer grafting. They noted lowest success 60% only by patch budding. They also reported the highest success during the month of May for the year 1969

and maximum growth during June for the year 1970 with veneer grafting.

Amin (1974) studied the suitable time of wedge grafting. They conducted experiment from last week of July to first week of September on insitu condition. They reported that when bronze coloured terminal growth is observed on rootstock then grafting gave highest success and concluded the grafting during last week of July to first week of August gave best results.

Kanwar and Bajwa (1974) studied the propagation of mango by side grafting for observing the suitability of period. While conducting the experiment they used scions and rootstocks of different ages. They reported the best results by side grafting was obtained in March-April and June-October.

Gunjate and Limaye (1978) studied the effect of the time on the success of veneer grafting. They transplanted seedlings in September and in the following year they were veneer grafted at intervals from 15th March to 1st June and they reported the percentage success ranged from 68 to 91% and also reported 15th May being the optimum date for grafting.

Narayanrao and Ramamurthy (1979) under taken the propagation trials to standardize the method and the operation. They reported maximum success 85% by March to June.

veneer grafting worked on 16-9-1978 and 1-10-1978 respectively. They also observed that 10 to 25% success was obtained by stone grafting during month of August.

Upadhyay and Gupta (1979) also studied different methods to decide the proper time of grafting. Their stone grafting work had shown 95% and 90% bud take and 80% & 85% success during July and August respectively.

Patel and Amin (1981) reported the best period for softwood grafting of mango in situ. For this experiment they used scions of cultivar Rajapuri and grafted from February to next January at 15 days interval. They observed that grafting between third week of May to third week of August gave 95 to 100% success and February to May had gave 85 to 97% success but after week of September it decreased considerably.

Singh and Srivastava (1982) studied success of grafting carried out from July to September. They carried out softwood grafting by using the cultivar of Dashehari and they reported that the grafting on 20th August gave highest success (90%) as compared to 67% in July and 70% in late September. They also observed that the softwood grafting was better than veneer grafting.

Desai and Patil (1984) studied the grafting of mango carried out from 1st July to 15th September at an interval of 15 days. For this work they used seven days old

old seedlings and defoliated scion. They observed that grafting success was higher on 1st July in greenhouse than open condition and concluded grafting in 1st July was better than other dates of grafting.

Shailendra and Sinha (1987) studied the grafting done in different months and they used the aluminium foil for tying the graft union. They carried out grafting in April, May, June, October, November, December and January. They observed the tying by aluminium foil gave higher success than untied and they reported the highest success in June and October (80%) and 70% in April, May and November while untied grafts gave 70% success in June and 50% in October and April.

Gupta et al (1988) observed the grafting success from 25 July to late September. While conducting the experiment they used the scion and stocks of different ages. They observed that grafting on ten days old seedlings gave highest success in second half of August than grafting on five days old seedling during late July.

Upadhyay and Prasad (1988) studied the effect of time on grafting in Dashehari mango. They carried out the grafting between July and June of the following year. They observed the grafting success was highest in June (85%) followed by July, August and September each with 80% and October with 70% and poorest results were obtained between November to February (18 to 25%).

### 2.3 Effect of climate:

Subbarao (1968) studied propagation of mango by veneer grafting under Anand(Gujrat) conditions. The result had shown that July to August and January to February were the best. Among them July to August were the best. He concluded that the season had played an important role in the success of grafting besides other influences. During the month of July to August, the maximum average temperature were  $31.9^{\circ}$  to  $29.7^{\circ}$  C and average minimum temperatures were  $25.4^{\circ}$  to  $24.7^{\circ}$  C. The average relative humidity was in the range of 93.5 to 86.7 % .Both these factors were lesser in the other months. Thus the temperature and humidity were closely related with success of grafting.

Dhillon et al (1970) reported that proper humidity and temperature was essential for survival also. So they used the green shelter like Arhar, Janter and Banana and reported green shelter as superior which provides shade and humidity during summer and 89.6% establishment was seen under this shelter.

Reyes (1978) studied the effect of ambient relative humidity on grafting success in mango and reported highest success in the grafts which were covered with wet plastic bags and kept in the shade. This clearly indicated that the higher humidity favoured the graft success.

Singh et al (1979) compared the different methods of

vegetative propagation in mango all around the year and reported that higher atmospheric humidity caused by high rainfall neither too high nor too low but maximum and high minimum temperatures were very congenial to the union of rootstock and scion and rooting in airlayers of mango. The aforesaid favourable condition prevailed during July to september and thus maximum success in all methods of propagation was observed during these months.

#### 2.4. Seedling growing conditions (Insitu and pots):

Nagawekar et al (1984) studied the survival of stone grafts grown in the container and that are transplanted from one place to other. And they observed that grafting success was maximum by grafting on container raised seedling than grafting on lifted seedling.

Reddy and Melanta (1988) observed the softwood grafting in container and in situ. They used the Cv Nekkare as rootstock and seedling raised in polythene for container study and sown in the field for insitu condition. They used cultivar Dashehari as scion and reported 58% success with three months old stock and 40% success with four to six <sup>months</sup> old rootstock raised in container. While insitu gave 90% success with seven months old root stock and 25% with three months old rootstock. So they concluded insitu conditions always gave higher success than in container seedling stock.

### 3. MATERIALS AND METHODS

The details of materials used and the methods followed in conducting the present investigation are given in this chapter.

#### 3.1 Experimental site :

The present investigations were carried out at Central Nursery Scheme, Department of Horticulture, college of Agriculture, M.A.U., Parbhani during the year 1991-92.

#### 3.2 General Climate :

Parbhani is situated at 409m altitude, 19° 16' N.latitude, 76° 47' E longitude and has subtropical climate. The average annual rain fall received during 1991-92 was 683.8 mm rainfall mostly during June to September.

The maximum temperature varies from 29.8 to 44° c in summer whereas minimum temperature varies from 5 to 14.8° c during winter.

##### 3.2.1 General climatic conditions during the period of investigation :

In order to get idea about climatic conditions during the period of investigation i.e. 1991-92, the weekly average of weather condition viz. maximum and minimum temperature, relative humidity (Morning and Evening) was obtained from central Meteorological observatory, M.A.U., Parbhani. The meteorological data for the year 1991-92 are presented in Table 1.

Table -1. Metecological data (December 91 to June 92)

Met.week	Temp. (°c)		Humidity (%)	
	max.	min.	am.	pm.
48	31.9	12.9	67	26
49	30.4	10.4	68	21
50	28.6	9.3	68	25
51	29.0	11.1	74	33
52	29.0	10.0	69	32
1	27.6	6.2	70	27
2	30.4	9.1	65	27
3	31.5	12.0	70	22
4	32.2	11.2	66	21
5	31.5	11.9	65	24
6	32.3	12.5	61	22
7	31.9	10.9	54	23
8	31.5	11.7	51	20
9	34.8	12.7	51	20
10	36.4	15.0	46	12
11	38.1	17.1	34	09
12	39.9	19.8	33	09
13	39.5	20.8	33	17
14	39.5	21.3	36	15
15	40.4	24.2	36	20
16	41.3	22.8	34	10

17	39.8	22.6	46	18
18	41.8	25.0	34	13
19	42.3	26.0	27	12
20	42.8	27.1	36	14
21	41.5	25.5	51	17
22	41.4	26.0	40	20
23	42.6	27.3	43	18
24	38.0	23.4	72	38
25	31.1	22.0	87	77
26	34	23.3	78	43

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### 3.3 Experimental details :

The main object of this experiment was to study the effect of period on the success of softwood grafting in situ and in container. The experiment was undertaken by employing the completely Randomised Block Design and the results were tested by randomised test of significance. The conducted experimental work was divided into two parts on the basis of seedling growing condition. Part A includes the seedling grown in situ and part B includes the seedling grown in container. In both parts of experiment the grafting was carried out on the same dates and observation were recorded at same intervals. For both parts of the experiments the scions of cultivar Totapuri were used. The plants spacing is maintained insitu condition while in container planting, there was no spacing problem. The plot size in case of in situ condition was  $10^m \times 3^m = 30$  sq. meter.

### 3.4 Methodology for part 'A' :

#### 3.4.1 Sowing of stones :

The mango stones of better quality having medium to big size and weighty were collected from local mango during the month of may. The collected stones were sown in the well prepared field in the month of June at the rate of 2 to 3 stones per spots at the distance of 1 m x 1 m. The seedling were allow to grow on same place.

#### 3.4.2 Treatments included :

There were three replications in the experiment which indicates three rows of mango seedlings that were used for grafting . The dates of grafting which were done at an

interval of 15 days indicates the treatments.

So in the experiment there were three replication and 10 treatments.

**Design** : Completely Randomised Block Design.

**Relications** : 1) First row - R1

2) Second row - R2

3) Third row - R3

**Treatments** : Dates - D1 - 5.12.1991

D2 - 20.12.1991

D3 - 5.1.1992

D4 - 20.1.1992

D5 - 5.2.1992

D6 - 20.2.1992

D7 - 5.3.1992

D8 - 20.3.1992

D9 - 5.4.1992

D10 - 20.4.1992

The plants per replication per treatments were equal to two. At each date of grafting two plants in each treatments were grafted and each treatment was replicated three times as the number of replications were three. Thus, in all 6 plants were grafted on each date of grafting.

### 3.4.3 Grafting method :

The grafting method employed in the experiment was softwood (wedge) grafting. For these the sowing of three better quality and viable mango stones were carried out in the last week of May, 1991 at distance of one into one meter.

After germination only one healthy seedling per hill was kept for grafting and other weak seedlings from each places were removed. Totapuri cultivar was used as scion for grafting purpose. Before 7 days of grafting defoliation of selected bud sticks were carried out. The sixth month old in situ vigorous and healthy seedlings were used for grafting purpose. Softwood grafting was carried out by giving horizontal cut to the stock plant. The cut was given at a height of 15 cm above the ground surface, so as to remove its terminal portion. Again one vertical cut was given on the stock plant which was 5 cm deep from the horizontal cut for inserting the wedge shaped scion stick. The 4 month old and matured bud sticks of Totapuri were selected for grafting purpose. On the selected bud sticks slanting cut of 5 cm length was given on two sides with the help of sharp budding knife and then the prepared wedge shaped scion was inserted in the cuts given on the stock plant. The graft joint was then tied with the help of 30 cm long and 2.5 cm wide polythelene tape. The tying by polythelene tape helps for better union success and avoiding water loss from the joint of graft union.

#### 3.4.4 After care :

When the grafting operation was over, the field was supplied with fertilizer and then watered immediatly and next waterings were given as per the requirement of field. The further sprouting of new growth below the graft joint was avoided by removing any sprout that had appeared so as to

encourage the sprouting of scions. Weeding operation were also carried out whenever necessary and also the plants were timely observed for disease and pest infestation. The grafting operation were undertaken from Decemeber to April at an interval of fifteen days.

### 3.5 Methodology for part 'B' :

This part of experiment includes the stock plants that were raised in the pots. In the same way of part 'A' the mango stones were selected in the month of may by considering the healthyness and weight of the mango stones.

#### 3.5.1. Sowing of Stones :

The selected local mango stones were planted in the container. In every container two mango stones were planted during the last week of May. Then after the sufficient growth of seedling only healthy and vigorous seedling were retained for grafting and other weak seedlings were removed from each container.

#### 3.5.2 Treatments included :

In this part of experiment, the treatments and replications were the same as the part 'A'. The treatments were dates of grafting and replications were the containers with seedlings arranged in three rows. Also the grafting was carried out at the same dates as like in situ grafting.

Replications : 1) First row of container - R1

2) Second row of container - R2

3) Third row of container - R3

Treatments : Dates of grafting - ,

D1 - 5.12.91

D2 - 20.12.91

D3 - 5.1.92

D4 - 20.1.92

D5 - 5.2.92

D6 - 20.2.92

D7 - 5.3.92

D8 - 20.3.92

D9. - 5.4.92

D10 - 20.4.92

In this part, the plants per replication per treatment were also equal to two. Each treatment was replicated three times so at each grafting date total 6 plants were grafted.

### 3.5.3 Grafting method :

The selected stock plants were given horizontal cut firstly for removing the terminal portion and the vertical cut was given for inserting the scions. The scions of proper maturity and size were selected from cultivar Totapuri as like part 'A'. Then selected scions were given wedge shape and that prepared scion inserted into vertical cut of stock plants. The scions used were defoliated a week prior to grafting. The graft union were also tied by polythelene sheet as like in situ grafting so as to avoid water loss from the graft joint. The grafted plants which were in the container kept in shade.

### 3.5.4 After care :

After completing the grafting operation, the containers were kept in the shade. The containers were supplied with fertilizers and watered immediately. Then after watering were given at regular interval. Also the watch for pest and disease was kept.

### 3.6 Observations :

#### 3.6.1 Growth observations :

From both parts of experiment three representative plants from each treatment were selected for different growth observations i.e. one plant from one replication of same treatment. The details of observations are as below.

##### A) The time required for sprouting :

The grafts were daily observed for their sprouting and the average days required for sprouting were calculated.

##### B) Height of the Bud sprouts :

The height of the bud sprouts of the scion were recorded after 30, 45, 60 and 75 days after grafting at 15 days interval. The height of scion shoot was measured in cm from the base of scion bud to the terminal end of graft.

##### C) Number of leaves per plant :

Average number of leaves per plant were recorded periodically at an interval of 15 days from 30 to 75 days of grafting operation.

##### D) Girth of stock :

The girth of stock was recorded from 30 to 75 days at an interval of 15 days by using vernier caliper. The girth of stock was observed one cm below the graft.

E) Girth of Scion :

The girth of scion was also recorded at an interval of 15 days from 30 to 75 days of grafting. The girth of scion was observed one cm above the graft union.

3.6.2 Observations on success :A) Initial Success :

After confirming the complete sprouting possibilities, the total sprouted grafts were counted and initial success percentage was calculated.

B) Mortality percentage :

The died grafts after successful sprouting were counted after 75 days and mortality percentage was calculated.

C) Final success :

The survived and successfully growing grafts were recorded after 75 days of grafting and the final success percentage was calculated.

#### 4. RESULTS

The data recorded on various aspects of growth and success in soft wood grafting of mango as influenced by time of grafting are presented under appropriate headings.

##### Part A

#### I. Growth observations :

The growth observations in respect of average number of days required for sprouting were recorded as soon as the sprouting of the plant was observed. The growth observations as height of scion shoot, number of leaves per plant, girth of scion and stock were taken at an interval of 15 days and it was continue from 30 to 75 days of grafting so as to see the effect of time on the grafting success and growth of grafted plant of mango.

#### 4.1 Time required for sprouting :

Sprouting observations of an individual plant in every replication were recorded and the average number of days required for sprouting were calculated and they are

Table - 2      Days required for sprouting:

Treatments	Days after grafting for sprouting			Mean
	R1	R2	R3	
D1	15	14	15	14.67
D2	14	14	14	14.00
D3	16	18	18	17.33
D4	18	17	18	17.67
D5	18	20	20	19.33
D6	20	19	18	19.00
D7	-	20	19	19.00
D8	20	20	20	20.00
D9	21	22	-	14.33
D10	-	22	-	07.33

$SE_{\bar{x}} = 3.76$

CD at 5% = 11.18

presented in Table 2.

It is evident from data presented in Table 2 that the days required for sprouting in every treatments do not differ significantly from each other. The sprouting observations in the month of December shows significant superiority over other treatments as the days required from sprouting on the date of 20th December, 91 and 5th December, 91 are 14 days and 14.67 days respectively. From the table it was found that the grafting on the 20th December gave early sprouting than other dates of grafting so 20th December grafting was significantly superior than other dates of grafting then followed by grafting of 5th December and 5th January. The Table also indicates that there was failure of grafts of the 20th April grafting.

From the observations it was found that the days required from sprouting at par level and there was also observed that the days required for sprouting in the month of February, March and April were more than days required from sprouting in the month of December and January. So it shows the superiority of the graft success during December and January than other months like February, March and April.

#### 4.2 Height of Sprouted scion shoot (cm) :

The observation in respect of height of sprouted scion shoot was recorded at an interval of 15 days upto 75 days of grafting. The observations are presented in Table 3.

Table - 3 Mean height of Scion shoot (cm) :

Treatments	Days after grafting			
	30	45	60	75
D1✓	2.40	5.00	6.57	8.57
D2✓	2.10	3.40	4.77	6.17
D3	2.17	3.57	4.57	5.70
D4	2.07	3.77	5.40	6.23
D5	2.10	2.90	3.60	4.27
D6	2.03	2.30	3.47	4.40
D7	1.43	1.37	1.73	2.17
D8	2.00	1.40	2.07	2.33
D9	1.37	1.43	2.07	2.33
D10	0.60	0.00	0.00	0.00
SE ±	0.37	1.05	1.46	1.80
SD at 5%	1.10	3.12	4.32	5.33

The data presented in Table 3 indicates that there was not significant difference in the growth height of scion shoot due to the treatments and the height of scion shoot in every treatment are at par level. The treatments which are at par level were D1, D4, D2, D3 with growth of scion shoot as 8.57 cm, 6.23 cm, 6.17 cm and 5.73 cm respectively which was observed after 75 days of grafting. From the table it was observed that the growth height of scion was maximum in the plant which were grafted on date 5th December and 20th January. So these dates shows significant superiority over other dates of grafting. Also it was observed that plants grafted during February and March showed very little growth. Therefore height of scion shoot of plants which were grafted during December and January were significantly superior over height of scion shoot of plants that were grafted during February and March. Also the height observation from April grafting showed unsuitability of grafting during this month.

#### 4.3 Average number of leaves per plant :

The observations taken on the number of leaves per plant were also recorded at an interval of 15 days from 15 to 75 days of grafting. The observation on an average number of leaves per plant were presented in Table 4.

From the data presented in the Table 4, it was found that there was not any significant difference between treatments and observation in Table 4 also showed that they were at par level. The observation of an average number of leaves per plant was recorded at an interval of 15 days from 15 to 75 days of grafting.

Table - 4 Mean number of leaves per plant :

Treatments	Days after grafting			
	30	45	60	75
D1	3.0	6.0	9.7	12.0
D2	2.3	3.7	6.3	9.0
D3	2.0	4.3	7.0	9.3
D4	3.0	5.0	6.7	9.7
D5	3.3	3.7	4.7	6.0
D6	2.3	4.0	5.0	6.3
D7	2.0	1.3	2.0	3.0
D8	2.7	1.7	2.3	3.0
D9	2.7	2.3	3.0	4.0
D10	1.0	0.0	0.0	0.0
SE $\pm$	0.74	1.43	1.88	2.52
CD at 5%	2.20	4.25	5.59	7.49

leaves per plant showed that the number of leaves were maximum on the plants that were grafted on 5th Decemeber then it was followed by plants grafted on 20th January with 12 and 9.7 number of leaves per plant respectively. It was also clear that the plant grafted during December and January showed more number of leaves per plant while plants grafted during Feburary and March gave comparatively less number of leaves per plant. Also the grafting during April gave less number of leaves in some plants and showed mortality in some plants. This indicates unsuitability of grafting during April. So grafting during December and Janurary gave more number of leaves per plant and were significantly superior over the grafting during Feburary and March which gave comparitively less number of leaves per plant.

#### 4.4 Girth of Scion :

The periodical observation in respect of girth of scion above one cm of grafting operation were taken at an interval of 15 days upto 75 days from grafting. The results of observation were analysed and presented in Table 5.

The results on the observation of the girth of scion obtained were significant. But there was not any significant difference in girth of scion due to treatments. The data presented in Table 5 also indicates that girth of scion was maximum in the plants which were grafted during December and then it was followed by Janurary. The girth of

Table -5                      Mean scion growth (MM)

Day after grafting	30	45	60	75
Treatment	days	days	days	days
D1	5.53	5.93	6.30	6.70
D2	5.27	5.67	6.07	6.43
D3	5.10	5.37	5.73	6.03
D4	5.00	5.33	5.63	5.90
D5	5.03	3.47	3.73	4.03
D6	4.77	3.33	3.57	3.77
D7	3.27	1.73	1.87	2.00
D8	4.70	1.63	1.73	1.87
D9	3.27	1.73	1.90	2.03
D10	1.77	0.0	0.0	0.0
SE $\pm$	0.91	1.25	1.35	1.45
CD <i>at 5%</i>	2.72	3.72	4.01	4.30



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Table-6 Mean root stock Girth (mm)

Treatment	Day after grafting			
	30	45	60	75
D1	5.73	6.13	6.50	6.80
D2	5.60	6.00	6.33	6.60
D3	5.93	6.23	6.67	7.07
D4	6.10	6.33	6.67	7.10
D5	5.83	4.20	4.20	4.47
D6	5.83	4.13	4.37	4.60
D7	3.57	1.93	2.03	2.10
D8	5.63	1.87	2.00	2.13
D9	3.50	1.83	1.97	2.06
D10	1.97	0.00	0.00	0.00
SE $\uparrow$	0.99	1.45	1.52	1.60
CD at 5%	2.95	4.31	4.52	4.76

scion in the plants grafted on 5th Decemeber and 20th Decemeber were 6.7 mm and 6.43 mm, was significantly superior than the girth of scion in the plants that were grafted during Feburary and March. The grith of scion which were observed in the plants grafted during April gave very less girth and some plants showed mortality, this indicates unsuitability of April grafting. So the girth of scion observed from Decemeber and January grafting were significantly superior than the girth of scion observed from February and March grafting.

#### 4.5 Girth of Stock :

The observation in respects of girth of stock were recorded at same interval below one cm of grafted operation from 30 to 75 days of grafting. The observations were analysed and presented in Table 6.

The results obtained on girth of stock were significant and data presented in Table 6 showed that there were not significant differences in the girth of stock due to grafting on the different dates. All observations in every treatment were at par level. From the data it was found that the maximum stock girth was observed the plants grafted during January (7.1 mm) and then followed by the plants grafted during Decemeber (6.8 mm). While the minimum girth was observed in the plants grafted during Februry and March. The girth of stock was also minimum in the plants grafted during April. This shows that the girth of stock in the plants grafted during January and Decemeber

Table 7 In situ Grafting Success

Treatments	Initial Success%	Mortality%	Fial Success%
D1	100.00	0.00	100.00
D2	83.33	0.00	83.33
D2	83.33	0.00	83.33
D4	50.00	0.00	50.00
D5	50.00	16.67	33.33
D6	66.67	16.67	50.00
D7	33.33	16.67	16.67
D8	50.00	33.33	16.67
D9	33.33	16.67	16.67
D10	16.67	16.67	0.00
SE +	4.9	5.1	4.72
CD <i>at 5%</i>	14.76	15.70	13.50

are significantly superior than the girth of stock in the plants grafted during February and March.

#### 4.6 Grafting Success :

The total number of grafted plant in each treatment were six and they were grafted at an interval of 15 days and their initial success, mortality percentage and final success was recorded in Table 7.

From the Table it is clear that the maximum final success 100 per cent was obtained in the plants grafted on 5th December and then followed by 20th December and 5th January each with 83.33 per cent and lowest final success obtained in the plants grafted on 20th February, 5th and 20th March. So it showed that the December and January months were significantly superior for grafting than February and March. Maximum mortality 33.33 per cent was observed in the plants grafted on 5th March. So average initial success of in situ grafting was 56.66 per cent and mortality observed was 11.66 per cent and it gave final success of 45 per cent.

#### Part 'B'

In this part of experiment, the effect of time on the grafting done on the seedling raised in pots were observed.

##### 1. Growth observations

Table 8 Mean Days Required for Sprouting

Treatments	R1	R2	R3	Mean
D1	15	16	16	15.67
D2	16	16	15	15.67
D3	18	19	18	18.33
D4	20	20	00	13.33
D5	22	20	22	21.33
D6	23	24	00	15.67
D7	24	26	24	24.67
D8	00	26	26	17.33
D9	24	25	00	16.33
D10	00	26	00	8.67
SE	+	5.22	CD at 5% = 15.50	

part 'A'.

#### 4.7 Time required for sprouting :

The samples in each replication were carefully observed after grafting operation and time required for sprouting was recorded. The average days required for sprouting were statistically analysed and results of same were presented in Table 8.

It was evident from Table 8, there were not any significant differences between the observations obtained in every treatment. All observations means the average days required for sprouting in each treatment are at par level. From Table it was also observed that early sprouting happened in the plants that were grafted during December and they required 15.67 days for sprouting. Table also indicates the more time required for sprouting in the plants grafted on 5th March and there was much failure of the plants grafted during April. From this it was clear that December grafting was significantly superior than February and March while April grafting proved unsatisfactory.

#### 4.8 Mean height of scion shoot (cm) :

Observation in respect of height of sprouted buds were recorded at an interval of 15 days upto 75 days of grafting. The final observations were statistically analysed and results are presented in the Table 9.

From the table it is seen that, there were significant

Table-9 Mean Height of Scion Shoot (cm)

Treatments	30days	45days	60days	75days
D1	2.20	2.70	3.37	4.43
D2	2.00	3.03	4.07	5.27
D3	1.90	2.40	3.27	4.30
D4	1.30	1.53	1.87	2.40
D5	1.83	1.50	1.93	2.50
D6	1.23	1.37	1.73	2.33
D7	1.80	1.37	1.60	2.30
D8	1.27	0.67	0.83	1.17
D9	1.30	0.73	0.90	1.20
D10	0.70	0.00	0.00	0.00
SE +	0.42	0.55	0.69	0.90
-				
CDat 5%	1.26	1.63	2.05	2.76





significant differences between height of shoot of every treatment. All height observation were at par level. The height of scion shoot was maximum in the plants which was grafted on 20th December and then followed by 5th December and 5th January with height 5.27, 4.43, and 4.30 cm respectively. The lowest height of shoot was observed in the plants grafted on 20th March. Table also indicates there was complete failure of grafted plants that were grafted on 20th April. Therefore 20th, 5th December and 5th January were significantly superior over other dates of grafting and 20th April was totally undesirable date for grafting.

#### 5.9 Average number of leaves per plant :

The average number of leaves per plant observation were recorded at an interval of 15 days from 30 to 75 days of grafting. The observations were analysed and presented in Table 10.

The results obtained were significant and it is evident from Table that the number of leaves per plant observation donot difere significantly from each other. The highest number of leaves were obtained on the plants grafted on 20th December then followed by 5th December and 5th January each with 9.7, 9.0 and 8.7 leaves respectively. The lowest number of leaves were observed on the plants grafted during March. only 6.5 leaves per plant. February gave medium success in case of leaves number per plants and 7.5

Table-10 Mean Number of Leaves per Plant

Treatments	30days	45days	60days	75days
D1	2.3	4.3	6.7	9.0
D2	2.3	5.0	6.7	9.7
D3	3.3	5.3	6.7	8.7
D4	1.0	2.3	3.0	3.7
D5	1.3	2.3	3.7	5.0
D6	1.7	3.0	4.3	6.0
D7	2.3	2.7	3.7	5.0
D8	1.7	1.0	1.3	2.0
D9	1.7	1.7	2.3	3.0
D10	0.3	0.0	0.0	0.0
SE±	0.56	1.03	1.45	1.98
CD at 5%	1.66	3.05	4.30	5.87

April was undesirable for grafting gave no success. Hence 20th December, 5th December and 5th January showed significant superiority over 20th January, February and March completely.

#### 4.10. Girth of Scion :

Periodical observations on girth of scion one cm above the graft union were recorded at an interval of 15 days. The observations recorded were analysed and results are presented in Table 11.

It is seen from Table that there were not any significant differences in the girth of scion from every treatments. But all observations on girth of scion were at par level. The table also indicate that maximum scion girth was noted in the plants grafted on 5th December and then followed by 20th December and 5th January each with 5.83, 5.60 and 5.50 mm respectively and lowest girth observed in the plants grafted on 20th March and 5th April. Medium scion girth was observed on the remaining dates from January 20th to 5th March. The 20th April showed complete failure in 45 days of grafting. Thus 5th December was most significant and 20th December, 5th January were significantly superior than later from 20th January to 5th March and 20th March and 5th April were poorest among all.

#### 4.11. Girth of Stock :

Frequent observations on girth of stock were recorded

Table 11 Mean Scion Girth (mm) :

Treatment	Day after grafting			
	30	45	60	75
D1	5.03	5.27	5.57	5.83
D2	4.90	5.13	5.37	5.60
D3	4.67	5.00	5.27	5.50
D4	3.20	3.37	3.50	3.63
D5	4.93	3.43	3.63	3.80
D6	3.00	3.50	3.70	3.83
D7	4.80	3.33	3.57	3.83
D8	3.27	1.70	1.77	1.80
D9	3.13	1.70	1.77	1.87
D10	1.53	0.00	0.00	0.00
SE $\pm$	1.50	1.31	1.37	1.43
CD at 5%.	3.10	3.83	4.07	4.24

below the graft union were recorded at an interval of 15 days from 30 to 75 days of grafting. The observations were analysed and presented in Table 12.

It is seen from table that the observation on girth of stock from each treatment do not differ significantly from each other. The all observations from every treatment are at par level. Also the table indicates that maximum stock girth was observed in the plants grafted on 5th December, 20th December and 5th January each with 6.20 mm, 6.06 mm and 6.03 mm respectively. Medium observations were noted from the 20th January to 5th March. While 20th March and 5th April gave lowest stock girth each with 2.03 and 1.57 mm respectively and 20th April grafting showed unsuitability.

#### 4.12 Grafting Success :

After taking the observations in respect of sprouting of scion the percentage were calculated after confirmation of no possibility of further sprouts. The results obtained are presented in Table 13 along with mortality percentage and final success of every treatments.

It is evident from data presented in Table 13 that the maximum initial or final success was obtained in the plants grafted on 5th December (80.0%) and then followed by 20th December and 5th January each with 66.67 per cent. Then medium success was observed from 20th January to 5th March and lowest success observed in the plants grafted on

Table -12

Mean epithelial width (mm)

Treatment	Day after grafting			
	30	45	60	75
D1	5.50	5.48	5.77	6.20
D2	5.18	5.47	5.77	6.36
D3	5.08	5.43	5.77	6.05
D4	3.87	3.80	3.97	4.07
D5	5.13	5.60	3.85	4.10
D6	3.30	3.53	3.77	3.77
D7	4.93	3.43	3.60	3.77
D8	3.50	1.93	2.00	2.50
D9	3.43	1.73	1.83	1.97
D10	1.73	0.00	0.00	0.00
SE <u>±</u>	1.14	1.40	1.48	1.50
CO <i>at 5%</i>	3.38	4.17	4.39	4.58

Table -13

## Grafting success:

Treatments	Initial Success %	Mortality %	Final Success %
D1	83.33	-	83.33
D2	66.67	-	66.67
D3	66.67	-	66.67
D4	33.33	-	33.33
D5	50.00	16.67	33.33
D6	50.00	-	50.00
D7	50.00	16.67	33.33
D8	33.33	16.67	16.67
D9	33.33	16.67	16.67
D10	16.67	16.67	-
SE+	2.99	3.75	2.71
OD at 5%	2.73	10.95	10.82
Average	48.33	8.33	40.00

Mortality was major problem in March and April each with 16.67 per cent. Hence 3th December, 20th December and 5th January was significantly superior than other dates from 20th January to 5th April. The average final success of pot grafting was 40 per cent and average mortality was 8.33 per cent.

## 5. DISCUSSION

In the review of literature on propagation of mango particularly soft wood grafting there appears to be very few work has been done so far to standardize the method of propagation. It is affected by several factors viz. thenutritional conditon of the plant, time of operation, soil condition, age of tree andshort taken hormonal balance and environmental factors. In the standardization of method of soft wood grafting in mango, the results on the various characters studied in respect of growth and success are presented in previous chapter and discussed here under appropriate headings.

### part 'A'

#### I Growth Characters :

The aspect of the growth were studied ~~the~~ on time required for sprouting, height of scion shoot, number of leaves per plant girth of scion and girth of stock which indicates the proper union and acting the scion and stock as one plant which ultimately results in vigour and they give the success of the propogared plants.

#### 5.1 Sprouting :

It is evident from the data presented in Table I, that the time of grafting was permost factor responsible for sprouting of grafted plant. The minimum days are required

for sprouting during the month of December and the days required are 14 to 15 days. The grafting carried out during December also gave vigorous sprout than the plants grafted in other month like January February and March which required 17 to 23 days for sprouting. The early sprouting in the plants grafted in the month of December may be due to the proper climatic condition viz. temperature and humidity. The maximum temperature ranged during the month of December varied from 28.6 to 31.9 c and minimum temperature ranged was 9.3 to 12.9 c. This temperature range might be favourable temperature range for sprouting so early and vigorous sprout had obtained. Also another factor responsible for sprouting might be humidity which was ranged from 67 to 74 per cent (maximum) and minimum humidity ranged from 21 to 32 per cent during December. This favourable humidity might be possible cause of early sprouting. similar results were obtained by Subbarao (1968) who studied propagation of mango under Akola condition by veneer grafting. They showed that average temperature range of 29.7 to 31.9 c was favourable for grafting success which was closely related to the temperature range of December.

## 5.2 Growth of Scion Shoot :

It is evident from the Table 3, <sup>that</sup> the maximum growth height of scion shoot was observed during December and January, but the height growth of scion shoot was observed in the plants grafted on 5th December and it was 8.57 cm which was significantly superior than the other plants

grafted from 20th December onwards. Also table indicates that growth height was minimum in the plants grafted on 20th March and 5th April. The reason for maximum height during December and January may be favourable temperature and humidity. As the more number of leaves also observed on these plants, perhaps they may be helpful in increasing scion shoot. This growth results obtained are some what different from the results obtained by Patel and Amin (1981), they showed that February to May gave 85 to 97 per cent, but in our experiment maximum success was during December and January while less success from February to April. This indicates that the region may affect of graft and growth of scion shoot the reasearch of scientist was carried out in one region while our experiment was carried out in another region that may be cause for changing climate.

### 3.3 number of leaves :

It is seen from Table 4, that more number of leaves per plant were observed during the month of December and January. The reason for more number leaves may be early and vigorous sprouting of graft. Due to the vigorous growth there may be proper utilisation of sunlight in photosynthesis and there had good food manufacture Table also indicates the less number leaves per plant was observed during March and April. This particularly due to the high temperature which causes rapid loss of water through the plant. As water is raw product of photosynthetic product

it yet lost then photosynthesis get affected. And if C:N ratio is not proper in the plant then all activity like growth of shoot and leaves get affected. Also the loss of water through graft union may be less during Decemebr and January due to low temperature, while it may be more during March and April due to high temperature. This may be reason for affecting vigour and number of leaves in plant.

#### 5.4 Scion and Stock girth :

It was found from Table 5 and Table 6 that the maximum girth of scion and stock was observed in the plants grafted during the month of December and January. The probable reason for this may be the effect of scion and stock on each other or there may be proper nutrition due to more number of leaves on these plants. Also, the plant grafted during December and January gave early and vigorous growth, this may cause significantly superior growth of scion and stock during these month. There is also possibility like the stock used for grafting may be from good local variety and if such good local cultivar is there for root stock then it ultimately encourages the girth of scion, height of scion shoot. For example, the cultivar like Diour, Bappakai induces dwarfness in the plant and ultimately causes increase in the breadth and diameter of the stock and scion simultaneously. There may be also effect of scion on stock which was in full nutritional condition and in active state during the month of December and January. So due to the

interaction girth of growth may be more during these month.

### 3.5 Success :

It is evident from Table 7, that the maximum success was observed during Decemeber and then followed by 5th January grafting. Very little success was obtained during March and April. The reason for success was temperature and humidity. The temperature was at favourable range during December and January but very high temperature was noted during March and April and that affect cambial activity due to lost of water through the graft joint. So mortality also observed from February to April and there was no mortality during the month of December and January. Hence final success was also maximum during December and January and it ranges from 88.33 to 100 per cent. The another reason for high success during these month may be well swelled scion stick because December and January is sprouting season of mango. Similar result was also observed by Subbarao (1968). they studied the propogation of mango by veneer grafting and they showed that January and Feburary are also good for grafting:

Part 13'

Part 13' studying the comparision between in situ soft wood grafting and grafting on seedling raised in container, pot grafting were done side by side while carried out the in situ grafting. In pot grafting studies same treatments of

dates of grafting were carried out as like in situ grafting. The result obtained in respect of growth and success are also discussed in part 'B'.

#### I. Growth observation :

The growth observation were similar to that of in situ grafting as number of days required for sprouting, height of scion shoot, number of leaves and girth of scion and stock.

#### 2.3 Sprouting :

It is evident from the Table 8, that the minimum days required for sprouting were observed in the month of December. And minimum days required were 15.67. It clearly indicates that the grafting success during December was significantly superior than other grafting dates. The less average success was obtained in the plants grafted on the 30th April indicates the failure of the plant, but not less days for sprouting. so in pots grafting study days required for sprouting varies from 15.67 to 24.67. The minimum days required for sprouting during December might be due to the well sprout condition of scion stick. And the sprouts were well swollen as December coincide with sprouting of mango for flowering. The maximum time during February and March might be due to exhaustion of the scion shoot for flowering. So the early sprouting observed during December and then followed by January while more days were required from February to April.

### 5.7 Scion Growth

The results in pot 2 (Table 9) indicates the maximum growth was observed in the plants grafted on the 20th December and then followed by 5th December and 5th January. These maximum growth may be due to well swelled scion stick which might gave vigorous sprout. And this may be due to less transpiration from graft union. Tayde et al. (1988) also observed the maximum scion growth by soft wood grafting than other methods of grafting, and they also showed that the proper maturity of scion stick gave better growth.

### 5.8 Number of leaves per plant

The results obtained were significant and there were not any significant differences in number of leaves from every treatment. Table 10 indicates that the maximum number of leaves obtained on the plants that were grafted on 20th December, 5th December and 5th January. This more number of leaves may be due to already vigour of root stock. Because such vigour root stock had more number of leaves and they might synthesised more food material that may be supplied to new growth and ultimately vigorous shoot with more number of leaves may be produced. Also, the temperature condition might be favourable for proper healing of graft union that might be caused more number of leaves per plant.

### 5.9 Girth of scion and stock

Girth of scion was maximum during month of December

and in the plants that were grafted on the 5th January. While minimum girth of scion was observed in the plants grafted on 20th March and 5th April. But the girth of stock was maximum in the plants grafted in December and minimum girth was observed in the plants grafted on same dates as like scion girth affecting dates. The probable reason might be the effect of root stock on scion and vice versa. Local mango stones selected from quickly growing mango might be root stock of these plants which had maximum stock and scion girth. Also, their root system may be well developed than other plants due to proper manufacture of food by favourable temperature.

### 3.10 Success

For the higher success the factors like temperature, humidity, cambial activity, root stock girth and maturity of scions are important. From Table 13, it is seen that the maximum success observed during December and plants grafted on 5th January. This results may be due to favourable temperature and humidity. The temperature range varies from 28 to 32 °C and humidity was above 65 per cent which might favour the graft success. Also, the mortality was only observed from February onward and this may be due to rise in temperature and decrease in humidity which were essential for graft success. Gunjate and Limaye (1978), showed that optimum date of grafting was 5th May. This relates to our study as there is cloudy weather from mid-May and they increase humidity in the atmosphere, such humidity

might be observed during winter. Also, the average initial success was 33 per cent and mortality was less only 3.33 per cent, which might be due to shady situation of the grafts which maintain the proper humidity.

Phillips et al (1970), also reported that the proper humidity and temperature required for survival and they used shed of Barana leaves which relates to our study.

#### 5.11 Comparison between in situ and in pot grafting

From the experimental investigation it was observed that, the in situ grafting gave higher success than in pot grafting. The average final success of in situ grafting was 45 per cent and in pot grafting was 40 per cent. While mortality percentage of in situ grafting was 11.66 per cent and of in pot grafting was 8.33 per cent. The success of in situ grafting was maximum might be due to well established root stocks having more leaves and good type of root system with proper nourishment from the soil, these conditions might be poor in pots where there may be restricted root system and less developed stock particularly due to temperature difference of in situ and in pot grafting. Reddy and Melante studied the soft wood grafting in situ and in container. They reported higher success in in situ grafting than in pot grafting, so our results obtained are significant and similar to this review.

But the mortality of in situ grafting were maximum than in pot grafting this might be due to open condition for in situ grafting which may cause high transpiration.

graft joint while pot grafts were in shed that why mortality  
may be less in pot grafting. But as for as all condition  
concerned in situ grafting was superior than in pots  
grafting as in respect of growth number of leaves, girth of  
scion and stock.

## 6. S U M M A R Y

An experiment was conducted to study the effect of time on the softwood grafting of mango in situ and in pots, at the central Nursery scheme, Department of Horticulture, M.A.U. Parbhani during 1991-92. The experiment was divided into two parts, each part consist of ten treatments which were replicated three times.

The growth observations on period required for sprouting, height of sprouted scion, number of leaves per plant, girth of scion and stock were recorded at 15 days interval from 30 to 75 days of grafting operation. The initial and final success along with mortality percentage were also studied. The experiment was carried out from December to April, the scion sticks for the experiment were used from Totapuri mango which were defoliated a week prior to grafting.

### PART-A

1. In insitu grafting, the time required for sprouting increased from December to April as 14 to 20 days which was due to increase in temperature and reduction in humidity.

The maximum successful sprouts were obtained during December and then followed by January, also early sprouting occurred during December and late sprouting during March-April.

.2 The periodical observation on growth of scion

shoot produced superior results during December and January. There was maximum growth of scion shoot during these two months which was in the range of 6.13 to 8.57 cm after 75 days from grafting.

3. The number of leaves also produced more during the December and January which indicates, there was correlation between growth of shoot and number of leaves. The highest number of leaves observed on the plant were 12.67 and minimum 3 leaves were observed from December and March grafting respectively.

4. Maximum scion and stock girth also observed during December and January. The maximum scion girth was ranged from 5.9 to 6.7 mm and minimum was from 1.8 to 2mm, while the stock girth ranged from 6.7 to 7.1 mm which was maximum and minimum was 2.06 to 2.10 mm.

5. The initial and final success was maximum from 5th December to 5th January grafting, which was ranged from 83.33 to 100 per cent. The lowest final success observed in the plants grafted from 5th March to 5th April (16.67%). While the grafting done on 20th April gave nil success. Mortality was observed from February to April which was generally 16.67%. The average initial success reported in insitu grafting was 56.66%, average mortality was 11.66% and average final success was 45%.

#### PART-B

1. In pots studies, early sprouting was also observed during December and the days required for sprouting was

15.67. This indicates, the superiority of December grafting over other months from January to April.

2. The maximum scion growth observed in the plants grafted from 5th December to 5th January which was 3.26 to 4.07 cm while minimum growth was only 1.10 to 1.20 cm, observed from 20th March and 5th April. Grafting on 20th April proved to be unsatisfactory.

3. The more number of leaves <sup>were</sup> also observed in the plants grafted from 5th December to 5th January was reported from 8.67 to 9.67. While minimum leaves 2-3 was reported from 20th March and 5th April grafting.

4. Scion and stock girth observation was also the same as above observation, that the scion girth was maximum in the plants grafted from 5th December to 5th January and minimum in the plants grafted from 20th March to 5th April. While stock girth was maximum and minimum in the same period of scion girth.

5. Initial success was maximum from the plant grafted during the period from 5th December to 5th January which was 66.67% to 83.33% and minimum initial success observed was 33.33%. The final success during December and January was same as initial success. While minimum final success only 16.67 was reported from 20th March to 5th April and nil from 20th April grafting. Mortality was started from February and was generally 16.67% in every treatment except D6.

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CONCLUSION

PART-A

Insitu grafting gave maximum success from the grafting carried out from 5th December to 5th January, **which** indicates that above period was superior than other dates from 20th January to 20th April. Also 20th April proved completely undesirable. It clearly indicates that temperature and humidity play an important role in the success of grafting.

The average initial success in insitu grafting was 56.66% and average mortality was 11.66%, so final average success was 45%. Therefore it was concluded that the grafting from 5th December to 5th January was superior than other remaining dates.

ART- B

In pot studies, the maximum success was obtained from 5th December to 5th January and minimum from 20th January to 5th April, except 20th February which gave 50% success (medium).

The initial average success was 48.33% and average mortality was 8.33%, so average final success was 40% .

Therefore it was concluded from the experimental study that insitu grafting always gave higher success (83-100%) than pot grafting (67-83%) during the month of December and January. Also all the growth observations were superior in insitu grafting than pot grafting. The average final

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success of insitu grafting was also more (45%) than pot grafting (40%). Hence insitu grafting was always superior than pot grafting.

However one year study is not sufficient to conclude result so it should be repeated and comparison between results should be carried out.

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