

Effect of date of stem cutting on success, survivor and growth of different minor fruits

M.A.K. Siddique, M.H. Rahman, M.A. Rahim and M.S. Alam

Department of Horticulture, Bangladesh Agricultural University, Mymensingh

Abstract: An experiment was conducted at the Bangladesh Agricultural University, BAU-Germplasm Centre of Fruit Tree Improvement Project (FTIP) under the Department of Horticulture, BAU, Mymensingh from January to May 2008 to study the effect of time of cutting on success, growth and survivor of different minor fruit trees. The two factor experiment consisted of five fruit varieties viz., Scented elachi lemon, Semi seedless lemon, Hog plum, Baichi, Indian olive and four cutting times viz., 21 January, 31 January, 10 February, 20 February. The experiment was laid out in Randomized Complete Block Design (RCBD) with three replications. The maximum success (78.58%) and survivor (58.66%) were recorded from cutting of Scented Elachi lemon. The minimum success and survivor of cutting were recorded in Indian olive. In case of effect of date of cutting, the maximum (58.66%) success was recorded from 20 February cutting operation while the minimum was recorded in 31 January. The maximum growth of the cuttage was observed in 20 February cutting operation. The combined effect of different minor fruits and cutting time was also significant. The treatment combination of Scented elachi lemon and 20 February cutting produced the maximum success and survivor and growth. The experiment showed that cutting on 20 February in scented elachi lemon is the best for propagation among the different minor fruits.

Key words: Cutting, date, minor fruits

Introduction

Lime (*Citrus aurantifolia*), Lemon (*Citrus limon*), Hog plum (*Spondias mangifera*), Indian olive (*Elaeocarpus floribundus*) and Baichi (*Flacourtia jangomas*) are common minor fruits of Bangladesh grown throughout the country mostly in homestead garden. The total production of lime and lemon is almost 15,000 metric tons from 5260.91 hectares of land. According to the available statistics the total area under minor fruits (including Indian olive) are about 15000 ha, while the total production in the year 2005-2006 was 20,000 mt (BBS, 2006). The common people of Bangladesh generally suffer from different malnutritional problems. It is reported that 93% people of Bangladesh are suffering from the deficiency of vitamin C (Anonymous, 1980). All such malnutrition problems could have been reduced if the people of Bangladesh would have adequate access of fruits, especially citrus fruits which are generally known to be rich in vitamins and minerals. Citrus have also some medicinal value (Reuther *et al.*, 1967). Citrus fruits are very important in respect of its food value specially being very rich in vitamin C and vitamin A. These fruits can be eaten as fresh fruit, and various food items can also be prepared from the juice. The flowers, leaf and rind of citrus contain oil of good fragrance and have good commercial value for preparation of perfume.

Citrus cultivation is gaining popularity day by day in Bangladesh. At present only 4574.89 ha of land is under citrus cultivation in Bangladesh. Both sexual and asexual methods are practiced in their propagation, sexual propagation in many cases results in poor fruit qualities and other varietal characters due to high genetic variations. In vegetative propagation, however, no genetic variation takes place since any genetic union with recombination of genes occur. Hence, the propagules are of generally true to type. There are various methods of propagation for citrus fruit. Among these, stem cutting is the easiest, cheapest, convenient and least time consuming method. It is less technical and therefore, possibly the widest method of propagation in practices (Kar *et al.*, 1973). Different species and varieties of citrus also vary considerably from one another in rooting performance. The present experimental set up has been established to study the rooting of Lime, Lemon, Hog plum, Baichi, and Indian olive. A vital part of the present study includes a through

investigation of rooting of stem cuttings of the above mentioned fruits. Plants propagated by cutting not only give early bearing of quality product, but also eliminate stock-scion interactions. For large scale of propagation, cuttage had been advocated by many horticulturists. A number of horticultural plants including lime are propagated by cutting. A number of factors influence the performance of stem cutting, among these proper handling, high humidity, moderate temperature, optimum mineral nutrition and selection of scion are important. Technology suitable for the conservation of minor fruits has not yet been developed (Hortman, 1972; Hoque and Ahmed, 1966 and Jaubar and Rahman, 1958). To achieve these goals the following objectives have been included in the study: i) to study the possibility of vegetative propagation in different minor fruits; ii) to study the conservation of minor fruits with their quality as like as their mother plant and iii) to analyze and study the performance of stem cutting in minor fruits.

Materials and Methods

The present study was carried out at the BAU Germplasm Centre of Fruit Tree Improvement Project (FTIP), Department of Horticulture, Bangladesh Agricultural University, Mymensingh during the period from January to May 2008. The experiment was consisted of five minor fruits viz., Scented elachi lemon (*Citrus limon*), Semi seedless lemon (*Citrus aurantifolia*), Hog plum (*Spondias mangifera*), Baichi or Madagascar plum or lukluki (*Flacourtia jangomas*) and Indian olive (*Elaeocarpus floribundus*) and four different dates of cutting viz. 21 January, 31 January, 10 February and 20 February and there were 20 treatment combinations. The two factors experiment was laid out in Randomized Complete Block Design with three replications. According to the design and objective of the experiment the following works were done (i) Selection of mother plants for cutting material collection (ii) Collection of cutting materials from mother plant, (iii) Preparation of cutting (iv) Preparation of poly bag (v) Manipulation of poly tunnel (v) Planting of cutting . The non-flowering shoots with fresh growth having dark green in colour leaves, about 18-25cm long straight; healthy, pest and disease free with swollen terminal bud in bulging condition were collected from the cutting mother plant on the day for using in cutting

operation. All the leaf blades of the collected shoots were trimmed off leaving one-fourth, of the petiole with dormant bud and carried immediately to the working place wrapped with wet cloth or polythene bag to minimize desiccation. Soil mixture for polythene bag was prepared by well decomposed cowdung and soil. Cutting was used in the experiment. In this method 4 cm long smooth slanting cut was made at the proximal end of the cutting. It was done with the help of a sharp knife. Then the cutting becomes ready for placing in the rooting media. Prepared cuttings were placed in the prepared polybag at 45° to the northern face. After performing cutting operation polybag were kept under the polytunnel. Immediately after planting, watering was done uniformly by watering cane. Shading, watering, weeding and insect and disease control were done as when necessary. Observation was made after 10 days of planting on the following parameters; Percentage of success, survivor percent, fresh weight of shoots per

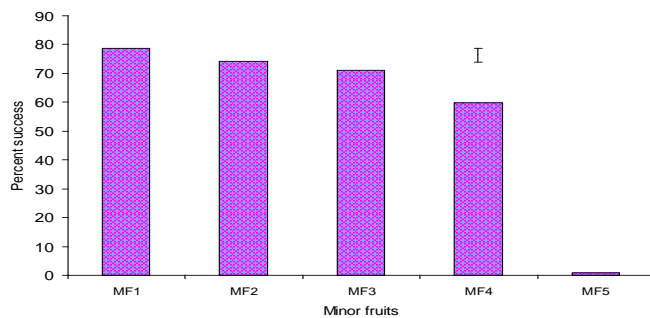


Fig. 1. Effect of minor fruit variety on percent success. The vertical bar represent LSD at 0.05 level of significance (MF1 = Scented elachi lemon, MF2 = Semi seedless lemon, MF₃ = Hog plum, MF₄ = Baichi, MF₅ = Indian Olive)

Table 1. Combined effect of minor fruit variety and time of cutting on % success, % survivor

Minor fruits	Cutting time	Percentage of success	Percentage of survivability
MF1	T1	78.00	67.33
	T2	79.00	68.00
	T3	77.66	66.33
	T4	79.66	64.66
MF2	T1	74.33	63.33
	T2	71.00	59.66
	T3	75.66	65.33
	T4	76.00	63.66
MF3	T1	70.33	63.33
	T2	66.00	57.00
	T3	72.00	60.66
	T4	76.33	64.00
MF4	T1	62.66	54.00
	T2	61.00	52.66
	T3	54.00	46.00
	T4	61.33	54.00
MF5	T1	0.00	0.00
	T2	0.00	0.00
	T3	0.00	0.00
	T4	0.00	0.00
LSD(0.01)		5.632	5.540

MF1=Scented elachi lemon, MF2= Semi seedless lemon, MF3= Hog plum, MF4= Baichi, MF5=Indian olive, T1= 21 January, T2= 31 January, T3= 10 February, T4= 20 February,

The maximum success percent (58.66) was recorded on 20 February, while the minimum success (55.40%) was

cutting, dry weight of shoots per cutting, fresh weight of roots per cutting, dry weight of roots per cutting, days required to first flash, number of flashes per cutting. The number of successful rooted cuttings was recorded. After initial success the cutting were observed for four months and some cuttings were died during this period. At the end of 120 days number of cuttings survivor was calculated.

Results and Discussion

Percent success of cutting: A highly significant effect was also observed with minor fruits on the percent of success and survivor. The maximum success (78.58%) in cutting was recorded with scented elachi lemon while the minimum (0.00%) was with indian olive (Fig.1). The maximum success with scented elachi lemon might be due to actively growing stage of cutting as well as cambial activity which helped maximum rooting. The success of cutting was found significantly affected by the different dates of cutting.

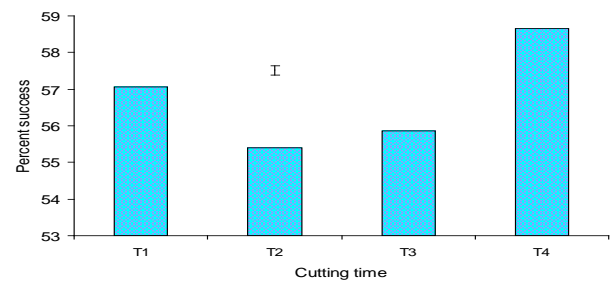


Fig. 2. Effect of cutting time on percent success. The vertical bar represents LSD at 0.05 level of significance (T₁ = 21 January, T₂ = 31 January, T₃ = 10 February, T₄ = 20 February)

recorded on 31 January (Fig.2). The difference in the success might be due to the prevalence of varying climatic conditions during cutting operation. The maximum success on 20 February might be due to hot and more humid (average relative humidity 75%) environment.

Combined effect of minor fruit and time of cutting on the percentage of success was highly significant. Percentage of success was counted 30 days after cutting operation for different treatment combinations which ranged from 00% to 79.66% (Table 1). The maximum success with scented elachi lemon placed on 10 February might be due to favourable climatic conditions, which enhanced rooting. The minimum success was observed in Indian olive (0.00%) at any date of cutting.

Survivor percentage: Survivor percentage was also varied greatly by the effect of minor fruits. The maximum survivor percentage (66.58%) was obtained with scented elachi lemon after 120 days of cutting operation (Fig. 3).

From the present investigation it was observed that percentage of survivor was significantly influenced by the different date of cutting. The maximum survivor (49.60%) was obtained from 21 January (Fig. 4) which was statistically identical with 20 February. The minimum survivor from 31 January (47.66%) was probably due to very low temperature because during low temperature root formation was not occurred properly which hindered the survivability of the cutting.

A highly significant combined effect was also observed with minor fruits and date of cutting on the percentage of survivor. Percentage of survivor was counted and 120 days after cutting from different treatment combinations. The survivor rate ranged from 0.00% to 67.33% (Table 1). The maximum survivor was observed from 31 January (68.00%) cutting in scented elachi lemon. The minimum survivor

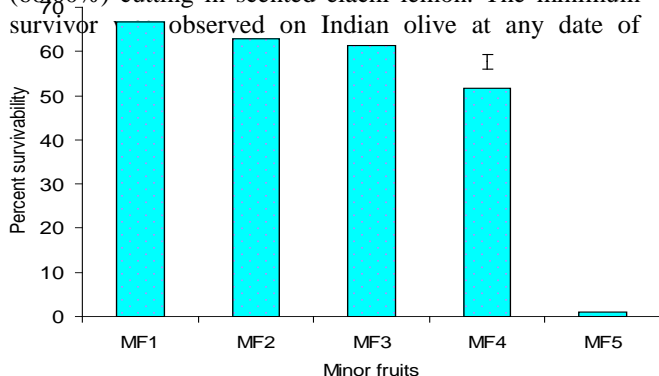


Fig. 3. Effect of minor fruit variety on survivor. The vertical bar represents LSD at 0.05 level of significance (MF₁ = Scented elachi lemon, MF₃ = Hog plum, MF₂ = Semi seedless lemon, MF₄ = Baichi)

observed on Indian olive at any date of cutting. The identical result was also recorded on 21 January and 31 January on scented elachi lemon. The maximum survivor of cutting in scented elachi lemon during the time of 31 January might be due to actively growing stage of cutting, favourable temperature and relative humidity. The minimum survivor of cutting of indian olive at any time due to incapability of producing root.

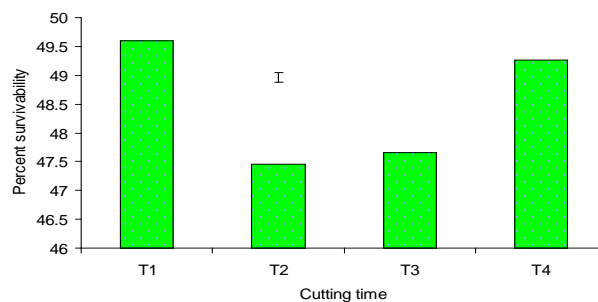


Fig. 4. Effect of cutting time on percent survivor. The vertical bar represents LSD at 0.05 level of significance (T₁ = 21 January, T₃ = 10 February, T₂ = 31 January, T₄ = 20 February)

Table 2. Combined effect of minor fruit variety and time of cutting on plant height (cm)

Minor fruits	Cutting time	Plant height (cm)					
		30 DAC	40 DAC	50 DAC	60 DAC	70 DAC	80 DAC
MF ₁	T ₁	16.62	17.83	20.00	21.93	23.90	26.30
	T ₂	14.73	16.73	18.60	21.10	23.13	25.33
	T ₃	13.13	15.26	17.30	22.60	23.90	26.13
	T ₄	17.26	19.06	21.03	23.23	25.10	27.40
MF ₂	T ₁	15.30	20.26	21.90	22.56	24.86	25.30
	T ₂	14.33	16.76	18.83	20.63	25.10	27.36
	T ₃	16.93	19.00	21.10	23.46	25.66	26.03
	T ₄	16	18.23	20.70	22.90	24.83	27.50
MF ₃	T ₁	18.50	20.50	22.46	24.70	26.62	21.53
	T ₂	17.66	19.63	21.96	23.96	25.96	28.13
	T ₃	14.00	16.26	18.66	20.46	22.53	25.03
	T ₄	17.50	19.63	21.66	24.03	25.70	28.16
MF ₄	T ₁	11.16	13.46	15.80	17.96	19.43	21.50
	T ₂	10.83	12.80	14.83	16.83	18.83	21.33
	T ₃	10.26	12.76	14.93	16.96	18.86	21.90
	T ₄	9.23	11.53	13.56	15.53	17.43	20.13
LSD(0.01)		1.834	2.003	1.960	0.710	1.810	1.534

DAC =Days after cutting, NS = Non significant, MF1=Scented elachi lemon, MF2= Semi seedless lemon, MF3= Hog plum, MF4= Baichi, MF5=Indian olive, T1= 21 January, T2= 31 January, T3= 10 February, T4= 20 February,

Plant height: Plant height was measured at 10 days interval and showed significant variation. At 80 days after cutting the maximum plant height (26.29cm) was found in scented elachi lemon. The minimum plant height (21.21cm) was found in Baichi. The maximum plant height found at 21 January cutting in scented elachi lemon due to earliest bud breaking and better rooting. The increase in plant height was appeared to be related with date of cutting which varied significantly but at 60

days after cutting it showed non-significant variation (Fig. 6). The results showed that there was a linear increase in plant height. The maximum plant height was found on 20 February (25.80cm) followed by 31 January (25.54cm) and the minimum was recorded on 10 February (13.06cm). The maximum plant height was found on 20 February might be due to better root formation, earliest bud breaking and proper nutrition supply to the growing shoot which was also supported by Dhar (1998).

Table 3. Interaction effect of minor fruit variety and date of cutting on fresh and dry weight of shoots and roots

Minor fruits	Cutting time	Fresh weight of shoots(g)	Dry weight of shoots(g)	Fresh weight of roots(g)	Dry weight of roots(g)
MF ₁	T ₁	3.41	0.751	2.725	0.381
	T ₂	1.010	0.263	1.497	0.155
	T ₃	2.66	0.623	0.438	0.045
	T ₄	1.798	0.424	0.344	0.035
MF ₂	T ₁	3.518	0.880	2.350	0.218
	T ₂	2.539	0.593	0.941	0.098
	T ₃	1.481	0.350	0.384	0.045
	T ₄	1.105	0.249	0.331	0.029
MF ₃	T ₁	6.944	1.448	1.240	0.118
	T ₂	5.327	0.945	0.125	0.037
	T ₃	4.546	0.881	0.831	0.075
	T ₄	3.73	0.784	0.727	0.074
MF ₄	T ₁	0.691	0.217	0.320	0.035
	T ₂	0.467	0.147	0.423	0.053
	T ₃	0.450	0.142	0.611	0.072
	T ₄	0.447	0.141	0.128	0.017
LSD(0.01)		0.123	0.123	0.224	0.007

DAC =Days after cutting, NS = Non significant, MF1=Scented elachi lemon, MF2= Semi seedless lemon, MF3= Hog plum, MF4= Baichi, MF5=Indian olive, T1= 21 January, T2= 31 January, T3= 10 February, T4= 20 February,

Table 4. Interaction effect of minor fruit variety and time of cutting on number of flash per plant

Minor fruits	Cutting time	Number of flash per plant					Days required to first flush
		30 DAC	40 DAC	50 DAC	60 DAC	70 DAC	
MF ₁	T ₁	1.66	2.00	3.30	4.00	5.00	24.00
	T ₂	1.66	2.00	3.00	3.6	4.66	23.33
	T ₃	1.00	1.66	2.3	3.00	4.33	22.23
	T ₄	1.33	2.00	3.00	4.33	5.00	20.33
MF ₂	T ₁	0.66	2.00	2.66	4.00	4.66	25.06
	T ₂	1.00	1.33	2.33	3.66	4.33	23.33
	T ₃	1.33	2.00	2.33	2.66	3.33	23.43
	T ₄	1.00	1.66	2.00	2.33	3.66	23.60
MF ₃	T ₁	1.66	2.00	1.66	2.33	3.00	25.63
	T ₂	1.33	1.33	2.33	2.33	3.00	24.83
	T ₃	1.00	1.33	2.33	2.33	3.00	23.86
	T ₄	1.33	1.66	2.00	3.33	4.00	24.00
MF ₄	T ₁	1.66	2.00	2.00	3.00	3.66	25.16
	T ₂	1.00	1.33	2.33	3.66	4.00	25.40
	T ₃	1.00	1.33	2.33	3.66	4.00	25.83
	T ₄	1.33	1.66	1.00	2.66	2.66	24.53
LSD(0.01)		0.369	0.362	0.497	0.395	0.340	0.180

DAC =Days after cutting, NS = Non significant, MF1=Scented elachi lemon, MF2= Semi seedless lemon, MF3= Hog plum, MF4= Baichi, MF5=Indian olive, T1= 21 January, T2= 31 January, T3= 10 February, T4= 20 February,

Plant height of different cutting plants differed significantly due to the combined effect of minor fruits and time of cutting (Table 2). The maximum plant height (28.16cm) was recorded with the 20 February operation in Hog plum interaction followed by 31 January (28.13 cm). The lowest plant height (20.13cm) was recorded in Baichi with 20 February interaction. The highest plant height obtained from Hog plum with 20 February cutting operation might be due to hog plum that had quick growing habit and favourable climatic condition.

Fresh and dry weight of shoots: Fresh and dry weight of shoot per cutting was statistically significant among the minor fruit varieties. The highest fresh (5.13g) and dry

(0.82 g) weight were found in Hog plum while the lowest were found in Baichi in all respect.

The effect of date of cutting on fresh and dry weight of shoot were also significant. The highest fresh (3.64g) and dry (0.723g) weight per cutting were obtained from 21 January cutting while the lowest were found on 20 February cutting in all respect.

Combined effect of date of cutting and minor fruit was statistically significant. The highest fresh (6.94) and dry (1.44g) weight of shoot were found on 21 January cutting in Hog plum. The lowest fresh weight of shoot (0.44g) and dry weight (0.17g) were found in Baichi at 20 February cutting (Table 3).

Fresh and dry weight of roots: The effect of minor fruits were significant in respect of fresh and dry weight of root which followed the same trend as for fresh and dry weight of shoots.

The effect of date of cutting were significant in respect of fresh and dry weight of root which followed the same trend as for fresh and dry weight of shoots.

The combined effect of date of cutting and minor fruit variety on fresh weight of root was found to be statistically significant (Table 3). The maximum fresh weight of roots (2.725g) and dry weight (1.04g) were found on 21 January in scented elachi lemon. The minimum fresh weight of roots (0.123g) and dry weight (0.82g) was found on 31 January in Baichi.

Days required to first flush: Statistically significant variation was observed in respect of days required to first flashing among the minor fruits. The highest time required for first flashing was found in baichi (25.23 days). The lowest time required for first flashing was in Scented elachi lemon (22.72 days).

Incase of cutting time statistically significant variation was also found in respect of time required for first flushing. The highest time required for first flushing (24.96 days) was on 21 January cutting operation while the lowest was on 20 February (23.31 days) cutting operation.

Interaction effect of time of cutting and minor fruit variety was also significant on days required for first flushing in case of days required for first flushing. The maximum days (25.83 days) required in Baichi on 10 February cutting operation. The minimum date (20.33 days) was required in Scented elachi lemon on 20 February cutting operation (Table 4).

Number of flush per plant: It was revealed from the results that the number of flash varied significantly among the treatments. At 80 days after cutting scented elachi lemon showed maximum number of flash (5.58). The minimum number of flashes (3.99) was produced by Baichi.

Date of cutting significantly influenced the number of flashes. The maximum number of flush (5.16) was found on 31 January cutting operation followed by 21 January (4.67) while the minimum was on 20 February cutting.

A highly significant combined effect of variety and cutting date was observed. However, combinedly the maximum number of flush (7.33) was found in Scented elachi lemon on 21 January cutting operation followed by 21 January (6.00) and 10 February (6.00). The minimum number of

flush was observed in Baichi on 31 January operation (Table 4).

The maximum success (78.58%) was recorded with scented elachi lemon while it was the minimum (59.74%) with baichi, similarly, the final survivor (66.58%) percentage was the maximum in Scented elachi lemon, and baichi gave the minimum (51.67%). Time of cutting had also significant effect on the percentage of success and growth. The maximum success (58.66%) was recorded on 20 February. Time of cutting had non significant effect on survivability.

The operation on 20 February was the most suitable for cutting in minor fruits. Although incase of survivor percentage, 21 January and 20 February had no significant difference but considering other parameters 20 February was the best cutting date. On the other hand, minor fruit had also significant effect on the aforesaid parameters. It was found that scented elachi lemon showed the best performance in case of stem cutting among the minor fruits. Therefore, Scented elachi lemon and cutting made on 20 February may be recommended.

References

- Anonymous 1980. Pusti Barta Sankalen (in Bengali). Institution and food science, Dhaka University. P. 108.
- B.B.S. 2006. Monthly statistical Bulletin (November). Bangladesh Bureau of statistics, Statistics Division, Ministry of Planing, Government people republic of Bangladesh Dhaka. P.58
- Dhar, M. 1998. Technical of vegetative and in vitro propagation of jackfruit .Ph.D. Dissertation .Institute of Post graduate Studies in Agriculture (IPSA Salna, Gazipur, Bangladesh.p151
- Haque, M.A. and K. Ahmed. 1966. Propagation of some citrus species by stem cuttings with growth regulators. Pakistan. J. Biol. Agric. Sci., 9 (3): 35-40..
- Hartman, H. T. and D. E. Kester. 1972. Plant propagation: Principale and practices (3rd edn.) Prentice Hall of India Pvt. Ltd., New Delhi. 656p.
- Jauhari, O.S. and S.P. Rahman. 1958. Investigation on rooting in cuttings of sweet lime (*Citrus limetoides*). Tanaka Sci. Cult., 23:615.
- Kar, P.L. T.R. Chanda R.P. Singh. 1973. Studies on vegetative propagation of Olive (*Olea europaea* L.). Prog. Hort., 5 (2): 5-9
- Reuther, W., L.D. Batchelor and H.J. Webber. 1967. The citrus Industry. Univ. of Calif. Div. Agril.. Sci. U.S.A., 1:534-537.