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Short communication

Studies on propagation of *bael (Aegle marmelos* L.*)* under Jhargram conditions

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ABSTRACT

To work out the optimum time and method for commercial multiplication of *bael* (*Aegle marmelos* L.), an investigation was carried out in 2007 and 2008 at a private nursery in Jhargram of Paschim Midnapur, West Bengal. Results revealed that grafting in March should be done under propagation-shed condition. During shortage of scion material, chip budding can be practiced from 20th to 30th March, under partial shade. For raising the orchard *in-situ*, chip budding should be done at the onset of monsoon (10th to 25th June) on two-year old seedlings, which should have been pruned the previous October.

Key words: *Bael*, budding, grafting, nursery, *in situ*, season

Bael (*Aegle marmelos* L.), considered to be a pack-house of nutrients and medicine, is one of the most neglected and underutilized fruit crops. In spite of possessing a good amount of nutritional and medicinal properties for mankind, little attention has been paid to its cultivation, research and development. Due to its Indian origin, a wide genetic base is available throughout the country, and this needs to be conserved and explored. As *bael* is a cross-pollinated crop propagated by seed, a wide variability in exists its population. Vegetative propagation ensures multiplication of selected, elite clones for commercial cultivation and conservation *in situ* / *ex situ*. A number of workers have suggested that budding was the best method, although the time of propagation varied from place to place (Kumar *et al*, 1995; Tripathi and Kumar, 2004).

At present, softwood method of wedge-grafting is very popular in many fruit crops like *jamun* (Madalageri *et al*, 1991), *sapota* (Pampanna and Sulikeri, 2000) and custard apple (Ghosh *et al*, 2004). Little information is available on bael. *Bael* is mainly grown in marginal lands, and *in situ*, cultivation of plants is useful for raising better plant stands with early bearing compared to nursery-raised planting material. Unfortunately meagre information is available on optimum time required for *in-situ* propagation of *bael.* Red laterite soil zone of West Bengal that covers five districts has a good number of elite *bael* genotypes, but no information on their propagation is available. To standardize propagation methods and time of operation suitable for nursery and field planting in *bael*, an investigation was carried out under Jhargram conditions.

The study was undertaken in a nursery at Jhargram, Paschim Midnapore, in the years 2007 and 2008. Soil in the area of study was laterite and the climate dry sub-tropical. Meteorological data for this period is presented in Table 1. Seedlings were raised from seeds of fruits collected from a single, elite plant from a nearby village. These were raised in perforated, black polythene bags (25cm x 15cm) under the open condition. For budding and grafting, 50 seedlings each were used and replicated thrice in Randomized Block Design. In the nursery, grafting operation was carried out under a propagation shed where a white, transparent fiber sheet was used as a cover. Budding was carried out under a thatch shed for the period 1st March to 30th April due to high day temperatures while, during 10th June to 10th September, this was done under the propagation shed (as in grafting). Success rate of propagation and data on plant growth were recorded two months after grafting and budding.

To workout the best time for *in situ* propagation, chip budding was carried out on two year old seedlings grown under open field condition at a spacing of 30cm x 60cm. For budding, 16-month old seedlings headed back during the previous October were used and one healthy shoot per seedling retained. Chip-budding was done in the following

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Table 1. Mean meteorological data of 2007-2008 recorded for the period under investigation

Month	Mean Temperature (°C)		Mean Humidity (%)		Mean rainfall (mm)	Mean number of rainy days
	Maximum	Minimum	Maximum	Minimum		
January	24.2	12.1	84.6	40.6	0	0
February	28.6	14.4	88.8	35.9	1.4	1
March	34.2	20.6	89.4	41.4	30.0	4
April	36.7	22.7	76.6	52.4	48.8	6
May	37.2	24.8	79.2	48.4	35.5	6
June	38.4	25.7	90.2	63.8	122.0	12
July	35.3	23.4	91.7	72.6	321.0	22
August	36.2	22.7	92.6	78.4	340.0	23
September	36.4	23.6	87.5	78.6	221.0	21
October	29.4	22.5	81.2	59.8	150.0	12
November	28.2	18.2	75.3	50.4	29.0	3
December	24.3	12.3	72.2	44.4	20.5	2

Table 2. Effect of season on success of budding and grafting in *bael* two months after the operation (average of two years)

Time of operation	In the nursery						In the field (*In situ*)		
	Chip budding			Grafting			Chip budding		
	Success (%)	Shoot length (cm)	Number of leaves	Success (%)	Shoot length (cm)	Number of leaves	Success (%)	Shoot length (cm)	Number of leaves
1st March	70 (56.79)	36	11	95 (77.08)	27	10	Not followed	-	-
10th March	80 (63.43)	29	9	85 (67.21)	22	8	-do-	-	-
20th March	80 (63.43)	39	14	85 (67.21)	28	10	-do-	-	-
30th March	90 (71.57)	40	15	95 (77.08)	32	12	-do-	-	-
10th April	70 (56.79)	22	9	80 (63.43)	20	8	-do-	-	-
20th April	0 (0.00)	-	-	10 (18.43)	10	6	-do-	-	-
30th April	0 (0.00)	-	-	5 (12.92)	12	8	-do-	-	-
10th June	30 (33.21)	20	26	50 (45.00)	22	14	44.0 (41.55)	40	46
25th June	35 (36.27)	22	25	70 (56.79)	17	10	64.0 (53.13)	36	32
10th July	8 (16.43)	35	18	40 (39.23)	14	9	16.0 (23.58)	48	25
25th July	50 (45.00)	45	20	35 (36.27)	15	9	0 (0.00)	-	-
10th August	22 (27.97)	13	10	30 (33.21)	10	6	20.0 (26.57)	23	8
25th August	6 (14.18)	10	8	0 (0.00)	-	-	8.0 (16.43)	29	19
10th September	0 (0.00)	-	-	0 (0.00)	-	-	0.0 (0.00)	-	-
C. D. *(p=0.05)*	(7.12)	8.1	3.2	(6.34)	5.5	1.5	(5.21)	4.5	2.8

Figures in parentheses indicate angular transformed values

year from 10th June to 10th September. Fifty seedlings grown *in situ* were chip-budded with scions of a selected, elite plant and replicated thrice in Randomized Block Design. Data on budding success and seedling growth were recorded two months after the operation.

Obtaining maximum success with better growth, information on the right method and exact time of propagation in polybags grown seedling is paramount for a successful nursery business. Results from two years of investigation revealed that grafting gave higher success compared to budding, irrespective of the time of operation, except 25th July (Table 2). March (1st March to 30th March) was the best month, both for budding and grafting, as the highest success of 70 to 90% was recorded in budding and 85 to 95% in grafting. This could be due to better physiological condition of both the scion and the stock. It is known that plants start a new growth flush after a long period of dormancy, in the month of March, under the present condition. This may have resulted in good sap flow and cambial activity. This would also give an added advantage to the nurseryman as good sale of planting material can be expected in the ensuing monsoon season.

Operations carried out during monsoon (10th June to 10th September) showed that 25th June was better for grafting (70% success), while 25th July was good for budding (50% success). It has been reported that mid- May to mid-June is the best period for patch-budding under Faizabad conditions (Kumar *et al*, 1994), while mid-August under Banaras conditions (Kumar *et al*, 1995) and the last week of July under Hisar conditions (Tripathi and Kumar, 2004) are best. Success in budding and grafting fell drastically after 10th August, which may be due to low cambial activity in the

stock and scion. In the present study too, physiological condition of the stock and scion may have been very important for getting higher budding and grafting success. Highest success was achieved in the month of March when the stock and scion plants were in an active phase of growth and climatic conditions were ideal (Table 1).

Regarding the growth of successful plants, it was observed that plants raised through budding had better growth (shoot length and leaf number) compared to grafting, irrespective of the time of operation. Maximum shoot length (45 cm) was attained when budding was made on 25th July, followed by 30th March (40 cm). Leaf number was highest (26) in plants budded on 10th June. In grafting, the longest shoot was recorded in plants grafted on 30th March (32 cm), followed by 20th March (28cm). Highest leaf production here was observed in plants grafted on 10th June (14), closely followed by those grafted on 30th March.

Bael is found to grow in degraded soils like laterite with poor water-holding capacity and that receive low precipitation from November to May. In such a situation, field-raising of an orchard, not only results in a better plant stand compared to polybag-raised plants, but also these plants require less water and care during the initial years (due to a good root system). Results from two years of investigation showed (Table 2) highest budding success (64%) in rootstock plants that were chip-budded on 25th June, followed by those on 10th June (44%). Success percentage fell drastically after 25th June probably due to frequent rain. This may have affected the bud union and cambial activity in both stock and scion, reported to be greatly correlated with prevailing atmospheric conditions (Kumar *et al*, 1995). Growth of successful plants was found to be satisfactory as shoot length was 36 to 40cm and leaf number 32 to 46 in June-budded field-grown plants.

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