EFFECT OF AGE OF SEEDLING AND VARIETY OF SCION IN STONE GRAFTING OF MANGO

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ABSTRACT

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A study was conducted for rapid multiplication of mango through stone grafting in RHRS, Chapai Nawabganj during last week of July, 2002. Mango seedlings of 5, 10, 15, 20, 25 and 30 days were grafted with three varieties of scion *viz*. BARI Aam-1, BARI Aam-3 and Langra. Maximum number of finally successful grafts (66.67%) was recorded in variety Langra grafted on 15 days old seedlings followed by the same variety grafted on 20 days old seedlings (53.33%). BARI Aam-1 grafted on 15 or 20 days old seedlings gave moderate success (46.67%). Minimum success (10.0%) was got in BARI Aam-3 grafted onto 5 and 30 days old seedlings. The tallest shoots (25.07 and 24.73 cm consecutively) were produced by Langra grafted on 15 and 20 days old seedlings.

Key words: Mango, propagation and stone grafting

INTRODUCTION

Mango (*Mangifera indica* L.) is one of the most common, important and popular fruits in Bangladesh. It is considered as the "king of fruits". Besides, having delicious taste, captivating flavor with multifarious color, it is an excellent source of nutritive values.

Bangladesh is one of the major mango producing countries along with India, Pakistan, Mexico, Brazil, the Philippines, etc. (Alexander, 1989). In Bangladesh, mango occupies about an area of 50,491 ha with a production of 187220 tones according to BBS, 2003. It is now in an increasing trend in area by 112% and in production by 116% in the year of 2000-01 compared to 1984-85 (BBS, 2002). So, quality grafts are now a time-demand.

Now a day, stone grafting is being a very important technique for raising mango saplings, becoming popular and commercial in India and elsewhere as inarching is a slow, laborious, expensive and cumbersome process including wastage of scion-wood. Traub and Auchter (1934) first reported about stone grafting of mango. It has many advantages over the methods as the nursery-life is shortened by a year as well as the grafts are small in size and can, therefore, easily be transported without damage (Majumder, 1989). Further, this technique requires less time in process of propagation proved to be cheaper (Kulwal and Tayde, 1989a). Due to graft-success, convenience and ease of stone grafting in commercial cultivars, it would be economically viable compared to traditional methods (Patil *et al.*, 1991). Earlier workers have reported varying degrees of success of stone grafting in different names such as bench grafting, epicotyl grafting, seedling grafting *etc*. (Kashyap *et al.*, 1989). Success in stone grafting may vary depending upon use of rootstock, variety of scion, length of scion, grafting season *etc*. Reddy and Kohli (1989) got better results from older seedlings using cleft method onto 4, 6, 8, 10 and 14 days old Alphonso seedling as rootstocks though Gunjate (1989) reported that the age of rootstock (1 to 6 weeks) did not affect success in stone grafting. Chakrabarty and Sadhu (1989) had a faster graft-take in Langra than in Bombai and Himsagar.

However, moderate temperature and high relative humidity are major factors related to success of grafts (Ram, 1997). Considering the above-mentioned observations, as multifarious results are produced, but in Bangladesh, a very scanty work regarding stone grafting of mango has been reported. Hence, the present study was undertaken with the following objectives: a) To find out the suitable age of seedlings in stone grafting of mango, b) To evaluate the performance of varieties in stone grafting of mango

MATERIALS AND METHODS

Ripe fruits of BARI Aam-1 were selected for extracting seeds and sown in a 5 days interval in seedbed densely. Freshly emerged seedlings were placed in 8"x10" polyethylene bags to grow them up to grafting. Grafting was done in cleft method of 10 seedlings in each treatment. Mature and plump 10.0 cm scion shoots of BARI Aam-1, BARI Aam-3 and Langra were used. Similar thickness of scions and rootstocks were selected. The rootstocks were beheaded at a height of 5-8 cm above the collar region. A 3-5 cm long vertical cut of was given into the beheaded seedlings. The scion shoot was mended in wedge shape in such a manner so that it fits into the rootstock well. Then it was tied firmly with polyethylene film to secure close contact between the cambium layers of scion and rootstock.

The grafts were covered with polyethylene papers from below the grafting zone. Grafting was done in last week July, 2002. Data were collected 150 days after grafting. Leaf area was measured by multiplying the product of length and maximum breadth of leaf with the "k" value = 0.737 (Saidha and Rao, 1985). Shoot length was measured at just above grafting.

RESULTS AND DISCUSSION

Days to first sprouting

The days to first sprouting among the grafts varied significantly on the stone grafting in mango due to different age of seedlings (Table 1). The grafts of 30 days old seedlings took maximum days to sprouting (16.07 days), which was statistically similar to the grafts of 25 days old seedlings. Significantly a minimum day to sprouting was coupled for the grafts of 10 days old seedlings (12.98 days). It was revealed that, the older seedlings required maximum days to sprouting. In respect of variety, maximum days to sprouting (15.47 days) were required for the grafts of BARI Aam-3 scion shoots followed by BARI Aam-1 whereas minimum days were required for Langra (12.96 days). The interaction effect of seedling age and scion variety in grafts of different treatment combinations was found insignificant.

Days to completion of sprouting

The completion of bud sprouting was significantly affected by the age of seedlings (Table 1). The longest period (22.94 days) was required to completion of sprouting by the grafts of 30 days old seedlings. In contrary, the shortest period (19.11 days) to complete sprouting was required in the grafts of 15 days old seedlings. Significantly, maximum days were required for BARI Aam-3 scions (21.83 days) followed by BARI Aam-1 whereas it was lowest in Langra. In case of interaction, period to completion of sprouting was maximum (23.83 days) in the grafts of BARI Aam-3 scions on 30 days old seedlings and minimum (16.33 days) in the grafts of Langra scions on 20 days old seedlings.

Initial success

The highest initial success (64.44%) was recorded from the grafts of 15 days old seedlings and was statistically similar to 20 days old seedlings (Table 1). Initial success was the lowest in the grafts of 5 days old seedlings (16.67%), which was statistically different to those of all other seedling ages. In respect of scion variety, the highest initial success was recorded from the grafts of Langra (58.33%) while it was the lowest in BARI Aam-3 (42.78%). Kulwal and Tayde (1989a) received maximum graft-take in Langra than in Bombai and Himsagar which is inferred as for more rapid formation of callus and vascular continuity at the grafting zone. In case of interaction, maximum initial success (83.33%) was recorded from 15 days old seedlings grafted with Langra scion and differed significantly from all other treatment combinations. The grafts of 5 days old seedlings had minimum success by grafting with all the three varieties.

Final success

Maximum final success (48.89%) was achieved from the grafts made with 15 days old seedlings followed by 20 days old seedlings (Table 1). Significantly, minimum final success was obtained in the grafts of 5, 25 and 30 days old seedlings. It might be due to high temperature, desiccating the young rootstock and undeveloped root system of aged seedlings having lesser reserve food material (Kulwal and Tayde, 1989b). But Gunjate (1989) concluded that there was no significant effect on the success among the grafts of 1 to 6 weeks old seedlings and reported higher success with 1 week old rootstocks. Reddy and Kohli (1989) recorded maximum success (66.66%) from 14 days old rootstocks in Alphonso that was similar to the current study. Thirty days old seedlings performed best survivability according to Kashyap *et al.* (1989).

Table 1. Effect of seedling age and scion variety on sprouting and success of the grafts in stone grafting of mango

Treatments	Days to first sprouting	Days to completion of sprouting	Initial success (%)	Final success (%)
Seedling age				
A_1	13.27 bc	19.66 c	16.67 c	13.33 d
A_2	12.98 c	19.13 c	52.22 b	22.22 c
A_3	13.41 bc	19.11 c	64.44 a	48.89 a
A_4	14.11 b	19.44 c	57.78 ab	37.78 b
A_5	16.02 a	21.56 b	52.22 b	16.67 cd
A_6	16.07 a	22.94 a	52.22 b	13.33 d
Scion variety				
V_1	14.49 b	20.56 b	50.67 b	33.89 b
V_2	15.47 a	21.83 a	42.78 c	28.89 c
V_3	12.96 c	18.53 c	58.33 a	50.33 a
Interaction				
A_1V_1	13.73	19.73 d-g	20.00 e	16.67 e
A_1V_2	14.33	20.67 c-e	13.33 e	10.00 e
A_1V_3	11.73	18.57 fg	16.67 e	13.33 e
A_2V_1	12.17	18.60 fg	40.00 d	20.00 de
A_2V_2	14.57	20.67 c-e	40.00 d	16.67 e
A_2V_3	12.20	18.13 gh	46.67 cd	30.00 cd
A_3V_1	13.97	19.60 e-g	56.67 b-d	46.67 b
A_3V_2	14.73	21.27 b-e	53.33 b-d	33.33 c
A_3V_3	11.53	16.47 hi	83.33 a	66.67 a
A_4V_1	14.90	20.43 c-f	60.00 b-d	46.67 b
A_4V_2	15.77	21.57 b-d	50.00 b-d	30.00 cd
A_4V_3	11.67	16.33 i	63.33 bc	53.33 b
A_5V_1	16.20	22.17 a-c	50.00 b-d	16.67 e
A_5V_2	16.77	23.00 ab	46.67 b-d	13.33 e
A_5V_3	15.23	19.50 e-g	50.00 b-d	20.00 de
A_6V_1	16.00	22.43 ab	40.00 d	13.33 e
A_6V_2	16.67	23.83 a	33.33 d	10.00 e
A_6V_3	15.40	22.17 a-c	43.33 cd	16.67 e
CV%	6.38	4.99	10.43	12.25

Means in a column followed by the same letter(s) or without letter are not significantly different at 5% level by DMRT.
A_1 = 5 days, A_2 = 10 days, A_3 = 15 days, A_4 = 20 days, A_5 = 25 days and A_6 = 30 days
V_1 =BARI Aam-1, V_2 = BARI Aam-3 and V_3 = Langra

In case of variety, maximum success (50.33%) was achieved from the grafts made with Langra scion whereas the grafts of BARI Aam-3 secured minimum success (28.89%). Madalageri *et al.* (1989) also reported similar result of the lowest success (34.0%) in Amrapali (BARI Aam-3). Kashyap *et al.* (1989) and Chakrabarty and Sadhu (1983)

also found the same trend for this variety. A higher success was also observed by Rahim *et al.* (1984) in veneer grafting and Faruque and Fakir (1973) in inarching in Langra. In case of interaction, maximum success (66.67%) was achieved in the grafts of Langra scions on 15 days old seedlings which were statistically different from all the treatment combinations. Langra on 20 days old seedlings and BARI Aam-1 on 15 and 20 days old seedlings had

Table 2. Effect of seedling age and scion variety on growth parameters of the grafts in stone grafting of mango

Treatments	Shoot length (cm)	Shoot diameter (cm)	No. of growth flushes	Number of leaves	Leaf area per plant (sq. cm)
Seedling age					
A_1	19.43 c	0.50 c	1.44 b	9.02 c	182.00 c
A_2	20.38 b	0.53 bc	1.81 a	11.38 b	228.70 b
A_3	21.76 a	0.56 ab	1.91 a	13.20 a	278.70 a
A_4	22.21 a	0.57 a	2.06 a	12.77 a	262.40 a
A_5	20.00 bc	0.54 ab	1.44 b	11.26 b	214.40 b
A_6	19.53 bc	0.57 a	1.17 b	9.53 c	187.50 c
Scion variety					
V_1	20.75 b	0.60 a	1.63 b	10.97 b	198.56 b
V_2	19.03 c	0.51 b	1.39 c	9.02 c	166.42 c
V_3	21.88 a	0.53 b	1.89 a	12.59 a	279.40 a
Interaction					
A_1V_1	19.37 d-g	0.54	1.00 f	7.93 i	128.60 h
A_1V_2	18.67 fg	0.48	1.33 ef	7.70 i	159.50 f-h
A_1V_3	20.27 b-f	0.48	2.00 a-d	11.43 d-f	257.80 c
A_2V_1	21.37 bc	0.58	2.00 a-d	11.20 d-f	183.50 e-g
A_2V_2	19.70 c-f	0.51	1.50 d-f	10.03 f-h	187.70 e-g
A_2V_3	20.17 b-f	0.50	1.92 a-d	12.90 b-d	315.00 b
A_3V_1	20.93 b-e	0.60	2.00 a-d	13.60 a-c	252.60 c
A_3V_2	19.27 e-g	0.52	1.33 ef	10.93 e-g	212.40 de
A_3V_3	25.07 a	0.56	2.41 a	15.07 a	371.10 a
A_4V_1	21.80 b	0.63	2.11 ab	12.77 b-d	222.40 c-e
A_4V_2	20.10 b-f	0.53	2.00 a-d	11.57 d-f	232.00 c-e
A_4V_3	24.73 a	0.56	2.07 a-c	13.97 ab	332.70 b
A_5V_1	20.33 b-f	0.60	1.50 d-f	11.00 e-g	191.40 e-g
A_5V_2	18.57 fg	0.50	1.17 ef	10.70 e-h	193.30 ef
A_5V_3	21.10 bcd	0.52	1.67 b-e	12.07 c-e	258.50 c
A_6V_1	20.70 b-e	0.62	1.17 ef	9.30 g-i	152.60 gh
A_6V_2	18.07 h	0.54	1.00 f	9.17 hi	160.50 f-h
A_6V_3	20.03 c-f	0.55	1.33 ef	10.30 f-h	249.40 cd
CV%	4.43	6.67	2.94	8.42	9.47

Means in a column followed by the same letter(s) or without letter are not significantly different at 5% level by DMRT.
A_1 = 5 days, A_2 = 10 days, A_3 = 15 days, A_4 = 20 days, A_5 = 25 days, A_6 = 30 days; V_1 =BARI Aam-1, V_2 = BARI Aam-3 and V_3 = Langra

moderate success. Minimum success (10.00%) was observed in the grafts of BARI Aam-3 grafted on 5 or 30 days old seedlings. Reza *et al.* (1994) got maximum success (74.30%) in the grafts of 10 days old seedlings of Khirsapat variety rather than the grafts of 20 days old seedlings of the same variety.

Shoot length

A significant effect in shoot length was observed among the grafts due to age of seedlings on the stone grafting in mango (Table 2). The tallest shoots (22.21 cm) were produced in the grafts of 20 days old seedlings which was identical to those of 15 days old seedlings (21.76 cm). The smallest shoots (19.43 cm) were obtained from the grafts of 5 days old seedlings. For varieties, the grafts of Langra scion gave maximum shoot length (21.88 cm) followed by BARI Aam-1 (20.75 cm). The interaction effect of different seedling age and scion variety also showed significant effect. The tallest shoot (25.07 cm) was produced in the grafts of Langra scions on 15 days old seedlings while the smallest shoot (18.07 cm) was recorded in BARI Aam-3 scions grafted on 30 days old seedlings.

Shoot diameter

There was a significant variation in diameter of scion shoot of different grafts due to different age of seedlings (Table 2). Maximum shoot diameter (0.57 cm) was recorded from the grafts of 20 and 30 days old seedlings and was statistically similar to those of the grafts of 15 and 25 days old seedlings. The thinnest shoot (0.50 cm) was measured from the grafts of 5 days old seedlings In case of variety; maximum shoot diameter (0.60 cm) was recorded from the grafts of BARI Aam-1 scion shoot which was significantly different with other varieties. Grafts of BARI Aam-3 scion shoot produced minimum shoot diameter (0.51 cm) and was identical to that of Langra (0.53 cm). There was no significant difference due to different interaction effects.

Number of growth flushes

The grafts of 10, 15 and 20 days old seedlings produced maximum number of growth flushes and they are statistically indifferent (Table 2). Others produced minimum number (1.17) of flushes and were also statistically same. In respect of variety, Langra grafts gave maximum number (1.89) of flushes whereas grafts of BARI Aam-3 produced minimum number (1.39) of flushes. Significant variation was also observed in number of growth flushes among the grafts due to interaction. BARI Aam-1 and Langra grafts were found to have statistically similar number of growth flushes in each age category except the grafts of 5 days old seedlings.

Number of leaves

The grafts of 15 days old seedlings produced statistically the highest number of leaves per plant (13.20), which was identical to the grafts of 20 days old seedlings but differed significantly to the grafts of other seedling ages (Table 2). The grafts of 5 days old seedlings gave minimum number of leaves per plant. In case of varieties, maximum number of leaves per plant (12.59) was produced in the grafts of Langra scion shoots whereas the grafts of BARI Aam-3 produced minimum number of leaves per plant (9.02). Due to interaction, maximum number of leaves per plant (15.07) was produced in the grafts of Langra on 15 days old seedlings which were similar to the grafts of 20 days old seedlings of same variety and BARI Aam-1 on 15 days old seedlings.

Leaf area

Maximum leaf area per plant (278.70 sq. cm) was recorded from the grafts of 15 days old seedlings, which was statistically similar to those of 20 days old seedlings but differed statistically to the rest ages of seedlings (Table 2). Minimum leaf area per plant (182.00 sq. cm) was observed in the grafts of 5 days old seedlings. The grafts of Langra produced maximum leaf area per plant (279.40 sq. cm) followed by BARI Aam-1. Due to the interaction, maximum leaf area per plant (371.10 sq. cm) was measured from the grafts of Langra on 15 days old seedlings which differed statistically from all other treatment combinations. The grafts of Langra scion possessed significantly the highest leaf area per plant among all ages of seedlings. The grafts of BARI Aam-1 on 5 days old seedlings had minimum (128.60 sq. cm) leaf area per plant.

Considering the above discussed findings, conclusion might be drawn with the following points: 1. The final success in stone grafting of mango was ranged from 10.00 to 66.67% among different treatment combinations. 2. Langra obtained the highest final success grafted on 15 days old seedlings. 3. Moderate success was got in the grafts of Langra (53.33% on 20 days old seedlings) and BARI Aam-1 (46.67% on 15 and 20 days old seedlings) in stone grafting of mango.

Finally, it could be recommended that the 15 days old seedlings in grafting with Langra scion shoots is the best combination to produce saplings successfully in stone grafting of mango.

Further research would be carried out to study the matter adequately imparting different shading or covering effects, time of grafting, method of grafting, age of scion etc.

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