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Standardization of grafting time and various environmental conditions in Jamun (*Syzygium cumini* Skeels)

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Abstract
The present investigation entitled "Standardization of grafting time and various environmental conditions in jamun (*Syzygium cumini* Skeels)" was carried out at Hi-Tech Horticulture Park, Department of Horticulture, Junagadh Agricultural University, Junagadh during the year 2020-21. The treatments comprised of nine level of grafting time (G) *viz*., G_1 = 16th January, G_2 = 1st February, G_3 = 16th February, G_4 = 1st March, G_5 = 16th March, G_6 = 1st April, G_7 = 16th April, G_8 = 1st May, G_9 = 16th May and three level of various environmental conditions (E) *viz*., E_1 = Open field, E_2 = Net house, E_3 = Polyhouse. The experiment was laid out in Completely Randomized Design (CRD) with Factorial concept comprising twenty seven treatments combinations with three replications. The result indicated that among nine grafting treatment, G_4 (1st March) gave minimum days required for emergence of sprout (17.67), success rate (58.33%) at 30 DAG with minimum mortality (51.11%) and maximum survival (48.89%) at 120 DAG. Among three environmental conditions, E_3 (Polyhouse) gave minimum days required for emergence for sprout (19.03), success rate (47.96%) at 30 DAG with minimum mortality (61.11%) and maximum survival (38.89%) at 120 DAG.

Keywords: Jamun, grafting time, environmental conditions

Introduction
Jamun is botanically known as (*Syzygium cumini* Skeels) an evergreen tree and belonging to the family Myrtaceae. It is locally known as 'Java plum', 'Black plum', 'Jambul' and 'Indian blackberry'. Jamun has promising medicinal value due to its various phyto-constituents such as tannins, alkaloids, steroids, flavonoids, terpenoids, fattyacids, phenols, minerals, carbohydrates and vitamins. Diabetes management through use of jamun has been demonstrated. Jamun fruit has considerable high nutritive value. It is a good source of iron, minerals, sugars and other phytochemicals (Singh *et al.*, 1967) [8]. It can also be used for the preparation of delicious beverages, jelly, jam, squash, wine, vinegar and pickles (Ochse *et al.*, 1961) [4]. Jamun has medicinal values and suitability for planting as windbreak. Its demand is increasing day by day so, that will require selected plants of superior quality and high yield potential. Jamun is propagated by both sexually and asexually. Jamun is generally propagated by seeds sowing in nursery and one year old seedlings are planted in the main field. However, at present the majority of nursery owners use the sexual method of propagation due to the presence of polyembryony. The new plant would be true-to-type but it attains bearing latter than vegetatively propagated plants. For vegetative propagation, it is only possible when desirable mother trees are available.

Propagation of jamun through softwood grafting is gaining popularity among nursery men and growers due to following reasons: (i) It is simple, economical, and less cumbersome. (ii) It has advantage of using detached scion and also results in fairly high rate of graft success and survival. The vegetative propagation techniques are much influenced by the climatic conditions of the region and is mostly carried out on the onset of monsoon. Thereby, restricting the availability of planting material for that particular season. Keeping this in view, the present investigation "Standardization of grafting time and various environmental conditions in jamun (*Syzygium cumini* Skeels)" was carried out to find out effective grafting time as well as environmental conditions for obtaining maximum success through softwood grafting in Jamun.

Material and Methods

The present investigation was carried out at Hi-Tech Horticulture Park, Department of Horticulture, JAU, Junagadh during the year 2020-21. The treatments comprised of nine level of grafting time (G) *viz*., G_1 = 16th January, G_2 = 1st February, G_3 = 16th February, G_4 = 1st March, G_5 = 16th March, G_6 = 1st April, G_7 = 16th April, G_8 = 1st May, G_9 = 16th May, and three level of various environmental conditions (E) *viz*., E_1 = Open field, E_2 = Net house, E_3 = Polyhouse. The experiment was laid out in Completely Randomized Design (CRD) with Factorial concept comprising twenty seven treatment combinations with three replications. Junagadh is situated in South Saurashtra Agro-climatic region of Gujarat state. Geographically, this place is situated at 21.5^0 N latitude and 70.5^0 E longitude with an altitude of 60 meters above the mean sea level and 80 kilometers away from Arabian Sea Coast on western side at the foothill of the mount Girnar.

The grafting operation was done on 6 month old jamun rootstock seedlings. Non-flowered terminal or lateral shoots of current season's growth with pencil thickness, greenish brown colored mature and healthy scions were collected from local variety of jamun trees at Jambuvadi Farm, College of Agricultural, JAU, Junagadh. Defoliation of scion on mother tree was done at 10 days prior to grafting. The petiole stubs dried up and dropped off when touched leaving a healed scar of defoliated scion sticks at this stage indicated that scion was ready for grafting. Unsprouted scion sticks with well-developed buds were detached from the selected mother tree in the morning on the day of grafting.

Method of softwood grafting

On the rootstock two pairs or 2-4 bottom leaves were retained and the other leaves were removed using a grafting knife. The selected rootstock was headed back about 20 cm above the polybag where soft wood portion was available on the rootstock and the terminal shoot was removed with the help of secateur. A deep vertical straight cut of 5 cm was made on the center of the beheaded rootstock with the help of grafting knife. Slant cut was made in both sides of lower part of scion stick to make a V-wedge shaped smooth cut of same length (5 cm) and to retain some bark on the remaining two sides with thin tip of wedge using a grafting knife. V-wedge shaped scion stick inserted into the splitted rootstock. The graft joint was secured properly with 2 cm wide and 25 cm long white polythene strip of 150 gauge thickness in order to provide proper contact of cambium cells and avoid the desiccation of the graft union.

The observations were recorded on various parameters *viz*., Days required for emergence for sprout, success rate at 30 DAG, Mortality and survival (%) at 120 DAG. Various characters under study were statistically analyzed by using analysis of variance technique for Completely Randomized Design (CRD) with Factorial concept as described by Panse and Sukhatme (1985) [5].

$$\text{Success rate (\%)} = \frac{\text{No. of sprouted grafts}}{\text{Total no. of plants grafted}} \text{ X } 100$$

$$\text{Mortality (\%)} = \frac{\text{No. of unsuccessful grafts}}{\text{Total no. of plants grafted}} \text{ X } 100$$

$$\text{Survival percentage (\%)} = \frac{\text{No. of grafts remained alive}}{\text{Total no. of plants grafted}} \text{ X } 100$$

Results and Discussion

Days required for emergence of sprout

Among the different grafting time minimum days required for emergence of sprout (17.67) was noted in G_4 (1st March) which was at par with G_5 (16th March) and G_9 (16th May). Maximum days required for emergence of sprout (21.89) days were noted in G_1 (16th January). The favorable weather conditions prevailed during these grafting times hastens the cell activity in scion and might early callus formation started. The higher cell activity resulted in early sprouting of scion. Similar results were found by Chouksey *et al.* (2016) [1] in guava, Singh and Singh (2015) [9] in khirni and Singh and Singh (2015) [9] in mahua.

Among environmental conditions days required for emergence of sprout (19.03) was noted in E_3 (Polyhouse) which was at par with E_2 (Net house). Maximum number of days required for sprouting (19.39) was observed in E_1 (Open field). Early emergence of sprout under polyhouse condition might be due to the temperature management and high humidity induced all physiological activities which induced early sprout in grafts. Same results found by Jalal *et al.* (2018) [3] in aonla, Visen *et al.* (2010) [11] Vanaja *et al.* (2017) [10] in guava and Patel *et al.* (2007) [6] in mandarin.

The interaction effect of grafting time and environmental conditions on days required for emergence of sprouts was observed non-significant.

Success rate (%)

Among the different grafting time highest success rate (58.33%) at 30 DAG, was noted in G_4 (1st March). Lowest success rate (29.44%) at 30 120 DAG, was noted in G_1 (16th January). The optimum temperature during March might be responsible for early callus formation and better matrix connection and stock and scion. While lower temperature during wider months and higher temperature during lower months might affected adversely to the callus formation and finally success rate. The influence of weather temperature and relative humidity led to the maximum success rate. This findings are in conformity with the results as found by Singh and Singh (2015) [9] in Khirni, Singh and Singh (2015) [9] in Mahua and Chovatiya (1994) [2] in custard apple.

Among environmental conditions highest success rate (47.96%) at 30 120 DAG was noted in E_3 (Polyhouse). Lowest success rate (37.96%) at 30 DAG was noted in E_1 (Open field). The congenial environmental conditions reveling in the control condition might lead to maximum success rate. Same research results were found by Singh *et al.* (2007) [7] in guava and Patel *et al.* (2007) [6] in mandarin.

The Interaction effect between different grafting time and various environmental conditions on success rate (%) was found non-significant at 30 DAG.

Mortality (%)

Among the different grafting time minimum mortality percentage (51.11%) at 120 DAG was noted in G_4 (1st March). Maximum mortality (78.89%) at 120 DAG was noted in G_1 (16th January). The optimum temperature during March might be responsible for early callus formation and better matrix connection and stock and scion. While lower temperature during wider months and higher temperature during lower months might affected adversely to the callus formation and finally minimum mortality percentage.

Among environmental conditions minimum mortality (61.11%) at 120 DAG was noted in E_3 (Polyhouse). Maximum mortality (71.30%) at 120 DAG was noted in E_1 (Open field). The minimum mortality in polyhouse condition due to microclimate conditions. The favorable environmental condition led to minimum mortality.

The Interaction effect between different grafting time and various environmental conditions on mortality (%) was found non-significant at 120 DAG.

Table 1: Effect of grafting time and environmental conditions on number of days required for emergence of sprout, success rate at 30 DAG, mortality (%) and survival (%) at 120 DAG in Jamun.

Treatments	Days required for emergence of sprout (Days)	Success rate (%)	Mortality (%)	Survival (%)
Factor A: Grafting time				
G_1: 16th January	21.89	29.44	78.89	21.11
G_2: 1st February	21.40	35.56	72.78	27.22
G_3: 16th February	20.22	46.67	62.22	37.78
G_4: 1st March	17.67	58.33	51.11	48.89
G_5: 16th March	18.00	53.33	56.11	43.89
G_6: 1st April	18.73	42.78	65.56	34.44
G_7: 16thApril	18.69	33.33	76.11	23.89
G_8: 1st May	18.20	37.78	70.56	29.44
G_9: 16th May	18.09	47.78	61.11	38.89
S.Em. ±	0.156	1.031	0.944	0.944
C.D. at 5%	0.44	2.92	0.55	2.68
Factor B: Environmental conditions				
E_1 : Open field	19.39	37.96	71.30	28.70
E_2 : Net house	19.21	42.41	65.74	34.26
E_3: Polyhouse	19.03	47.96	61.11	38.89
S.Em. ±	0.092	0.602	2.677	0.552
C.D. at 5%	0.26	1.69	1.55	1.55
Interaction (G x E)				
S.Em. ±	0.274	1.793	1.642	1.642
C.D. at 5%	NS	NS	NS	NS
C.V.%	2.43	7.23	4.29	8.34

Survival percentage (%)

Among the different grafting time maximum survival percentage (48.89%) at 120 DAG was noted in G_4 (1st March). Minimum survival percentage (21.11%) at 120 DAG was noted in G_1 (16th January). The higher survival of softwood grafting in Jamun during this grafting time might be attributed to the suitable weather condition and moderate relative humidity prevailed during this time which resulted in increase cell activity led to better survival of graft. Same result was observed by Bharad *et al.* (2006) [12] in Jamun and Gotur *et al.* (2017) [13] in guava.

Among environmental conditions maximum survival percentage (38.89%) at 120 DAG was noted in E_3 (Polyhouse). Minimum survival percentage (28.70%) at 120 DAG was noted in E_1 (Open field). The maximum survival in polyhouse due to the suitable microclimate conditions. Similar results were found by Gotur *et al.* (2017) [13] in Guava and Sivudu *et al.* (2014) in mango.

The Interaction effect between different grafting time and various environmental conditions on survival (%) was found non-significant at 120 DAG.

Conclusion

On the basis of the results found from the experiment, it can be concluded that jamun softwood grafts prepared on 1st March observed early sprouting and taken minimum days required for emergence of sprout, maximum success rate, and survival rate with the least mortality of grafts. Similarity, grafts put in polyhouse conditions reported better in terms days to sprout less days required for emergence of sprout, maximum success rate and survival rate with least mortality of grafts.

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