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Propagation Studies on Different Rootstocks of Jamun (*Syzygium cuminii* skeels)

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Jamun is propagated by seeds as well as vegetatively and the grafts raised on seedling rootstocks of unknown source resulting in variation among the plants. Hence, there is a need to identify the suitable rootstock for propagating jamun to get maximum graft success. The time of grafting is the most important factor for highest graft success and influenced by the climatic conditions prevailing

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in particular season in addition to the type of rootstocks. Considering the above factors the research was carried out at Kittur Rani Channamma College of Horticulture, Arabhavi during 2018-2019 to study suitable season and rootstock for the jamun variety AJG-85, which is more popular variety in and around Belgaum district. Jamun variety AJG-85 grafted on its own rootstock during October recorded the maximum number of sprouts (3.92, 4.49 and 4.56 respectively), sprout length (7.91, 16.18 and 22.20 cm respectively), per cent graft success (79.39, 88.80 and 90.94% respectively), per cent graft survival (93.96 and 89.30% respectively) at different days after grafting and minimum number of days taken for sprouting (19.15).

Keywords: Jamun varieties; rootstocks; seasons; grafting, rootstock; blackberry; malabar plum; nutritional properties.

1. INTRODUCTION

Jamun (*Syzygium cuminii* Skeels) is an important underutilized, indigenous tropical fruit crop of India, belongs to the family Myrtaceae. It is also known as Jambul, Black plum, Damson plum, Duhat plum, Jambolan plum, Portuguese plum, Indian blackberry and Malabar plum. It has recently attained importance as an arid zone horticulture crop because of its hardy nature and high yielding potential. It consists of over 75 species and found growing wild throughout the country for its edible fruits. It is commonly grown in India, Malaysia, Myanmar, Pakistan, Afghanistan and Bangladesh [1].

Jamun has gained tremendous importance because of its incomparable medicinal and nutritional properties. It is a good source of iron, apart from the usual content like minerals, sugar, proteins, pigments *etc*. Singh and Srivastava, [2]. Almost all parts of the tree are used for various purposes. The ripen fruits are tasty and pleasant flavored used in the preparation of delicious beverages, jellies, jam, squash, wine, vinegar and pickles. Swami *et al*., [3]. The plant is rich in compounds containing anthocyanins, glucoside, ellagic acid, isoquercetin, kaemferol and myrecetin. Seeds contain alkaloid like jambosine and glycoside like jambolin or antimellin, which stops the diastatic conversion of starch into sugar [4]. In view of the potential of processing and high returns, there is a tremendous scope for bringing substantial additional area under jamun cultivation in India. The orchardists demand the plants of early bearing, dwarf statured with high yield potential in large numbers. This is only possible with vegetative propagation. For vegetative propagation of jamun, there is a need to produce healthy, quick growing and graft attainable size rootstock. Jamun variety AJG-85 has been developed from Kitttur Rani Channamma College of Horticulture, Arabhavi, UHS, Bagalkot. It has been identified through field survey and selection. High yielding and good quality fruits with TSS-18º Brix and Fruit weight 12 to 15 g with an average yield of up to 200 kg per tree. Still there is no standard rootstock for AJG-85. At present there is a huge demand for superior rootstock for rapid and mass multiplication. Hence, there is a need to identify the suitable rootstock for propagating jamun variety AJG-85 to get maximum graft success. Time of grafting is also one of the important factor for maximum graft success.

2. MATERIALS AND METHODS

The investigation was carried out on graft success in different varieties of jamun in different seasons at the Department of Fruit Science, Kittur Rani Channamma College of Horticulture, Arabhavi, during 2018-19. The experiment was laid out in Factorial completely randomized design using two factors. Factor I considered as three varieties *viz*., Konkan Bahadoli-M_1, AJG-85-M_2 and Local selection-M_3 and Factor II as seasons October-S_1, November-S_2 and December-S_3 with 5 replications. The softwood grafting of jamun was done using AJG-85 as scion and Konkan Bahadoli, AJG-85 and Local selection as a rootstock at an intervals of one month for three consecutive months from October to December. Observations were recorded on five grafts randomly selected 30, 60 and 90 days after grafting. The data were subjected to statistical analysis as per the procedure outlined by Panse and Sukhatme (1985) and the treatment means were compared by critical difference values computed at 5% level of significance.

3. RESULTS

3.1 Number of Sprouts and Sprout Length

The data in the Table 1 revealed that, among interaction effects minimum number of days

taken for sprouting was recorded in AJG-85 grafted on its own rootstock during October M_2S_1 (19.15), which was on par with AJG-85 grafted on Kokan Bahadoli during November M_1S_2 (20.17) and AJG-85 grafted on its own rootstock during November M_2S_2 (21.80) whereas, the maximum number of days were taken in AJG-85 grafted on Local selection during December M_3S_3 (33.44). Significantly maximum sprout length was recorded in AJG-85 grafted on its own rootstock during October M_2S_1 (7.91 cm) which was on par with AJG-85 grafted on Konkan Bahadoli during same month M_1S_1 (7.47 cm) whereas, the minimum was recorded in AJG-85 grafted on Konkan Bahadoli and Local selection rootstocks during December M_1S_3 and M_3S_3 (3.90 cm each) at 30 DAG. The maximum sprout length was recorded in AJG-85 grafted on its own rootstock and Konkan Bahadoli during October M_2S_1 and M_1S_1 (16.18 and 22.20 cm) whereas, the minimum was recorded in AJG-85 grafted on Local selection during December M_3S_3 (9.70 and 12.66 cm) at 60 and 90 DAG respectively.

3.2 Growth Parameters

The data pertaining on growth parameters presented in Table 2. Among the interaction effects maximum number of leaves were recorded in AJG-85 grafted on Konkan Bahadoli during October M_1S_1 (14.28) at 30 DAG whereas, the minimum number of leaves were recorded in AJG-85 grafted on Local selection during December M_3S_3 (4.24). The maximum number of leaves recorded in AJG-85 grafted on Konkan Bahadoli during October M_1S_1 (16.40) which was on par with AJG-85 variety grafted on its own rootstock in the same month M_2S_1 (15.06) and on Konkan bahadoli during November M_1S_2 (14.81). Whereas, the minimum number of leaves were recorded in December grafting on Local selection rootstock M_3S_3 (8.96) at 60 DAG.

Table 1. Influence of different rootstocks and time of grafting on number of days taken for sprouting, number of sprouts and sprout length (cm) in jamun at different days after grafting

Treatments	Number of days taken for sprouting	Number of sprouts			Sprout length (cm)		
		Days after grafting			Days after grafting		
		30	60	90	30	60	90
Factor I (Rootstocks)							
M_1	**21.94**	2.77	3.62	4.01	5.45	12.13	16.68
M_2	21.28	**3.14**	**3.85**	**4.31**	**6.36**	**13.90**	**20.11**
M_3	28.53	1.81	2.69	3.15	4.68	10.37	14.42
SE m±	0.53	0.08	0.13	0.07	0.20	0.31	0.33
CD @ 5%	1.54	0.22	0.37	0.21	0.58	0.89	0.95
Factor II (Time of grafting)							
S_1	**21.45**	**3.27**	**3.51**	**4.61**	**7.01**	**13.95**	**19.27**
S_2	23.76	2.44	3.63	3.89	5.61	11.82	16.84
S_3	26.53	2.03	3.01	3.43	3.88	10.63	15.09
SE m±	0.53	0.08	0.13	0.07	0.20	0.31	0.33
CD @ 5%	1.54	0.22	0.37	0.21	0.58	0.89	0.95
Interaction effect (Rootstocks × Time of grafting)							
M_1S_1	20.17	3.76	3.92	4.60	7.47	14.62	18.20
M_1S_2	22.36	2.48	3.82	4.04	5.68	11.78	17.60
M_1S_3	23.28	2.08	3.10	3.38	3.90	10.00	14.20
M_2S_1	**19.15**	**3.92**	**3.36**	**4.56**	**7.91**	**16.18**	**22.20**
M_2S_2	21.80	2.88	4.39	4.44	6.62	13.32	19.72
M_2S_3	22.87	2.64	3.79	3.94	4.56	12.20	18.40
M_3S_1	25.04	2.12	3.26	3.28	5.62	11.06	17.40
M_3S_2	27.12	1.96	2.67	3.20	4.52	10.36	13.20
M_3S_3	33.44	1.36	2.14	2.96	3.90	9.70	12.66
SE m±	0.92	0.13	0.22	0.13	0.35	0.53	0.57
CD @ 5%	2.66	0.38	0.65	0.37	1.02	1.54	1.64

M_1: Konkan Bahadoli; M_2: AJG-85; M_3: Local selection; S_1:October; S_2: November; S_3: December

Table 2. Influence of different rootstocks and time of grafting on number of leaves and graft height (cm) in jamun at different days after grafting

Treatments	Number of leaves			Graft height (cm)		
	Days after grafting			Days after grafting		
	30	60	90	30	60	90
Factor I (Rootstocks)						
M_1	**10.49**	**13.73**	**20.89**	**39.02**	**45.26**	**46.59**
M_2	9.80	13.46	20.47	38.68	43.56	46.10
M_3	6.20	9.69	16.90	31.27	34.83	38.37
SE m±	0.29	0.35	0.39	0.62	0.79	0.97
CD @ 5%	0.84	1.02	1.12	1.78	2.26	2.81
Factor II (Time of grafting)						
S_1	**11.28**	**13.91**	**22.36**	**39.10**	**43.55**	**47.22**
S_2	10.42	12.66	19.12	37.90	41.56	43.62
S_3	4.79	10.31	16.76	31.97	38.53	40.22
SE m±	0.29	0.35	0.39	0.62	0.79	0.97
CD @ 5%	0.84	1.02	1.12	1.78	2.26	2.81
Interaction effect (Rootstocks × Time of grafting)						
M_1S_1	14.28	16.40	25.84	43.80	48.92	51.80
M_1S_2	12.55	14.81	22.02	39.64	45.04	48.64
M_1S_3	4.64	10.01	14.80	33.61	41.82	39.34
M_2S_1	**12.61**	**15.06**	**23.28**	**41.14**	**47.39**	**49.94**
M_2S_2	11.32	13.34	19.74	38.68	42.42	44.54
M_2S_3	5.48	11.98	18.40	36.22	40.86	43.84
M_3S_1	6.96	10.28	17.98	32.34	34.34	39.94
M_3S_2	7.40	9.84	15.62	35.38	37.22	37.68
M_3S_3	4.24	8.96	17.10	26.10	32.92	37.50
SE m±	0.50	0.61	0.67	1.07	1.36	1.68
CD @ 5%	1.46	1.77	1.94	3.08	3.92	4.86

M_1: Konkan Bahadoli; M_2: AJG-85; M_3: Local selection; S_1:October; S_2: November; S_3: December

The maximum number of leaves recorded in October grafted Konkan Bahadoli variety M_1S_1 (25.84) whereas, the minimum number of leaves per graft was noticed in AJG-85 grafted on Konkan Bahadoli rootstock during December M_1S_3 (14.80) at 90 DAG. The maximum graft height was recorded in AGJ-85 grafted on Konkan Bahadoli during October M_1S_1 (43.80, 48.92 and 51.80 cm) at 30, 60 and 90 DAG. Which was on par with AJG-85 grafted on its own rootstock during October M_2S_1 (41.14, 47.39 and 49.94 cm) at 30, 60 and 90 DAG and AJG-85 grafted on Konkan Bahadoli during November M_1S_2 (45.04 and 48.64 cm) at 60 and 90 DAG. Whereas, the minimum graft height was observed in AJG-85 grafted on Local selection during December M_3S_3 (26.10, 32.92 and 37.50 cm) at 30, 60 and 90 DAG respectively.

The highest graft diameter was recorded in AJG-85 grafted on Konkan Bahadoli during October M_1S_1 (5.23, 6.03 and 7.27 mm) which was on par with AJG-85 grafted on its own rootstock during November month M_2S_2 (5.11, 5.92 and 6.46 mm) at 30, 60 and 90 DAG and AGJ-85 grafted on its own rootstock during October M_2S_1 (4.90 and 5.58 mm) at 30 and 60 DAG. The least graft diameter was recorded in December grafted AJG-85 on Local selection rootstock M_3S_3 (3.60 and 3.80 mm) at 30 and 60 DAG and AJG-85 grafted on Local selection during October M_3S_1 (4.46 mm) at 90 DAG respectively.

3.3 Graft Success and Graft Survival

The data in the Table 3 revealed that, among the interaction effects maximum graft success per cent was recorded in AJG-85 variety grafted on its own rootstock during October M_2S_1 (82.37%) followed by same combination on November M_2S_2 (79.25%) and AJG-85 grafted on Konkan Bahadoli during November M_1S_2 (77.66%) whereas, the minimum graft success was observed in AJG-85 grafted on Local selection during December M3S3 (53.23%) at 30 DAG. At 60 DAG the maximum graft success was recorded on its own rootstock grafted during October M_2S_1 (91.39%) which was statistically on

Table 3. Influence of different rootstocks and time of grafting on graft diameter and graft success in jamun at different days after grafting

Treatments	Graft diameter (mm)			Graft success (%)		
	Days after grafting			Days after grafting		
	30	60	90	30	60	90
Factor I (Rootstocks)						
M_1	**4.82**	**5.62**	**6.25**	75.58(60.54)	85.22 (67.86)	87.35 (69.87)
M_2	4.76	5.25	5.93	**79.39 (63.12)**	**88.80 (70.80)**	**90.94 (72.94)**
M_3	3.76	3.96	4.59	64.80 (53.78)	77.92 (62.48)	85.29 (67.84)
SE m±	0.07	0.09	0.16	1.65 (1.06)	1.46 (1.15)	2.26(1.36)
CD @ 5%	0.22	0.27	0.48	4.75 (3.06)	4.21 (3.32)	4.60 (3.92)
Factor II (Time of grafting)						
S_1	**4.64**	**5.16**	**5.96**	**76.99 (61.46)**	**88.89 (70.74)**	**89.19 (71.12)**
S_2	4.61	4.96	5.69	75.06 (60.20)	85.12 (67.61)	89.28 (71.20)
S_3	4.08	4.70	5.12	67.71 (55.78)	77.93 (62.78)	82.13 (65.86)
SE m±	0.07	0.09	0.16	1.65 (1.06)	1.46 (1.15)	2.26 (1.36)
CD @ 5%	0.22	0.27	0.48	4.75 (3.06)	4.21 (3.32)	4.60 (3.92)
Interaction effect (Rootstocks × Time of grafting)						
M_1S_1	5.23	6.03	7.27	75.74(60.54)	88.14(70.04)	88.94 (71.55)
M_1S_2	5.11	5.92	6.46	77.66(61.86)	84.94 (67.45)	90.23 (72.08)
M_1S_3	4.10	4.90	5.02	73.32 (59.22)	82.57 (66.12)	73.89 (59.50)
M_2S_1	**4.90**	**5.58**	**6.14**	**82.37 (65.16)**	**91.39 (73.09)**	**93.49 (75.34)**
M_2S_2	4.82	4.78	5.87	79.25 (62.96)	89.25 (71.10)	91.43 (73.29)
M_2S_3	4.56	5.39	5.78	76.57 (61.26)	85.77 (68.21)	87.88 (70.18)
M_3S_1	3.76	3.89	4.46	72.88 (58.68)	87.15 (69.11)	85.15 (67.36)
M_3S_2	3.92	4.18	4.75	68.28 (55.79)	81.16 (64.61)	86.10 (68.25)
M_3S_3	3.60	3.80	4.56	53.24 (46.86)	65.46 (54.02)	84.61 (67.91)
SE m±	0.13	0.16	0.28	2.86 (1.84)	2.53 (2.00)	2.77(2.36)
CD @ 5%	0.39	0.47	0.83	8.23 (5.89)	7.29 (5.76)	7.97 (6.45)

Values in parentheses are arc sign transformed data

M_1: Konkan Bahadoli; M_2: AJG-85; M_3: Local selection; S_1: October; S_2: November; S_3: December

par with same combination on November M_1S_2 (89.25%), AJG-85 grafted on Konkan Bahadoli M_1S_1 (88.14%) and Local selection grafted in October M_3S_1 (87.15%). Whereas, the minimum graft success was observed in AJG-85 grafted on Local selection during December M_3S_3 (65.46%) at 60 DAG.

AJG-85 grafted on its own rootstock during November recorded the maximum graft survival M_2S_2 (96.54%) followed by October with same combinations M_2S_1 (95.09%) whereas, the minimum was recorded in AJG-85 grafted on Konkan Bahadoli during December M_1S_3 (85.19%) at 120 DAG. October grafted AJG-85 on its own rootstock recorded the maximum graft survival M_2S_1 (92.52%) followed by November grafted M_2S_2 (89.63%) whereas, the minimum survival was recorded in AJG-85 grafted on Konkan Bahadoli during December M_1S_3 (65.46 %) at 180 DAG.

4. DISCUSSION

The minimum number of days taken for sprouting, maximum number of sprout, sprout length observed in AJG-85 grafted on its own rootstock during October due to same variety high graft compatability between scion and stock and congenial weather condition like optimum temperature and high relative humidity helps in early contact of cambial stock and scion results in early callus formation and initiation of sprout. Similar results were reported by Giri and Lenka (2007) in jamun. The maximum number of days was recorded in December grafted Local selection due to distant species and unfavourable climatic condition. The results were in line with results of Chander *et al.* (2016) in jamun.

The maximum graft height was observed in AJG-85 grafted on its own rootstock during October

Table 4. Influence of different rootstocks and time of grafting on graft survival per cent in jamun at different days after grafting

Treatments	graft survival per cent (Days after grafting)	
	120	**180**
Factor I (Rootstocks)		
M_1	90.66 (72.91)	84.54 (67.27)
M_2	**93.96 (76.82)**	**89.44 (71.82)**
M_3	89.02 (71.23)	78.95 (63.31)
SE m±	1.14 (1.33)	1.36 (1.36)
CD @ 5%	3.28 (3.83)	4.58 (3.92)
Factor II (Time of grafting)		
S_1	91.67 (74.62)	**88.56 (71.23)**
S_2	**93.21 (76.86)**	86.63 (69.17)
S_3	88.76 (71.35)	77.93 (62.81)
SE m±	1.14 (1.33)	1.36 (1.36)
CD @ 5%	3.28 (3.83)	4.58 (3.92)
Interaction effect (Rootstocks× Time of grafting)		
M_1S_1	91.09 (72.85)	88.24 (70.17)
M_1S_2	90.78 (74.43)	83.15 (65.80)
M_1S_3	85.19 (67.58)	65.46 (54.04)
M_2S_1	95.09 (80.33)	**92.57 (76.05)**
M_2S_2	**96.54 (80.34)**	89.83 (73.45)
M_2S_3	90.25 (72.02)	85.76 (68.24)
M_3S_1	88.84 (70.69)	84.94 (67.47)
M_3S_2	92.31 (75.82)	86.10 (68.28)
M_3S_3	90.85 (74.46)	82.57 (66.15)
SE m±	1.97 (2.30)	2.70 (2.36)
CD @ 5%	NS	7.80 (6.80)

Values in parentheses are arc sign transformed data; NS: Non Significant
M_1: Konkan Bahadoli; M_2: AJG-85; M_3: Local selection; S_1: October; S_2: November; S_3: December

might be due to favourable climatic condition helps in higher cell activity and early healing of graft union which results in faster growth of grafts and minimum graft height was recorded in December. This in turn might be due to decreased synthesis of endogenous auxin and mobilization of reserved food material caused by reduced activity of hydrolyzing enzymes. The similar results were obtained by Ghojage *et al*. [5] and Chander *et al.* [6] in jamun.

The maximum graft success percentage was observed in AJG-85 grafted on its own rootstock during October due to prevailing optimum temperature coupled with higher humidity which encourages early contact of cambial layers of stock and scions results in earlier callus formation and initiation of growth in grafts led to higher graft success and also fact that the maturity and availability of healthy scion. The results are in conformity with findings of Gadekar *et al*. [7] in jamun and the minimum graft success percentage was observed in AJG-85 grafted on Local selection during December because of different species and unfavourable climatic condition [8].

5. CONCLUSION

Based on the findings of the present study, it could be inferred that AJG-85 performed well, when it is grafted on its own rootstock in October month for maximum number of sprouts, sprout length, minimum number of days taken for sprouting, per cent graft success and per cent graft survival at different days after grafting.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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