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Impact of growth regulator and cutting time on growth of jamun [*Syzygium cuminii*, (L.) Skeels] hardwood stem cuttings

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Abstract
Jamun is an evergreen tropical tree; its seed has vast ability to control blood pressure, blood sugar, glycosuria and other health problems, now days, which is common in our society. Therefore, in order to produce good quality and genuine planting materials, a study aimed at optimizing propagation and survivability of jamun hard wood cutting was conducted. In this experiment four levels of different dates of cutting planting with six levels of IBA concentrations are used in 50 cuttings were replicated three times in every treatment. The results showed that the jamun cuttings treated with 3000ppm IBA (G_5) produced the significantly higher sprouting and all shoot characteristics under 2nd fortnight of September (D_1) month compared to other treatments including control.

Keywords: *Syzygium cuminii*, hardwood stem cuttings, growth regulator, cutting time

Introduction
Jamun (*Syzygium cumini* Skeels) belongs to the myrtle family Myrtaceae is highly adapted to diverse environmental conditions, is widely distributed in India up to an altitude of 1600 m. It is well-known for its nutritional and therapeutic attributes (Mishra *et al*., 2015) [7]. Studies have shown that the various extracts of Jamun possess a range of pharmacological properties such as antibacterial, antifungal, antiviral, anti-genotoxic, anti-inflammatory, anti-ulcerogenic, cardio protective, anti-allergic, anticancer, chemo preventive, radio protective, free radical scavenging, antioxidant, hepatoprotective, anti-diarrheal, hypoglycaemic and antidiabetic effects. The presences of Anthocyanins, fibres and ellagitannins which are present in the pulp are important in reducing the oxidative stress-induced diseases.
It is an evergreen tropical tree, which belongs to the family Myrtaceae. In India the maximum number of Jamun trees is found scattered throughout the tropical and subtropical regions. It has more nutritive and medicinal value with minimum calories. Jamun is known as powerhouse of health. Dried alcoholic extract of jamun seeds reduces blood sugar and glycosuria. The seed extract lowers blood pressure by 34.6%.
In addition to soaking in water, a number of other initiatives had been recorded for enhancing germination by use of chemicals and growth regulators like gibberllic acid, thiourea, KNO3 *etc* with varied success.
The mechanism underlying improved germination by water soaking could be that, it stimulates series of biochemical change in the seed that are essential to initiate the emergence process like break down of dormancy, hydrolysis, metabolism of growth inhibitors, imbibitions, activation of enzymes (Ajouri *et al.*, 2004) [1].
The seed longevity and germination percentage of jamun is 3 week, 8% respectively (Roberts, 1985) [9]. According to various research works, Indole-3-butyric acid (IBA) is the best growth regulator for promoting root initiation of a large number of species. For resolving these health issues, which is commonly present in every small population, the present investigation was undertaken with the objectives of multiplication of healthy, genuine *Syzygium cuminii* plant through cuttings.

Materials and Methods
The present experiment was laid out and carried out at Horticulture Research Station, Department of Horticulture, JNKVV, Jabalpur (M.P.), with Asymmetrical Factorial Completely Randomized Design.

The experiment was consists of all possible treatment combinations as a result of two factors i.e. different dates of cutting planting (2nd fortnight of September (D1), 2nd fortnight of October (D2), 2nd fortnight of November (D3) and 2nd fortnight of December (D4)) and different IBA concentrations i.e. (1000, 1500, 2000, 2500 and 3000 ppm), each treatment consisted of 50 cuttings were replicated three times.

The requisite quantity of IBA (1000, 1500, 2000, 2500, 3000 mg) was weighed separately by electronic chemical balance, these weighed samples were first dissolved in 10 ml of ethyl alcohol (90%) by thoroughly shaking and then measured quantity (990 ml) of distilled water was added in to the flask make up the volume to 1 liter. This yields 1000, 1500, 2000, 2500 and 3000 ppm of IBA solutions. Pure distilled water without any growth regulator was considered as control i.e. at 0 ppm.

The observations of jamun cutting plants were recorded on Days taken to start sprouting, Percentage of cutting takes (percentage of sprouted cuttings), Length of shoot (cm), No. of shoots per cutting, No. of leaves per shoot, Total no. of leaves per cutting, Fresh weight of leaves (g) at 30, 45, 60, 90 and 120 days after planting.

Results and Discussion

The results of present investigation (Tables) clearly exhibits that the days taken to start sprouting were significantly affected by different date of cutting planting, but earliest sprouting of cuttings was noted in 2nd fortnight of September (D_1). Whereas, maximum days required for sprouting of cuttings under 2nd fortnight of December (D_4). The percentage of cutting takes at 45 days was also found significantly higher (73.89) in September cutting. Whereas, minimum in D_4. Most probably this may be due to favorable environmental conditions like (temperature, relative humidity and sunlight), which helps early completion of physiological process and growth of cuttings. Those cuttings of Karna Khatta planted during rainy season (July – August) rooted better than the cuttings planted in spring season (February). The length of shoot after 120 days was maximum (10.58 cm) in 2nd fortnight of September (D_1) as the minimum was recorded (2.22 cm) in December (D_4) month cutting. This may be results of earlier sprouting and more survival of the cutting under September planting. Such phenomena encourage the faster growth of shoot resulted more length. Similarly, the maximum (4.56) number of shoots per cutting was recorded in 2nd fortnight of September at 120 DAP. Whereas, minimum (2.63) in D_4, which may be nutritional status of the cutting and linear growth of stem by causing cell elongation.

The number of shoots per cutting was similar at 90 &120 days after planting, this may be result of accumulated of synthesized food material, including carbohydrates in the plants. Number of leaves per shoot as well as total number of leaves per cutting was also found significantly higher in September month planting, which was at par with 2nd fortnight of October while the minimum in 2nd fortnight of December cuttings. This may be due to higher starch, sugar and ascorbic acid synthesis during mass rooting and shoot growth. The maximum (5.36 g) fresh weight of leaves was recorded in D1, Which may be results of higher number of leaves and their size under this treatment.

Under growth regulator, (fig. 1) minimum days taken to start sprouting, percentage of sprouted (78.75%) cutting was perform well in 3000 ppm IBA as compared to control (55.00). This may be the appropriate level of auxin resulted in earlier completion of physiological process involving in rooting and sprouting of cuttings that the division of the first root initial cells is depending upon either applied or endogenous auxin. The maximum (8.83 cm) length of shoot, (4.11) number of shoots per cutting and number of leaves per shoot was recorded in 3000 ppm IBA, while minimum in control. Which was at par with 1000 ppm IBA, This may be outcome of, IBA encourage the cell division and elongation with the modification of physiological process resulted more length of shoots. Total number of leaves per cutting and fresh weight of leaves at 120 DAP, was also recorded higher under 3000 ppm IBA treatment. It may be vigorous root system, which increased nutrient uptake.

The interaction of both factor on days taken to start sprouting was affected non-significantly and also all the shoot characteristics perform well in D1G5 (2nd fortnight of September x 3000 ppm IBA) as compare to D4G0.

Table 1: Effect of different cuttings planting time on sprouting and shoot characteristics.

Cuttings planting time (D)	Days taken to start sprouting	Percentage of sprouted cuttings at 45 DAP	Length of shoot (cm) at 120 DAP	No. of shoots per cutting at 120 DAP	No. of leaves per shoot at 120 DAP	Total no. of leaves per cutting at 120 DAP	Fresh weight of leaves (g) at 120 DAP
D_1	9.00	73.89	10.58	4.56	6.84	23.08	5.36
D_2	9.61	69.61	8.56	3.68	5.26	15.73	4.24
D_3	11.22	64.33	2.89	3.29	3.80	9.77	0.55
D_4	19.17	56.50	2.22	2.63	2.70	7.83	0.45
S.Em+	0.38	0.44	0.18	0.04	0.10	0.26	0.12
C.D.at 5%	1.09	1.25	0.52	0.11	0.28	0.75	0.33

Table 2: Effect of different concentration of growth regulator on sprouting and shoot characteristics

Growth regulator concentrations (G)	Days taken to start sprouting	Percentage of sprouted cuttings at 45 DAP	Length of shoot (cm) at 120 DAP	No. of shoots per cutting at 120 DAP	No. of leaves per shoot at 120 DAP	Total no. of leaves per cutting at 120 DAP	Fresh weight of leaves (g) at 120 DAP
Control (G_0)	16.17	55.00	3.62	3.21	3.82	11.64	1.02
T1000 (G_1)	12.25	59.67	5.15	3.32	4.10	12.81	1.94
T1500 (G_2)	11.92	64.25	5.48	3.45	4.53	13.48	2.09
T2000 (G_3)	11.50	67.50	6.23	3.53	4.79	14.08	2.96
T2500 (G_4)	11.08	71.33	7.06	3.62	5.15	15.36	3.51
T3000 (G_5)	10.58	78.75	8.83	4.11	5.51	17.24	4.40
S.Em+	0.47	0.54	0.22	0.05	0.12	0.32	0.14
C.D.at 5%	1.34	1.54	0.63	0.14	0.34	0.92	0.40

Table 3: Interaction between Planting time and Concentration of growth regulator

Interaction between Planting time and Concentration of growth regulator							
D_1G_0	11.33	61.33	7.98	4.13	6.06	20.40	2.86
D_1G_1	9.33	67.00	9.31	4.33	6.41	21.80	3.74
D_1G_2	9.00	72.67	9.53	4.40	6.80	22.40	3.85
D_1G_3	8.67	76.00	10.83	4.47	6.87	23.13	6.40
D_1G_4	8.00	79.33	12.17	4.51	7.23	24.00	6.55
D_1G_5	7.67	87.00	13.65	5.50	7.64	26.73	8.76
D_2G_0	13.00	57.00	3.35	3.47	3.68	11.07	0.79
D_2G_1	9.67	63.00	7.93	3.53	4.27	13.87	3.45
D_2G_2	9.33	68.33	8.69	3.60	5.15	15.73	3.80
D_2G_3	9.00	71.67	9.09	3.67	5.83	17.00	4.58
D_2G_4	8.67	74.67	10.46	3.73	6.15	17.70	6.33
D_2G_5	8.00	83.00	11.85	4.07	6.50	19.00	6.47
D_3G_0	16.67	52.00	1.73	2.97	3.53	8.60	0.25
D_3G_1	11.00	57.67	1.80	3.07	3.57	8.97	0.31
D_3G_2	10.67	63.00	2.03	3.27	3.67	9.07	0.39
D_3G_3	10.00	66.33	3.27	3.33	3.70	9.40	0.48
D_3G_4	9.67	69.33	3.39	3.40	3.97	10.37	0.62
D_3G_5	9.33	77.67	5.10	3.67	4.37	12.20	1.27
D_4G_0	23.67	49.67	1.40	2.27	2.00	6.50	0.18
D_4G_1	19.00	51.00	1.56	2.33	2.17	6.60	0.24
D_4G_2	18.67	53.00	1.67	2.53	2.50	6.70	0.32
D_4G_3	18.33	56.00	1.71	2.63	2.77	6.80	0.37
D_4G_4	18.00	62.00	2.23	2.83	3.23	9.37	0.53
D_4G_5	17.33	67.33	4.72	3.20	3.53	11.03	1.08
S.Em+	0.94	1.08	0.44	0.10	0.24	0.65	0.28
C.D.at 5%	NS	3.07	1.26	0.28	0.68	1.84	0.81

Fig 1: Combined Effect of Indole Butyric Acid (IBA) concentrations and cutting planting time on jamun hard wood cuttings

Conclusions

For the multiplication and production of true to type of jamun plant 3000 ppm IBA concentration is essential under 2nd fortnight of September cuttings planting. Rootex and hardwood cutting worked better together to demonstrate additional shooting and rooting characteristics in jamun. The findings would be very helpful in standardizing an effective procedure for growing jamun from cuttings.

Conflict of Interest

Not Applicable

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