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Effect of GA_3 and growing media on seed germination of jamun (*Syzygium cumini* L.)cv. Local

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ABSTRACT
The present investigation was conducted at Fruit Research Station Lalbaug, Department of Horticulture, College of Agriculture, JAU, Junagadh during 2018. The treatments comprised of different concentrations of GA_3 and growing media. The treatment G_4: GA_3 500ppmhad significant influence on different seed germination traits like minimum days required for seed germination (9.25 days), maximum germination percentage (91.98%) and survival percentage (78.66%) of jamun seedling. The media M_3: Soil+ Cocopeat+ Vermicompost (1:1:1) had also significant influence on different seed germination traits like minimum days required to seed germination (13.17 days), maximum germination percentage (78.41%) and maximum survival percentage (75.99%) of jamun seedling. Among the interaction effect $G_4M_3$was found to be better with respect to minimum days required to germination (7.67 days), the maximum germination percentage (93.90%) and maximum survival percentage (84.44%) of jamun cv. Local.The polyembryony percentage was found non-significant among the different treatment of $GA_3$and media, as well as their interaction. From the observation, it can be concluded that seed germination of jamun cv. Local, can be enhanced by the seed treatment with GA_3 @ 500ppmfor 24 hours followed by sowing the seed in media composed Soil+ Cocopeat+ Vermicompost (1:1:1) alone or in combination.
Keywords: Jamun, Media, Gibberellic acid, cocopeat, Vermicompost, Farm Yard Manure, Germination.

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INTRODUCTION

Jamun (*Syzygium cumini*L.) is an important indigenous minor fruit, belonging to the family Myrtaceae, grown throughout the tropics and subtropics as an avenue plantation. Jamun is also known as Indian blackberry, java plum and black plum. In India, these trees are mostly found in scattered range from lower Himalaya region having an elevation of 1300 m to Kumaon hills of 1600 m. It is widely grown in various part of India from the Indo Gangetic plains in the north to Tamil Nadu in the south [3].

It isa slow growing species and can reach a height up to 30 m in life span of more than 100 years. Its dense foliage provides shade and preferred for its ornamental value. It has the bark up to 2.5 cm thick, brown or dark grey in colour fairly smooth, inner bark with thin green outer layer, mottled light brown, astringent and bitter to the taste. Twigs are light green, becoming light grey, slightly flattened and hairless. The wood is water resistant. Jamun trees start flowering from March to April. It has many valuable properties and virtually every part of the tree has been utilized by both urban and rural dwellers. The fruit is good source of iron, sugar, minerals, protein and carbohydrate. It contain fat (0.10%), moisture (86.4%), protein (0.65%), juice (65%), iron (0.1%), calcium (0.02%), Acidity (2.5%) and vitamin-C (40 mg/100 g pulp) [2].The fruits are used as effective medicine against diabetes, heart and liver trouble. The jamun fruits are good source of antioxidant. Gallic acid and tannins account for the astringency of the fruit. Fully ripe fruits are eaten fresh and can also be processed into jam, jelly, squash, wine and vinegar. A little quantity of fruit syrup is much useful in curing diarrhea. Seeds contain various alkaloids such as jambos in and glycoside which inhibits the conversion of starch into sugar. Therefore, the powdered seeds are useful for diabetic patients.

It is commonly propagated by seed and has no dormancy hence fresh seeds are sown immediately after extracting from fruits. Seed can be sown 4-5 cm deep in the nursery. There is occurrence of

polyembryony in jamun to the extent of 20-50% hence nucellar seedling may be utilized to produce true to the type plants. The seeds of jamun took 24-61 days for total germination under Bihar conditions [8].Studies revealed that seed extraction of jamun after heaping the fruits for a single day was better for getting good quality seeds in comparison to the extraction of seeds immediately after collection [9].Large sized seeds to have higher germination percentage (99-98%) than the smaller one (89-79%) [7]. Seeds are orthodox in nature and it can't be stored for long time because germination capacity decreases with increasing storage period.

Seed germination is the resumption of active growth of embryo that results in the emergence of the young plant. Cotyledonary endosperm is good source of energy during germination because that is the storage body of carbohydrates. This carbohydrate converted into sugar and helps in germination of seed but conversion of carbohydrate to sugar depends upon different enzyme. During germination, GA_3 induces the synthesis of hydrolytic enzymes, such as amylase and protease. These enzymes degrade the stored food reserves accumulated in the endosperm or embryo as the seed matured. This degradation of carbohydrate and storage protein provides nourishment and energy to support germination. Gibberellins (GA_3) activate the embryonic vegetative growth, weakens the endosperm layer that involves the embryo and restricts its growth and mobilizes the reserves from the endosperm of cereals [1]. Sometimes germination percentage is good but survivability of the seedlings can't be assured due to lack of proper nutrition in the media.

Media is one of the important factors, which plays an important role in growth and survival of seedlings. Different growing media like soil, cocopeat, Farm Yard Manure (FYM) and vermicompost either alone or in different proportion have been found beneficial to influence germination and growth of seedlings. A good growing media provides sufficient anchorage or support to the plant, serves as a reservoir for nutrients and water, allows oxygen diffusion to the roots and permits gaseous exchange between roots and the atmosphere outside root substrate. Hence the present study was conducted to evaluate the effect of GA_3 and media on germination, growth and survival of jamun cv. Local.

MATERIAL AND METHODS

The experiment was conducted at Fruit Research Station, Lalbaugh, Department of Horticulture, College of Agriculture, Junagadh Agricultural University, Junagadh, Gujarat during July to November of 2018. Junagadh is situated at 21.5°N latitude and 70.5°E longitude with an altitude of 60 meters above MSL on the western side at the foot hill of mountain Girnar sierra (Gujarat). Climate is typically subtropical, characterized by fairly cool and dry winter, hot and dry summer and warm and moderately humid monsoon. The rainy season commences by third week of June and ends in September. July and August are the months of heavy precipitation. Winter sets in the month of November and continues till the month of February. December and January are the coldest months of winter. Summer commence in the second fortnight of February and ends in the middle of June. April and May are the hottest months.

The treatments comprised of different concentrations of GA_3 (G_1: Water soaked, G_2:GA_3 300 ppm, G_3: GA_3 400 ppm and G_4: GA_3 500 ppm) and different growing media [M_1: Soil+ Cocopeat+ FYM (1:1:1), M_2: Soil+ Cocopeat+ FYM (2:1:1), M_3: Soil+ Cocopeat+ Vermicompost (1:1:1), M_4: Soil+ Cocopeat+ Vermicompost (2:1:1)]. There were sixteen treatments combination embedded in a Completely Randomized Block Design (factorial) with three repetitions. The details of the treatments applied in the present investigation are as under: T_1: G_1M_1, T_2: G_1M_2, T_3: G_1M_3, T_4: G_1M_4, T_5: G_2M_1, T_6: G_2M_2, T_7: G_2M_3, T_8: G_2M_4, T_9: G_3M_1, T_{10}: G_3M_2, T_{11}: G_3M_3, T_{12}: G_3M_4, T_{13}: G_4M_1, T_{14}: G_4M_2, T_{15}: G_4M_3 and T_{16}: G_4M_4.

Gibberellic acid solution of 300, 400 and 500ppm were separately prepared by dissolving 300, 400 and 500 mg GA_3. (GA_3 was completely dissolved by addition of small quantity of NaOH pellets) in 1 liter of distill water. Seeds were soaked with different concentration of GA_3 for 24 hours and sown 1.2 cm deep in the 9 x 11 cm polythene bags. Whereas, Different growing media were prepared according to predefined proportion of various soil, cocopeat, FYM and vermicompost and filled in 9 X 11 cm black polythene bags on 1st July, 2018 at experimental site. A light irrigation was given immediately after dibbling of seeds in the black polythene bags for proper establishment. Irrigations were given repeatedly depending upon soil moisture status of the plant.

Five plants were selected at random from each treatment and tagged for recording the observations. Required observations were recorded from each repetition of different treatments and average value was calculated.The analysis of variance for experimental design was carried out for all the characters under study.The days taken for germination were calculated from the date of sowing up to germination of jamun seeds.Total number of germinated seeds under each treatment was counted daily, right from the first emergence of the seed up to the period of completion of seed germination. The per cent of seed germination was calculated by following formula:

$$\text{Seed germination (\%)} = \frac{\text{Total no.of germinated seeds}}{\text{Total no.of seeds sown}} \text{x } 100.$$

The survival percentage of each treatment was recorded at 120 days after seed sowing. The survival percentage was calculated by using formula as given below:

$$\text{Survival (\%)} = \frac{\text{No.of survived seedlings}}{\text{Total no.of seedlings}} \text{x } 100.$$

Five seedlings were randomly selected from each treatment form that embryos were separated and counted.

$$\text{Polyembryony percentage} = \frac{\text{No.of polyembryony germinated plants}}{\text{No.of seedlings}} \text{ x } 100$$

RESULTS AND DISCUSSION

The results of the present investigation revealed that the different concentration of $GA_3$and growing media were significantly affected the seed germination parameters *viz*., days to seed germination, germination percentage (%), survival (%) of seeds and interaction effect of different concentration of $GA_3$and different growing media on seed germination parameters were found significant. However polyembryony percentage was found non- significant.

Effect of GA_3on seed germination parameters

The results pertaining to seed germination parameters (Table 1) were significantly influenced by varying GA_3 concentrations. The minimum days required for seed germination (9.25 days) was noted with the treatment(G_4). The same treatment also recorded highest germination percentage (91.98%) and survival percentage (78.66%) whereas, the polyembryony percentage was found to be non-significant.The increasing seed germination parameters might be due to the involvement of GA_3 in the activation of cytological enzymes along with increase in cell wall plasticity and better water absorption. GA_3 acts directly on embryo relieving them from dormancy through promoting protein synthesis, elongation of coleoptiles and leaves and also helps in the production of ethylene. This ethylene invokes the synthesis of hydrolases, especially amylase, which favours the seed germination [10]. GA_3 stimulates seed germination by formation of α-amylase enzymes which converts insoluble starch into soluble sugars and it also initiates the radical growth by removing some metabolic blocks as suggested by [4 and 11].

Effect of media on seed germination parameters

Regarding different media under study, the medium M_3consisting of Soil+ Cocopeat+ Vermicompost (1:1:1) were recorded significant influence on different traits like minimum days required to seed germination (13.17days), maximum germination percentage (78.41%) and survival percentage (72.10%). Whereas, the percentage of polyembryony found with different media was non-significant (Table 1).

The increasing seed germination parameters might be due to beneficial effect of medium composition in improving bio-physicochemical properties of media. Soil provides natural support to plant, cocopeat facilitate warm condition, high water holding capacity, vermicompost act as a source of organic manure providing better nutritionto the germinating seedlings [5]. The well decomposed compost may preserve soil humidity, increase nutrients, cell turgidity, cell elongation and respiration at optimum level. Organic matter may also improve nutrient availability and improve phosphorus absorption [6]. All these factors are favorable for seed germination and ultimately increase seed germination per cent.

Interaction effect of $GA_3$and media on seed germination parameters

The interaction effect between GA_3 concentrations and different media on seed germination parameters was foundto be significant (Table 1). Among the different combinations of GA_3concentrations and media,G_4M_3[GA_3 @ 500 ppm with Soil+ Cocopeat+ Vermicompost (1:1:1)] recorded minimum days to germination (7.33 days), maximum germination (93.90%) and survival percentage (84.44%) of jamun seedling during the course of experimentation whereas, the polyembryony percentage was non-significant. Polyembryony might be not influenced by the GA_3 or growing media as it is a genetically controlled character.

CONCLUSION

In the light of the results obtained from this investigation, it can be concluded that seed soaking treatment with GA_3 @ 500 ppm for 24 hours, then seeds are sown in media consisting of Soil+ Cocopeat+ Vermicompost at the rate of 1:1:1 were found to be superior in terms of seed germination of jamun seedling cv. Local.

Table 1: Effect of different GA_3 levels and growing media on days to germination, survival percentage and germination percentage of jamun cv. Local

Treatments	Days to germination	Germination percentage (%)	Survival percentage (%)
Gibberellic acid (G)			
G_1	19.83	61.00	63.40
G_2	16.00	69.00	66.61
G_3	12.75	76.00	71.28
G_4	**9.25**	**91.08**	**78.66**
S.Em.±	0.21	0.95	0.85
C.D. at 5%	0.60	2.73	2.44
Media (M)			
M_1	16.00	69.57	67.43
M_2	15.33	73.51	69.15
M_3	**13.17**	**78.41**	**72.10**
M_4	13.33	75.58	71.28
S. Em.±	0.21	0.95	0.85
C.D. at 5%	0.60	2.73	2.44
Interaction			
T_1: G_1M_1	21.67	57.73	62.17
T_2 : G_1M_2	21.33	62.93	63.25
T_3 : G_1M_3	19.00	62.95	64.88
T_4 : G_1M_4	17.33	60.40	63.31
T_5 : G_2M_1	17.33	63.57	67.48
T_6 : G_2M_2	16.67	65.89	66.68
T_7 : G_2M_3	14.67	77.42	65.14
T_8 : G_2M_4	15.33	69.12	67.16
T_9 : G_3M_1	14.33	66.97	64.97
T_{10} : G_3M_2	13.00	76.49	71.46
T_{11}: G_3M_3	11.67	79.39	73.96
T_{12} : G_3M_4	12.00	81.16	74.75
T_{13} : G_4M_1	10.67	90.02	75.08
T_{14} : G_4M_2	10.33	88.74	75.22
T_{15} : G_4M_3	**7.33**	**93.90**	**84.44**
T_{16} : G_4M_4	8.67	91.66	79.89
S. Em.±	0.42	1.90	1.69
C.D. at 5%	1.20	5.47	4.88
C.V. %	4.99	4.42	4.19

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