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IMPACT OF INDOLE BUTYRIC ACID AND GROWING MEDIA ON GROWTH PARAMETERS OF DRAGON FRUIT [*HYLOCEREUS UNDATUS* L.] CUTTINGS

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ABSTRACT

An experiment was conducted during August–November 2021 in shade net house of Horticulture farm, S.K.N. College of Agriculture, Jobner- Jaipur (Rajasthan). The experiment was laid out in Factorial CRD and replicated three times with 16 treatment combinations including four plant growth regulator (IBA) concentrations (control, 2000, 4000 and 6000 ppm) and four growing media (control, sand: cocopeat, sand: vermicompost and sand: vermicompost: cocopeat). The result revealed that the dragon fruit cuttings treated with IBA at 6000 ppm performed superior for shoot parameters *viz.*, least days taken for sprouting (25.03 days), percentage sprouting (59.98%), sprouts per cutting (2.35), shoot length per cutting (14.80 cm), diameter of shoot (36.99 mm) and fresh and dry shoot weight (55.85 and 11.08, respectively). Similarly, least days taken for sprouting (25.01 days), percentage sprouting (59.53%), sprouts per cutting (2.35), shoot length per cutting (14.80 cm), diameter of shoot (36.47 mm) and fresh and dry weight of shoot (56.01 and 11.21, respectively) at 75 days of planting. Dragon fruit stem cuttings treated with 6000 ppm of IBA and grown in sand: vermicompost: cocopeat (1 : 1 : 1) media proved significantly superior combined treatment in maximum (18.64 cm) shoot length.
***Keywords*:** Pitahayas, *Hylocereus undatus*, rooting hormone, Growing media and Cuttings.

Introduction

Pitahayas (*Hylocereus* spp.) (Best known as dragon fruit) are perennial climbing cactus plants native to tropical areas of North, Central, and South America (Morton, 1987). Vietnam, Colombia, Costa Rica, Mexico, Nicaragua, and to a lesser extent Australia, Israel, and Reunion Island, are the principal producers of pitahaya fruit. dragon fruit is a great source of vitamin C and fiber. Consequently, they are rich in minerals, especially phosphorus and calcium supplements. The phyto-albumins found in dragon fruits may have anti-oxidant properties that aid in preventing the growth of cancer cells. According to reports, dragon fruit also prevents memory loss, controls blood sugar levels in diabetic individuals, and other health benefits. Additionally, it can encourage the development of probiotics in the digestive system (Zainoldin and Baba, 2012). In dry areas, it is thought that dragon fruit has potential for commercial growth (Vaillant *et al*., 2005). This species was shown to have a high water-use efficiency. One of the dragon fruit methods to meet the need for water is forming aerial roots from the stem's sides to draw water from the environment (Nobel *et al.*, 2004).

Cuttings or seeds are typically used for propagation. Cross pollination causes seeds that are not true to type even though the mechanism of seed propagation is fairly simple (Andrade *et al*., 2005). Therefore, a large number of plantlets with a healthy shoot and root system can be created via vegetative propagation techniques, such as cuttings, to satisfy the demands of expanding commercial cultivation. It is

also known that stem cuttings can be propagated to create a derivative with the same beneficial features as the original plant. The challenge in growing dragon fruit is finding cuttings of superior grade. Vegetative propagation, like cutting, can increase availability. Therefore, economical, quick, and easy vegetative techniques of propagation such as stem cuttings are used. There are few publications on research into the application of growth regulators for enhanced root growth as they have an indispensable position in indispensable position in inducing rooting and the multiplication of Dragon fruit from cuttings (Siddiqua *et al*., 2018). Apart from that, different plant growth media also play quintessential role for same. Growing dragon fruit has been plagued by a number of issues, including cuttings that fail to take root and those that turn yellow. Understanding how to select appropriate growing material and apply chemical control is required to address this issue. This study was done to find out how different growth media compositions and IBA concentrations affected shooting behaviour of dragon fruit stem-cutting.

Materials and Methods

The current study was conducted in the polyhouse situated at the horticulture farm of the S.K.N. College of Agriculture, Jobner (Jaipur), Department of Horticulture. Jobner is 426 meters above mean sea level and is located at 26˚5' North Latitude and 75˚28' East Longitude. The area is located in Rajasthan's Semi-Arid Eastern Plain Zone, or Agroclimatic Zone III-A. This region experiences subtropical weather that is extreme, with freezing winters and scorching, dry summers. The mean maximum temperature in summer ranges from 25 ^{0}C to 46 ^{0}C and the mean maximum temperature in winter ranges from 17 ^{0}C to 32 ^{0}C. The average maximum temperature in summer spans from 25 ^{0}C to 46 ^{0}C, while in winter it ranges from 17 ^{0}C to 32 ^{0}C.

Factor A: Rooting hormone (ppm)	**Factor B**: Growing media
R_0 - Control	GM_0 - Control
R_1 - IBA 2000	GM_1- Sand: Cocopeat (1:1)
R_2 - IBA 4000	GM_2 - Sand: Vermicompost (1:1)
R_3 - IBA 6000	GM_3 - Sand: Vermicompost: Cocopeat (1:1:1)

A Factorial Complete Randomized Design was used to set up the experiment. IBA in various concentrations and growth media mixed in various ratios by volume were used in 16 separate treatments. Each treatment consisted of 30 stem cuttings that were replicated three times.

Source of stem cuttings

Dragon fruit cuttings of pink to white variety were procured from the Dragon fruit orchard at Horticulture Farm of S.K.N. College of Agriculture, Jobner, Jaipur. Uniform cuttings, each 10-15 cm in length, were taken from one-year-old shoots. A slanted cut was made at the base of cuttings to expose maximum absorbing surface for effective rooting. Cuttings were shade dried for one day before planting to remove the oozing from the fresh cuttings.

Preparation of Growth regulators

The IBA solution was prepared by dissolving 2 g, 4 g, and 6 g of IBA in a small amount of 0.2 N NaOH solution. Each concentration was then adjusted to a total volume of 1000 ml with distilled water. This resulted in concentrations of 2000 ppm, 4000 ppm, and 6000 ppm.

Preparation of Potting mixture

Three types of potting mixture were prepared, by mixing sand and cocopeat (1:1), sand and vermicompost (1:1) and sand, cocopeat and vermicompost (1:1:1). Polythene bags of 20 x 8.5 cm size was used for filling the media mixture and kept in shade.

Planting of cuttings

The dragon fruit cuttings were first dipped in fungicide and then treated with plant growth regulators using a quick dip method for 2 minutes. After treatment, they were allowed to shade dry for 15 minutes before being planted in poly bags with growing media. This process was carried out in August, and the planted cuttings in poly bags were placed in a low-cost polyhouse for maintenance.

Data collection on shoot characters

The observations recorded included several parameters: the number of days taken for sprouting, the percentage of sprouting (calculated as the number of sprouted cuttings divided by the total number of cuttings planted, multiplied by 100), and the number of sprouts per cutting. The shoot length per cutting was measured using a scale, with mean values expressed in centimeters, while the diameter of the shoot was measured with a vernier caliper, with mean values expressed in millimeters. These measurements were taken at 50 and 75 days after planting. Additionally, the fresh weight of the shoot was recorded using an electronic balance, with mean values expressed in grams. For the dry weight of the shoot, recorded at 75 days after planting, the shoots were dried in a hot air oven at 65 °C until a constant weight was achieved.

The dried shoots were then weighed using an electronic balance, and the mean dry weight was calculated and expressed in grams.

Statistical analyses

The experimental data on various parameters were statistically analysed using the analysis of variance (ANOVA) method for a Factorial Complete Randomized Design (FCRD), following Fisher and Yates (1963). When the 'F' test indicated significant differences between treatments, the critical difference (C.D. at 5%) was calculated to compare the means of the two treatments.

Results and Discussion

The study investigated the impact of four different concentrations of IBA (control, 2000, 4000, and 6000 ppm) and four types of growing media (control, sand: cocopeat, sand: vermicompost, and sand: vermicompost: cocopeat) on the shooting behavior of dragon fruit. The results are illustrated in graphical form (Fig. 1 to 7).

Effect of Plant growth regulator (IBA) on shoot parameters

The data presented in graphical format revealed that applying IBA at 6000 ppm led to significantly better values for all shoot parameters compared to the control. This included a reduction in the number of days to sprouting 25.03 days, a sprouting percentage of 59.98 per cent, 2.35 sprouts per cutting, a shoot length of 14.80 cm, a shoot diameter of 36.99 mm, a fresh weight of 55.85 g, and a dry weight of 11.08 g. The enhanced performance at this higher IBA concentration is likely due to the activation of dormant buds and hydrolytic enzymes that break down stored food materials in the cuttings. This process supplies respiratory substrates to glycolytic enzymes, releasing energy and facilitating earlier sprouting. Additionally, this treatment resulted in more roots, improved water and nutrient uptake from the soil, and a greater number of shoots per cutting compared to the control.

This improvement is likely due to the application of auxin, which enhances histological features such as callus formation, tissue development, and vascular tissue differentiation. The results are consistent with findings by Rafael (2006), who reported the highest number of sprouts per cutting and the maximum number of leaves at 2000 ppm IBA. Similar results were observed by Khapare *et al.* (2012), Singh *et al.* (2013) in lemon, Seran and Thiresh (2015) in dragon fruit cuttings, and Ali *et al.* (2022), who noted that 7000 ppm IBA led to the earliest shoot initiation, maximum shoot growth, increased shoot length, and more new shoots in dragon fruit.

Effect of Growing media on shoot parameters

The significant increase in shoot parameters like number of days taken for sprouting are 25.01 (Fig. 1), percentage sprouting (59.53% in Fig. 2), number of sprouts per cutting (2.35 in Fig. 3), shoot length per cutting (14.80 cm as represented in Fig. 4), diameter of shoot (36.47 mm as shown in Fig. 5), fresh weight of shoot (56.01 g in Fig. 6) and dry weight of shoot 11.21 g (Fig. 7) were observed when Dragon fruit cuttings were grown in growing media of sand + vermicompost + cocopeat (1: 1: 1) over the control and followed by sand + vermicompost (1: 1) which was at par. Vermicompost contains humic acids and growth-regulating substances (Atiyeh *et al.,* 2002) and plant growth hormones (Arancon and Edwards, 2006), which may have enhanced plant growth. Additionally, it offers favorable physical conditions and stimulates beneficial biochemical activities. (Wazir *et al*., 2003). It contains more nitrogen than farm yard manure and nitrogen play a significant role in photosynthesis, cell division and differentiation, growth, chlorophyll content, photosynthetic rate, electron transport rate and is a necessary component of proteins required for metabolic processes that take place at the time of plant growth.

Cocopeat in soil imparts favourable changes like pH, EC, major and micro-nutrients which provides resistance against biotic and abiotic stresses. More production of shoots in cocopeat media might be due to an increase in soil porosity, water retention and increase in ion exchange capacity (Devidas, 2012). The more availability of nutrients in the rooting media and high C:N ratio of cocopeat (Awang *et al*., 2009) which led to the more production of shoot parameters. Abo-Rezq *et al.* (2009) concluded that using a higher proportion of inexpensive sand in growing media is more cost-effective. The coarse texture of the sand enhances the drainage system and provides better aeration for cutting growth. These findings are consistent with the results reported by Sudarjat *et al*. (2018), Apiratikorn (2020), Minz *et al*. (2021) and Tani *et al*. (2021) in dragon fruit studies.

Interactive Effect

The interactive effect (Fig.8) was found significant in terms of length of shoot per cuttings at 50 and 75 days after planting. The treatment combination R_3GM_3 showed significantly higher length of shoot (Plate 1) over other treatment combinations. Minz *et al.* (2021) observed that dragon fruit cuttings treated with IBA at 7000 ppm and grown in a media mix of soil, sand, cocopeat, and vermicompost had longer

shoots. Similar findings were reported by Mehra *et al.* (2019) in persimmon.

Control **R_3GM_3**

Plate 1 : Best treatment compared with control for shoot growth

[R_3GM_3 - Cutting treated in IBA 6000 + Sand: Vermicompost: Cocopeat (1:1:1)]

Conclusion

Based on the findings of the experiment **"Impact of indole butyric acid and growing media on growth parameters of dragon fruit [*Hylocereus undatus* L.] cuttings"** it may be concluded that in terms of shoot parameters, cuttings treated with 6000 ppm of IBA and grown in media of sand: vermicompost: cocopeat (1: 1: 1) were found to be statistically at par with the other treatment combinations, with the exception of R_2GM_2 (IBA @ 4000 ppm + sand: vermicompost). In order to multiply dragon fruit plants, it is advised to use the treatment combination of sand + vermicompost: cocopeat with IBA @ 6000 ppm.

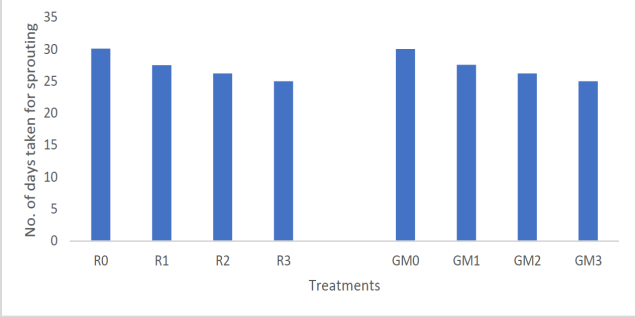

Fig. 1 : Number of days taken for sprouting

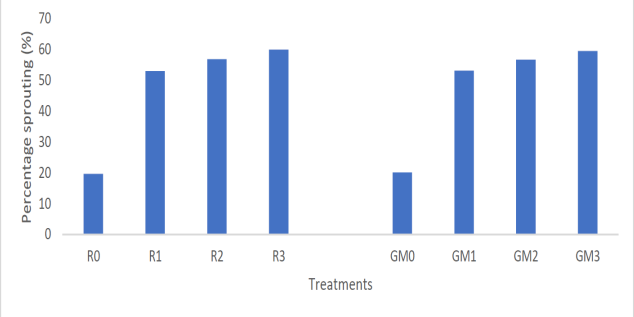

Fig. 2 : Per cent sprouting (%) at 75 DAP

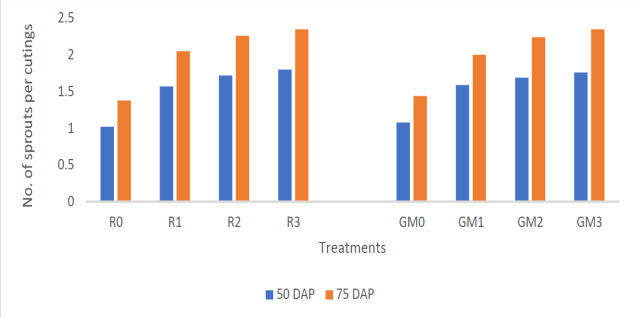

Fig. 3 : Number of sprouts per cutting at 50 and 75 DAP

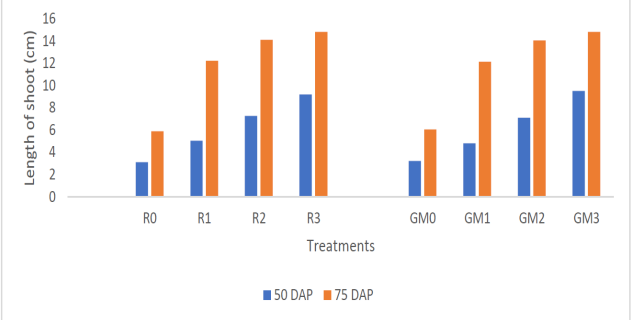

Fig. 4 : Length of shoot (cm) at 50 and 75 DAP

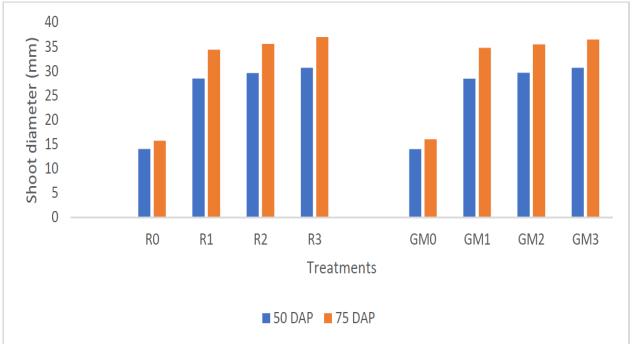

Fig. 5 : Shoot diameter (mm) at 50 and 75 DAP

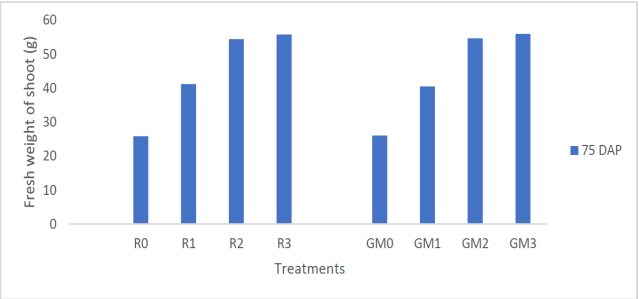

Fig. 6 : Fresh weight of shoot (g) at 75 DAP

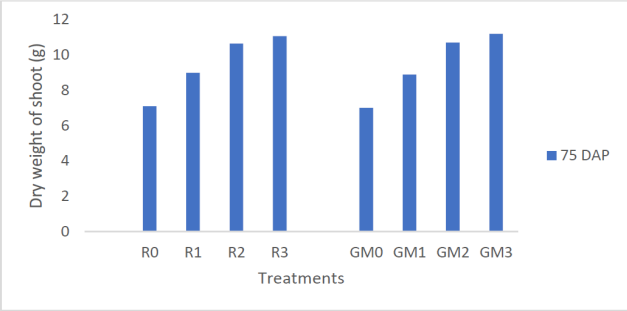

Fig. 7 : Dry weight of shoot (g) at 75 DAP

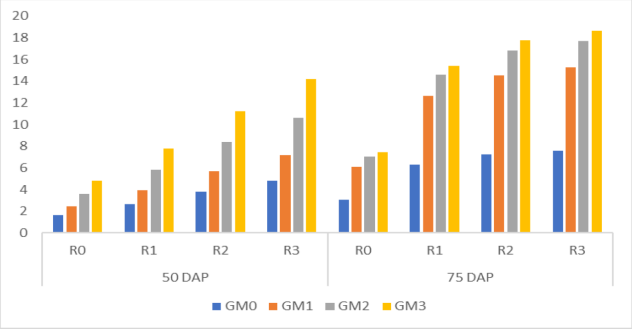

Fig. 8 : Interactive effect of plant growth regulator and growing media on shoot length in Dragon fruit stem cuttings at 50 and 75 DAP

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