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# EFFECT OF INDOLE 3- BUTYRIC ACID (IBA) ROOTING MEDIA AND THEIR INTERACTION ON ROOT AND GROWTH CHARACTERISTICS OF DRAGON FRUIT (*HYLOCEREUS UNDATUS* HAWORTH)

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**ABSTRACT**

The present investigation was carried out at Fruit Research Station, Madhadibagh, Department of Horticulture, College of Agriculture, Junagadh Agriculture University, Junagadh during the year 2018-19 to study the effect of different concentration of IBA (500, 1000, 1500 ppm) and different type of rooting media (i.e. soil, sand, soil + sand, soil + cocopeat, sand + cocopeat, soil + sand + cocopeat) on rooting characteristics of dragon fruit. The result revealed that the exogenous application of 1500 ppm IBA with media combination of soil + sand + cocopeat (I3M6) significantly increased the root characters i.e. length of roots (31.17 cm) and rooting percentage (89.20%). days taken for initiation of sprouts (17.17 days), survival percentage (87.00%),, sprout length (16.27, 25.10 and 34.43 cm) and number of sprouts per cuttings (2.70, 3.20 and 3.97) at 30, 60 and 90 DAP, respectively, over the other treatments.
***Keywords*:** Dragon fruit, stem cutting, rooting media, Indole-3-butyric acid, days after plant.

## Introduction

Dragon fruit (*Hylocereus undatus*) is a member of the cactaceae family which is a perennial, climbing cactus with triangular green stem. It is believed to be originated from tropical and subtropical America (Zee *et al*., 2004). It is commonly called as strawberry pear, night blooming cereous, pitaya, queen of night, honorable queen etc. (Andrade *et al*., 2005). It has been cultivated in tropical and subtropical regions of the India. In India, it is believed that the area under this crop is less than 900 hacters and is grown in some parts of Gujarat, Maharashtra, Kerala, Tamil Nadu and Karnataka (NHB 2015). Dragon fruits consist of phytoalbumins, which may have anti-oxidant qualities which help to stop the development of cancer cells. It is also a good source of natural pigments in food processing, due to their high content of betalains and used in food industries to extract natural colours and in cosmetic industries to prepare facial and hydrating creams (Le Bellec *et al.,* 2006). The plants developed from stem cutting start flowering one to two years after planting. Cuttings can be obtained throughout the year. However, it is preferable to collect the cuttings after fruiting season of mother plants. In propagation by cutting, the entire stem segment or 5-60 cm cutting could be used. The longer the cutting, faster is the regeneration rate of new roots which is probably associated with the amount of stored food. Mature cuttings are better as they are resistant to insect and snail damage and contain more stored food than immature ones. In general, cuttings from mature branches which have ceased growth root better than those taken from younger branches. The difference in the rooting ability of cuttings taken from different parts of a plant is considered to be due to a difference in their physiological age. Cuttings with high carbohydrate content root better than those with low carbohydrates content. The ability of cuttings to regenerate varies also with the plant species and their varieties. Dragon fruit can be propagated both sexually by seed and asexually by grafting and stem cutting. Seedlings become ready for field planting by 9-10 months after sowing. This method is very simple and can be practised with the objectives of obtaining variability in improvement program and to meet the demand of large planting material in new areas as a single fruit contains more than 1000 seeds. But the fruit and stem characteristics are variable due to cross pollination and seedlings grow very slowly and the time taken for bearing will be usually 3-4 years which is longer than the plants propagated by stem cutting. Grafting has potential for selection of rootstock adaptable to various soil types and climatic conditions and other problem for having selected desired variety of true-to type. But this method is not commonly practiced. The easiest, cheapest and convenient method of propagation of dragon fruit vegetatively is by stem cutting. Dragon fruit is adoptable to wide range of environmental conditions from rainforests to deserts. It is considered a promising crop to be grown commercially in dry regions (Vaillant *et al*., 2005). This species is found to have high water-use efficiency. The dragon fruit has mechanisms to secure water requirement by developing aerial roots from the sides of the stem to collect water from the surroundings (Nobel *et al.,* 2004).

The use of IBA and rooting media in dragon fruit propagation through stem cuttings is very scanty. In India it is newly extending in all the dry areas. Therefore, it is important to select the appropriate concentration IBA and appropriate volume of rooting media for rapid and commercially production of plantlets. Hence, the experiment was conducted to know the effect of IBA on rooting of stem cutting of dragon fruit, effect of media on rooting of stem cutting of dragon fruit and interaction effect of rooting media and IBA treatments on stem cuttings of dragon fruit.

The present investigation was conducted at Fruit Research Station, Madhadibagh, Department of Horticulture, College of Agriculture, Junagadh Agriculture University, Junagadh during the year 2018-19. The experiment was laid out in Completely Randomized Design (Factorial) with eighteen treatment combinations and three replications. The treatment consists of six types of rooting media $M_1$ (soil), $M_2$ (sand), $M_3$ [soil + sand (1:1)], $M_4$ [soil + cocopeat (1:1)], $M_5$ [sand + cocopeat (1:1)], $M_6$ [soil + sand + cocopeat (1:1:1)]. three type of IBA concentration $I_1$ (500 ppm), $I_2$ (1000 ppm), $I_3$ (1500 ppm) and the different treatment combinations ($I_1M_1$- IBA 500 ppm + Soil, $I_1M_2$- IBA 500 ppm + Sand, $I_1M_3$- IBA 500 ppm + Soil + Sand (1:1), $I_1M_4$- IBA 500 ppm + Soil + Cocopeat (1:1), $I_1M_5$- IBA 500 ppm + Sand + Cocopeat (1:1), $I_1M_6$- IBA 500 ppm + Soil + Sand + Cocopeat (1:1:1) , $I_2M_1$- IBA 1000 ppm + Soil, $I_2M_2$- IBA 1000 ppm + Sand, $I_2M_3$- IBA 1000 ppm + Soil + Sand (1:1), $I_2M_4$- IBA 1000 ppm + Soil + Cocopeat (1:1), $I_2M_5$- IBA 1000 ppm + Sand + Cocopeat (1:1), $I_2M_6$- IBA 1000 ppm + Soil + Sand + Cocopeat (1:1:1), $I_3M_1$- IBA 1500 ppm + Soil, $I_3M_2$- IBA 1500 ppm + Sand, $I_3M_3$- IBA 1500 ppm + Soil + Sand (1:1), $I_3M_4$- IBA 1500 ppm + Soil + Cocopeat (1:1), $I_3M_5$- IBA 1500 ppm + Sand + Cocopeat (1:1), $I_3M_6$- IBA 1500 ppm + Soil + Sand + Cocopeat (1:1:1).

The cuttings were treated with IBA by quick dip methods and for this a required amount of IBA was weighed and dissolved in few ml of 80% ethanol and then volume was made up to 1 liter using distilled water and 540 cuttings was dipped in solution for 10 second and planted in polybag . Rooting percentage was find out by of cuttings number of cuttings rooted over total number of cuttings multiplied by hundred and survival percentage can be find out by number of cuttings survived 3 months after planting over total number of cuttings planted multiplied by hundred. The observation were taken for days taken for initiation of sprouts, length of longest roots, rooting percentage and survival percentage at 90 days after planting. Sprout length and number of sprouts per at 30, 60 and 90 DAP, respectively.

Statistical analysis of the individual data of various characters studied in the experiment was carried out as per Completely Randomized Design with Factorial concept through computer. Analysis of variance worked out using standard statistical procedures as described by Panse and Sukhatme (1985). Statistical analyses were carried out in the Stata software, Department of Agricultural Statistics, College of Agriculture, J.A.U., Junagadh.

## Results and Discussion

### Effect of IBA rooting media and their interaction on growth character

The results indicate that IBA concentration, rooting media and their interaction exhibited a significant effect on growth parameters (Table 1&2). The days for initiation of sprouts which were found significantly less number of days (18.38) in cuttings treated with $I_3$-IBA at 1500 ppm. In case maximum number of days (27.60) taken in which cuttings treated with $I_3$- IBA at 500 ppm. In rooting media combination also found significant and less number of days (21.15) taken for initiation of sprouts after planting in rooting media $M_6$ containing soil+ sand+ cocopeat (1:1:1). In case maximum number of days taken in days (25.19) taken in rooting media $M_1$ containing soil. This result might be due to the high nutrient content of cocopeat, sand which have macrospores for good aeration and soil which balance the decomposition of lignin present in coir pith results in the formation of humic fraction. Similar result was supported by (Kadalli *et al*., 2001). In interaction effect of IBA and rooting media treatment less number of days (17.17) taken for initiation of sprouts after planting recorded in treatment combination $I_3M_6$ containing IBA at 1500 ppm+ soil+ sand+ cocopeat (1:1:1). Which was at par with $I_3M_5$ (17.67) containing IBA at 1500 ppm sand+ cocopeat (1:1). Whereas maximum number of days taken sprout initiation was recorded with $I_1M_1$ (30.67). This might be due to sprouting is mainly attributed to the quantum of stored carbohydrate in the cuttings. However, with auxin application to the cutting is an increase in sprouting, highlighting the role of certain material produced in the rooting media, which are responsible for sprouting. This result was agreement with the finding of (Sulaiman *et al.*, 2015) in citrus

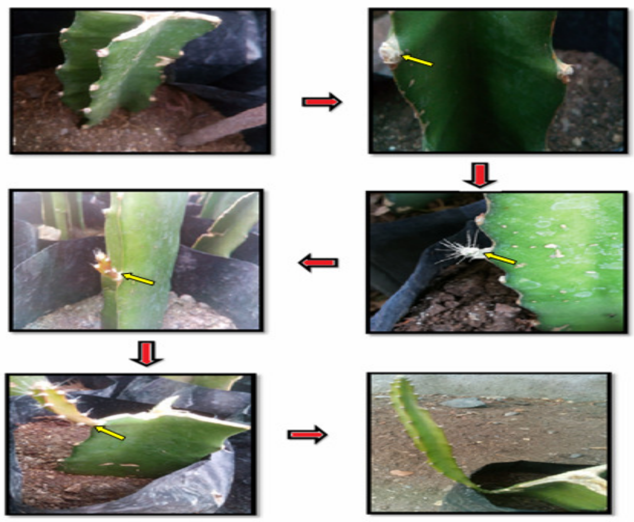

**Fig. 1:** Different sprouting stages of dragon fruit cutting

The number of sprouts per cutting was assessed at 30, 60, and 90 days after planting (DAP), as shown in Table 2. Among the IBA treatments, $I_3$ (IBA at 1500 ppm) produced a significantly higher number of sprouts per cutting, recording 2.05, 2.73, and 3.55 sprouts at 30, 60, and 90 DAP, respectively. However, the lowest number of sprouts was observed in treatment $I_1$ (IBA at 500 ppm), with values of 1.45, 1.53, and 1.70 at the corresponding time intervals. Among the rooting media combinations, $M_6$ (soil + sand + cocopeat in a 1:1:1 ratio) recorded the highest number of sprouts per cutting, with values of 1.96, 2.34, and 2.83 at 30, 60, and 90 days after planting (DAP), respectively. At 60 DAP, $M_6$ was statistically at par with $M_5$ (sand + cocopeat in a 1:1 ratio). The lowest number of sprouts per cutting was observed in $M_1$ (soil alone), with 1.69, 1.77, and 2.22 sprouts recorded at 30, 60, and 90 DAP, respectively. This might be due to auxin enhancement of physiological functions in the cuttings favourably. This result was also close conformity by Manan *et al.* (2002) in guava and (Singh *et al*., 2025) in dragon fruit. Whereas media was porous material and presence of decomposed nutrient which increase the sprouts. This result also supported by Rymbai *et al*. (2012) in guava.

The interaction effect of IBA concentration and rooting media was found to be significant with respect to the number of sprouts per cutting. The treatment combination $I_3M_6$ (IBA at 1500 ppm + soil + sand + cocopeat in a 1:1:1 ratio) produced the maximum number of sprouts, recording 2.70, 3.20, and 3.97 at 30, 60, and 90 days after planting (DAP), respectively. This was statistically at par with $I_3M_5$ (IBA at 1500 ppm + sand + cocopeat) at 60 and 90 DAP.The lowest number of sprouts was observed in the treatment $I_1M_1$ (IBA at 500 ppm + soil), with values of 1.83, 1.33, and 1.60 at 30, 60, and 90 DAP, respectively. The enhanced sprouting in the superior combinations may be attributed to the synergistic effect of the growth regulator auxin (IBA) and the favourable physical and chemical properties of the media components cocopeat, sand, and soil which collectively provide a balanced environment for shoot initiation. These findings are in close agreement with those reported by Singh *et al.* (2014) in mulberry.

The effect of IBA treatments on sprout length was found to be significant. The highest sprout lengths were recorded in treatment $I_3$ (IBA at 1500 ppm), measuring 13.34 cm, 20.27 cm, and 30.16 cm at 30, 60, and 90 days after planting (DAP), respectively. In contrast, the shortest sprouts were observed in $I_1$ (IBA at 500 ppm), with lengths of 4.37 cm, 9.76 cm, and 16.69 cm at the corresponding intervals.

Among the rooting media, the combination $M_6$ (soil + sand + cocopeat in a 1:1:1 ratio) resulted in the maximum sprout lengths of 10.07 cm, 17.69 cm, and 26.98 cm at 30, 60, and 90 DAP, respectively. The minimum sprout lengths were recorded in $M_1$ (soil alone), measuring 6.21 cm, 12.22 cm, and 21.01 cm at the respective time points.

The superior performance of $M_6$ may be attributed to the presence of growth-promoting substances in cocopeat and the improved aeration and moisture-holding capacity provided by the media components. These results are in agreement with the findings of Sabir *et al.* (2004) in grape. Similarly, the role of auxin in IBA, which enhances cell elongation and sprout growth, supports the increased sprout length observed in higher IBA concentrations. These findings are consistent with the reports of Kakon *et al.* (2008) in guava and Singh *et al.* (2025) in dragon fruit.

The interaction effect of IBA concentration and rooting media on sprout length was found to be significant. The maximum sprout lengths of 16.27 cm, 25.10 cm, and 34.43 cm at 30, 60, and 90 days after planting (DAP), respectively, were recorded in the treatment combination $I_3M_6$ (IBA at 1500 ppm + soil + sand + cocopeat in a 1:1:1 ratio). In contrast, the minimum sprout lengths of 3.67 cm, 7.30 cm, and 13.30 cm were observed in $I_1M_1$ (IBA at 500 ppm + soil) at the corresponding intervals. The increased sprout length in the $I_3M_6$ treatment can be attributed to the synergistic effect of auxin (IBA) and the balanced rooting medium containing cocopeat, sand, and soil, which provide both growth-promoting substances and favourable physical conditions for sprout elongation. These results are in close agreement with the findings of Malik and Harnad (2013) in orange.

Significant differences were observed in the survival percentage of rooted stem cuttings of dragon fruit across various IBA concentrations, rooting media treatments, and their interactions, as presented in Table 1. Among the IBA treatments, the highest survival percentage was recorded in $I_3$ (IBA at 1500 ppm), with 75.61% survival. Regarding rooting media, treatment $M_6$ (soil + sand + cocopeat in a 1:1:1 ratio) showed the highest survival rate of 71.00%, which was statistically at par with $M_5$ (sand + cocopeat in a 1:1 ratio), recording 68.67%.

The interaction treatment $I_3M_6$ (IBA at 1500 ppm + soil + sand + cocopeat in a 1:1:1 ratio) exhibited the maximum survival percentage of 87.00% at 90 days after planting (DAP). Conversely, the lowest survival percentage was observed in $I_1$ (IBA at 500 ppm) with 54.94%, in $M_1$ (soil alone) with 59.89%, and in the interaction $I_1M_1$ (IBA at 500 ppm + soil) with 51.33%.

The improved survival in treatments containing cocopeat and sand can be attributed to better aeration, which facilitates effective gaseous exchange between the soil and the atmosphere. This process helps in removing carbon dioxide released by root and microbial respiration and ensures adequate oxygen supply to the developing roots, thereby enhancing root respiration and overall plant survival (Jeyaseeli and Paul Raj, 2010).

**Table:** 1 Interaction effect of IBA and rooting media treatments on days taken for initiation of sprout, survivability percentage 90 DAP, on growth parameter of stem cuttings of dragon fruit

| IBA concentration (I) | Days taken for initiation of sprout | | | | | | | Survivability percentage (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rooting media | | | | | | | Rooting media | | | | | | |
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) |
| $I_1$ | 30.67 | 28.10 | 27.67 | 27.33 | 26.00 | 25.85 | 27.60 | 51.33 | 52.33 | 54.67 | 55.00 | 56.33 | 60.00 | 54.94 |
| $I_2$ | 25.20 | 25.00 | 24.67 | 24.10 | 23.67 | 20.43 | 23.44 | 62.00 | 62.67 | 62.33 | 64.33 | 65.33 | 66.00 | 63.78 |
| $I_3$ | 19.70 | 24.67 | 18.23 | 18.00 | 17.67 | 17.17 | 18.38 | 66.33 | 70.00 | 71.00 | 75.00 | 84.33 | 87.00 | 75.61 |
| Mean (M) | 25.19 | 24.20 | 23.52 | 23.14 | 22.44 | 21.15 | | 59.89 | 61.67 | 62.67 | 64.78 | 68.67 | 71.00 | |
| Factor | A | | B | | A × B | | | A | | B | | A × B | | |
| S. Em. ± | 0.22 | | 0.31 | | 0.54 | | | 1.01 | | 1.43 | | 2.47 | | |
| C.D.@ 5% | 0.64 | | 0.90 | | 1.56 | | | 2.89 | | 4.09 | | 7.08 | | |

Note: $I_1$ = IBA @ 500 ppm, $I_2$= IBA @ 1000 ppm, $I_3$= IBA @ 1500 ppm, $M_1$ =soil, $M_2$= sand, $M_3$ = soil + sand, $M_4$= soil + cocopeat, $M_5$ = sand + cocopeat, $M_6$ = soil + sand + cocopeat

**Table 2 :** Effect of IBA and rooting media treatment for number of sprouts per stem cutting of dragon fruit

| IBA (I) | Number of sprouts per cutting | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | At 30 DAP | | | | | | | At 60 DAP | | | | | | | At 90 DAP | | | | | | |
| | Rooting media | | | | | | | Rooting media | | | | | | | Rooting media | | | | | | |
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) |
| $I_1$ | 1.83 | 1.90 | 1.10 | 1.13 | 1.30 | 1.47 | 1.45 | 1.33 | 1.50 | 1.53 | 1.57 | 1.60 | 1.62 | 1.53 | 1.60 | 1.65 | 1.68 | 1.73 | 1.75 | 1.77 | 1.70 |
| $I_2$ | 1.50 | 1.53 | 1.60 | 1.62 | 1.65 | 1.70 | 1.60 | 1.65 | 1.80 | 1.99 | 2.09 | 2.10 | 2.20 | 1.97 | 1.87 | 2.00 | 2.37 | 2.43 | 2.53 | 2.77 | 2.33 |
| $I_3$ | 1.75 | 1.85 | 1.90 | 2.00 | 2.10 | 2.70 | 2.05 | 2.34 | 2.35 | 2.65 | 2.85 | 3.00 | 3.20 | 2.73 | 3.20 | 3.33 | 3.40 | 3.63 | 3.77 | 3.97 | 3.55 |
| Mean (M) | 1.69 | 1.76 | 1.53 | 1.58 | 1.68 | 1.96 | | 1.77 | 1.88 | 2.06 | 2.17 | 2.23 | 2.34 | | 2.22 | 2.33 | 2.48 | 2.60 | 2.68 | 2.83 | |
| Factor | A | | B | | A × B | | | A | | B | | A × B | | | A | | B | | A × B | | |
| S. Em. ± | 0.02 | | 0.03 | | 0.06 | | | 0.03 | | 0.04 | | 0.07 | | | 0.03 | | 0.05 | | 0.08 | | |
| C.D.@5% | 0.07 | | 0.09 | | 0.16 | | | 0.08 | | 0.11 | | 0.20 | | | 0.10 | | 0.14 | | 0.24 | | |

Note: $I_1$ = IBA @ 500 ppm, $I_2$= IBA @ 1000 ppm, $I_3$= IBA @ 1500 ppm, $M_1$ =soil, $M_2$= sand, $M_3$ = soil + sand, $M_4$= soil + cocopeat, $M_5$ = sand + cocopeat, $M_6$ = soil + sand + cocopeat

**Effect of IBA rooting media and their interaction on root character**

The results (Table 3) clearly indicate that IBA concentration, rooting media, and their interaction had a significant influence on root development parameters. Among the IBA treatments, the application of IBA at 1500 ppm ($I_3$) resulted in a significantly greater root length (27.14 cm), whereas the shortest root length (14.23 cm) was observed in $I_1$ (IBA at 500 ppm). With respect to rooting media, the M6 combination (soil + sand + cocopeat in a 1:1:1 ratio) significantly enhanced the length of the longest roots (22.06 cm) and was statistically at par with $M_5$ (sand + cocopeat in 1:1 ratio), which recorded a root length of 21.50 cm. In contrast, the lowest root length (17.11 cm) was observed in $M_1$ (soil alone). Regarding the interaction effect, the treatment combination $I_3M_6$ (IBA at 1500 ppm + soil + sand + cocopeat) recorded the maximum root length (31.17 cm) at 90 days after planting (DAP), which was statistically on par with $I_3M_5$ (30.33 cm; IBA at 1500 ppm + sand + cocopeat). The minimum root length (13.67 cm) was observed in $I_1M_1$ (IBA at 500 ppm + soil).

The enhanced root length in treatments involving cocopeat and higher IBA concentration may be attributed to the physical and chemical properties of cocopeat. Its low particle density and high specific surface area promote water and nutrient retention, which supports better root elongation. Additionally, the presence of auxins (such as IBA) stimulates cell elongation and root growth. These findings are in close agreement with the results of Porghorban *et al*. (2014) in olive and Araujo *et al*. (2010) in Passiflora, who reported that improved substrate texture and porosity facilitated enhanced root growth through better aeration and nutrient mobility.

At 90 days after planting (DAP), a significant variation in the percentage of rooting in stem cuttings of dragon fruit was observed in response to different IBA concentrations, rooting media, and their interactions (Table 3). Among the IBA treatments, the highest rooting percentage (81.20%) was recorded in cuttings treated with IBA at 1500 ppm ($I_3$), while the lowest (55.03%) was observed in $I_1$ (IBA at 500 ppm).

Regarding the rooting media, the maximum rooting percentage (73.22%) was achieved with $M_6$ (soil + sand + cocopeat in 1:1:1 ratio), whereas the minimum rooting (63.94%) was recorded in $M_1$ (soil alone). A significant interaction effect was also noted. The treatment combination $I_3M_6$ (IBA at 1500 ppm + soil + sand + cocopeat) resulted in the highest rooting percentage (89.20%), which was statistically at par with $I_3M_5$ (87.00%; IBA at 1500 ppm + sand + cocopeat) and $I_3M_4$ (86.10%; IBA at 1500 ppm + soil + cocopeat). Conversely, the lowest rooting percentage (53.07%) was recorded in the $I_1M_1$ treatment (IBA at 500 ppm + soil).

The enhanced rooting observed in the higher IBA concentration and cocopeat-containing media may be attributed to rapid hydrolysis of stored polysaccharides in stem cuttings into physiologically active sugars. These sugars provide energy to meristematic tissues, stimulating root primordia initiation (Chander and Kumar, 2023; Singh *et al*., 2025). Additionally, cocopeat has been reported to release phenolic compounds (Lokesha *et al*., 1988), and its beneficial physical properties such as high aeration and water-holding capacity further support root development (Smith, 1995). Similar findings were also reported by Prabhakar *et al*. (2006) in fig.

**Table 3 :** Interaction effect of IBA and rooting media treatments on length of longest roots and rooting percentage on root parameter of stem cuttings of dragon fruit

| IBA (I) | Length of longest roots (cm) | | | | | | | Rooting percentage (%) | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Rooting media | | | | | | | Rooting media | | | | | | |
| | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) | $M_1$ | $M_2$ | $M_3$ | $M_4$ | $M_5$ | $M_6$ | Mean (I) |
| $I_1$ | 13.67 | 14.00 | 14.20 | 14.33 | 14.50 | 14.67 | 14.23 | 53.07 | 54.77 | 55.17 | 56.00 | 57.17 | 60.00 | 55.03 |
| $I_2$ | 15.00 | 16.33 | 18.00 | 18.37 | 19.67 | 20.33 | 17.95 | 63.50 | 65.50 | 66.40 | 67.13 | 68.73 | 70.47 | 66.96 |
| $I_3$ | 22.67 | 25.33 | 26.33 | 27.00 | 30.33 | 31.17 | 27.14 | 75.27 | 78.00 | 83.67 | 86.10 | 87.00 | 89.20 | 81.21 |
| Mean (M) | 17.11 | 18.56 | 19.51 | 19.90 | 21.50 | 22.06 | | 63.94 | 66.09 | 68.24 | 69.74 | 70.97 | 73.22 | |
| Factor | A | | B | | A × B | | | A | | B | | A × B | | |
| S. Em. ± | 0.27 | | 0.38 | | 0.65 | | | 0.55 | | 0.77 | | 1.34 | | |
| C.D. @5% | 0.76 | | 1.08 | | 1.87 | | | 1.57 | | 2.22 | | 3.85 | | |

Note: $I_1$ = IBA @ 500 ppm, $I_2$= IBA @ 1000 ppm, $I_3$= IBA @ 1500 ppm, $M_1$ =soil, $M_2$= sand, $M_3$ = soil + sand, $M_4$= soil + cocopeat, $M_5$ = sand + cocopeat, $M_6$ = soil + sand + cocopeat

## Conclusion

The present study demonstrated that among the 18 treatment combinations, the application of indole-3-butyric acid (IBA) at 1500 ppm combined with a rooting medium consisting of soil, sand, and cocopeat in a 1:1:1 ratio was most effective in enhancing the overall rooting and growth performance of dragon fruit stem cuttings. This combination significantly reduced the number of days taken for sprout initiation and improved sprout length, number of sprouts per cutting, length of the longest roots, rooting percentage, and survival rate of the cuttings.

These results suggest that the vegetative propagation of dragon fruit using stem cuttings treated with IBA at 1500 ppm in the specified rooting medium is a viable, efficient, and economical method for commercial-scale plant multiplication. This propagation technique ensures rapid establishment, uniformity, and better root development, making it a suitable strategy for sustainable dragon fruit production.

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