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C Partheeban
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

B Surjith
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

SV Saravanan
Department of Crop Physiology, Faculty centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

SR Nagendra
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

RB Kavin
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

T Jayasurya
Department of Crop Physiology, Faculty centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

S Sanjeev
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

VK Kishore
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

S Mounish
Department of Crop Physiology, Faculty centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

K Mugunthan
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

K Natarajan
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

S Chandraprakash
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

Corresponding Author
C Partheeban
Department of Crop Physiology, Faculty Centre for Agricultural Education and Research, Ramakrishna Mission Vivekananda Educational and Research Institute, Coimbatore, Tamil Nadu, India

Effect of IBA on rooting ability in mango cuttings

C Partheeban, B Surjith, SV Saravanan, SR Nagendra, RB Kavin, T Jayasurya, S Sanjeev, VK Kishore, S Mounish, K Mugunthan, K Natarajan and S Chandraprakash

Abstract
Mango is known as King of fruit and also as Food of God's. Mostly, the propagation method followed in mango is grafting to produce true to type. Even though, this technique was commercial and also produce fruits in earlier. This technique needs skilled labours and more expenditure. So, the present investigation is focussed to develop a new methodology to produce mango plants through cuttings with less expenditure and true to type using IBA rooting hormone. Auxin is a plant growth hormone favours apical dominance and root growth promotion. IBA is a rooting hormone and induce the roots effectively within short duration.

The present experiment was conducted in in Ramakrishna Mission Vivekananda Education and Research Institute, Faculty Centre for Agriculture Education and Research (FAR), Periyanaickenpalayam, Coimbatore. The research area lies between the coordinates of 11°08'16.5" N to 76°56'32.5" E. The Mango variety Banganapalli was used for this study. The concentrations of IBA (0, 1000, 3000 and 5000 ppm) were taken for the treatments with ten replications. The observation was taken at 14th, 20th days to record the bud sprout, length of the bud sprout and rooting percentage. The result was showed that bud sprout was recorded in all the treatments at 14thday after planting of cuttings. After 3rd week of planting most of the vegetative buds were died. Higher rate of survival and a greater number of bud sprout was observed in 3000 ppm of IBA after 4th week after planting. The number and length of the root was very minimal at 14th and 20th day. So, the study concluded that IBA concentration at 3000 ppm shows more survivability in mango cuttings and it may be used as rooting hormone, to induce the rooting and buds in the cuttings of mango.

Keywords: Mango, cuttings, IBA, hormone, rooting

1. Introduction
Mango (*Mangifera indica* L.) is a tree belonging to Anacardiaceae family is known as "King of Indian Fruits" and is grown in almost all parts of India; due to its great utility and taste. Healthy as well as good quality plant material is the basic requirement and fundamental of successful fruit industry in any place. India occupies first position among mango growing countries of the world and produces 40.48% of the total world mango production. Major countries which receive the exported Indian mango are (2020-21): U Arab Emts, U K, Qatar, Oman, Kuwait. India is an important exporter of fresh mangoes to the world. India has exported 21,033.58 MT of fresh mangoes to the world for the worth of Rs. 271.84 crores/ 36.23 USD Millions during the year 2020-21.

Andhra Pradesh, Uttar Pradesh, Karnataka, Bihar, Gujarat, and Tamil Nadu are the top mango-producing states in the country. With a share of 23.47 percent and the maximum productivity in mango production, Uttar Pradesh takes top place. In Tamil Nadu, the key types grown include Alphonso, Totapuri, Banganapalli, and Neelum (APEDA., 2021) [1].

Farmers and breeders are looking for easiest options with low cost techniques. To meet the mango production, there is a need of high-quality planting material. Most of researchers planned to produce planting material through cutting to avoid expenses. Rooting hormones have been identified as IBA. Asexually propagated fruit crops are easier to retain its purity (Bordolui *et al*., 2017) [2]. Exogenous application of IBA induces rooting in the stem cuttings. IBA enhances the root growth and also increases the numbers of roots. Auxin play role in rooting and occupies position of commercial application in cuttings. Application of 2000 ppm IBA increased the rooting percentage. The quality and density of roots were increased in the Wounded portion by IBA treatment (Kumar and Mitra, 1994) [3]. Cuttings propagation does not require technical labor. Hence, the present study focused to quantify the optimum concentration of IBA to induce rooting in mango cuttings and also to determine the Morpho-

Physiological characteristics of rooted cuttings of mango

2. Materials and Methods

The experiment was conducted at the Nursery unit, Department of Crop Physiology, Ramakrishna Mission Vivekananda Educational and Research Institute, Faculty Centre for Agriculture Education and Research (FAR), Periyanaickenpalayam, Coimbatore. The research area lies between the Co-Ordinates of 11°08'16.5" N to 76°56'32.5" E. Completely Randomized Block Design was followed in this study. It contains 4 treatments with 10 replications. The different concentration of IBA solutions 0 (Control), 1000, 3000, 5000 PPM of IBA were used in this study. The pencil thickness cuttings were collected from current season growth with the length of 1520 cm. The cuttings consist of 4-5 active buds. The leaves were detached from the cuttings by using secateurs without causing any injury on the surface of cuttings. Different concentrations of IBA (0, 1000, 3000 and 5000) solutions were prepared. IBA powder (Isochem Laboratories, Kochi, Kerala) were weighed based on the requirement to prepare different concentrations of IBA solution. Weighed IBA powder was transferred to the 500 ml beaker and 10 ml of ethanol was used to dissolve the IBA to avoid precipitation. Required amount of distilled water was added slowly to the respective concentration of IBA. A circular cut was given at the basal end of the cuttings up to 2-2.5 cm length. The bark portion was removed in the basal region to expose the cambial region. The exposed cambial region of the cuttings was immersed in different concentrations of IBA for a period of one hour. Number of bud sprout and Length of bud sprout was observed at 7th and 20th day after planting. Number of primary root and length of root were observed at 7th and 20th day and also after four weeks of planting.

3. Statistical analysis

The data on various parameters were analysed statistically as per the procedure suggested by Gomez and Gomez (1984) [4]. The treatment differences were found significant, critical differences were worked out at P≤0.05 probability level and the values were presented in the relevant tables.

4. Result and Discussion

4.1 Number of Bud sprout per plant

The cuttings treated with T3 (3000 ppm) of IBA concentration gave desirable results as compared to T0 (0 ppm). When cuttings treated with T3 observed on the 14th day it was 2.9 and on the 20th day the value was 2.8 while in cuttings with no treatment the value was 1.9 and 0.9 on the 14th day and 20th day respectively (Fig. 1). The result indicates that when the cuttings were treated with IBA it had favorable impact on number of bud sprouts. In a study, it was observed that the number of sprout/cuttings was significantly varied at different days. Maximum number of sprout bud/cutting (3.6) was observed from T3 at 20 days after establishment of stem cutting while minimum was observed from T0 (1.6). Because of the exogenous application of IBA it was found that more branching of the cutting which led to bushy appearance of the cutting. And also, it led to rapid growth of cuttings. (Mehraj *et al*., 2013) [5].

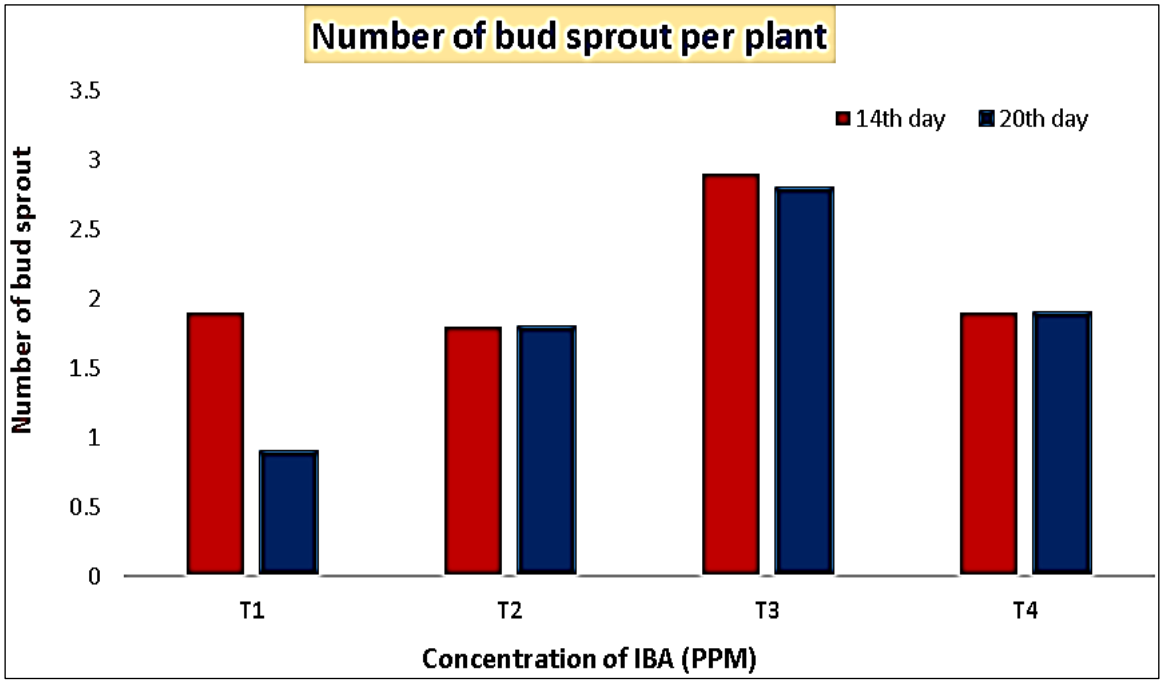

Fig 1: Effect of IBA in mango cuttings on number of bud sprout per plant

4.2 Average length of bud sprout

Effect of IBA in mango cuttings on average length of the sprout, shows that the average length of the sprout was higher in T3 (3000 ppm of IBA) with the value of 3.9 cm on 14th day and 6.5 cm on 20th day. The lowest average length of the sprout is observed in T2 (1000 ppm of IBA) with the value of 3.1 cm on 14th day and T1 (0 ppm of IBA) on 20th day with the value of 5.4 cm (Fig. 2). The treatment T3 was 21 percentage higher than the control on 14th day and 20.3 percentage higher when compared to control on 20th day. Lidwien and Dubois (1988) [6] reported that the sprout length was decreased as auxin concentration increased. The exogenous application of IBA in the cuttings of mango play a major role in rooting and also involved in the increasing the length of the sprout. So, this study was supporting the previous finding and the similar result was observed.

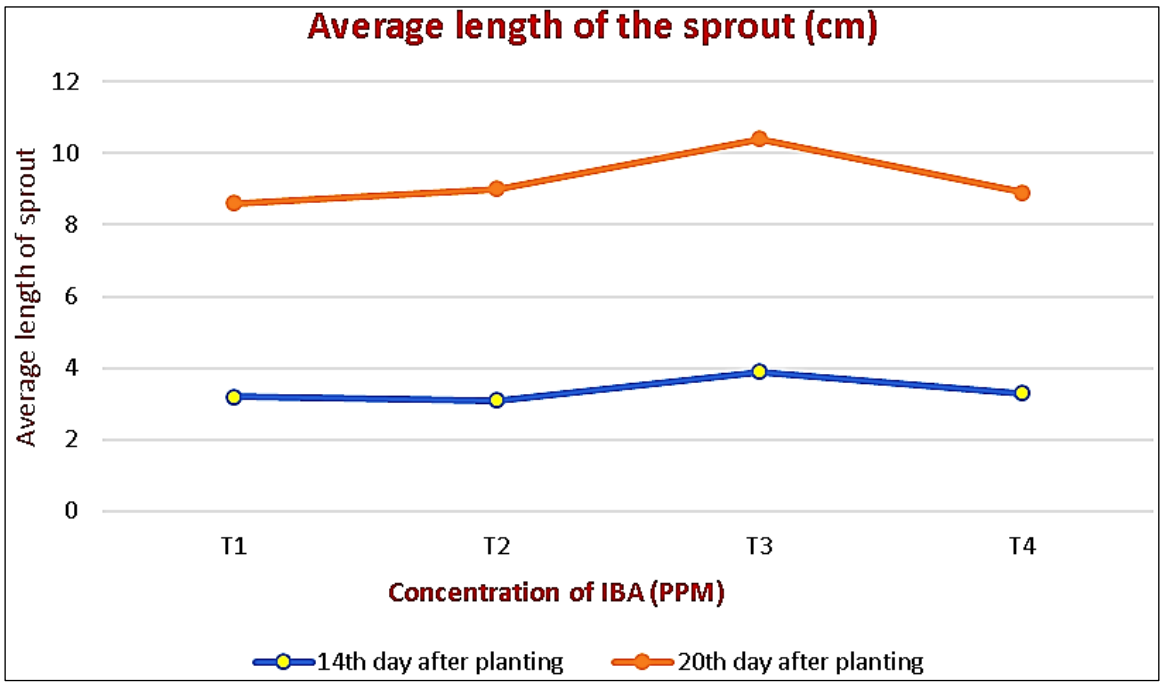

Fig 2: Effect of IBA in mango cuttings on average length of the sprout

4.3 Bud sprout percentage

The highest bud sprout percentage was seen in treatment T3 (28.93). This result shows that the exogenous application of IBA revealed the expected and desired effect on bud sprout percentage. While comparing the values between T1 and T3, the percentage increase was found to be 111.7%. Similarly, when the value of T3 compared with the mean average of all other treatments, it was found to be 71.6% increase (Fig. 3). The effect of the exogenous application of rooting hormone (IBA) on bud sprout have been discussed in several studies. In a study, when IBA concentration increased, it was found that time and frequency of sprouting were inhibited. Particularly at low concentrations, IBA increased sprout length and inhibited multiple breaks. (Lidwien and Dubois., 1988) [6]. In another study, Anand *et al*. (1972) [7] found that application of higher concentration of IBA decreases the sprouting of buds. All these studies show that, in general, the auxin group of hormones has an effect on bud sprouting. These results are in conformity with the results of this study.

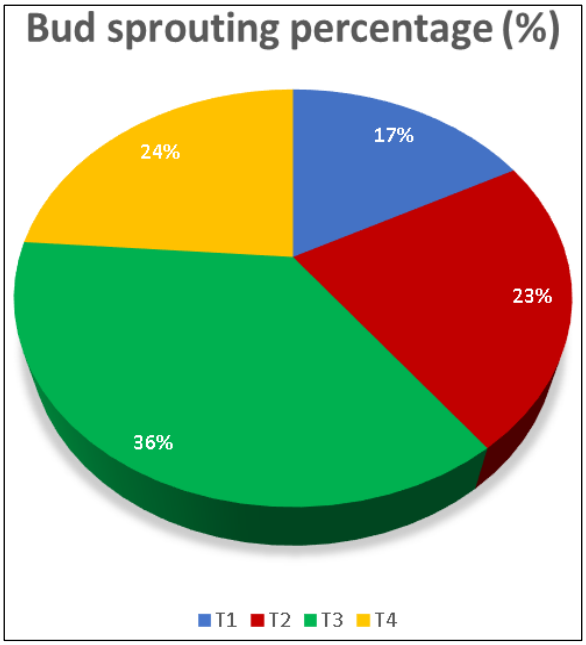

Fig 3: Effect of IBA in mango cuttings on bud sprouting percentage

4.4 Number of roots per plant

The number of roots per plant were studied after 4th week of planting the higher numbers observed in T3(8.3) and lower in T1(5.6). Finally, it is clear that IBA of 3000 PPM is more effective in inducing the root growth followed by 1000 PPM and 5000 PPM (Fig. 4). The effect of IBA and other Auxin related hormones in inducing root growth in plants is discussed in various studies. Hossain *et al*. (2004) [8] analyzed the effectiveness of IBA in Mahogany. Swamy et al. (2002) [9] studied the effectiveness of IBA and NAA in both

Black locust and Bhimal. From the studies it is known that IBA and other auxin related hormones are effective in inducing the rooting of the plant. Which are similar to our study on finding the optimum concentration of IBA for inducing rooting's in mango.

4.5 Length of the roots

IBA 3000 ppm (T3) concentration showed highest root length 0.9cm. The lowest root length was observed in T1 (control) 0.3 cm. The length of root in T3 is 0.6cm more than length of root in T1(control). The average mean value of root length irrespective of treatment is 0.55 (Fig. 4). The root length treatment T3 is 52% more compared to others. From the study conducted it was recorded that T3 3000 ppm showed the highest level of root length in mango cuttings. Ghosh *et al*. (2017) reported similar results, that when phalsa cuttings treated with IBA 200 ppm exhibited high rooting and root length. This property might be due to the activity of an auxin which might help in additional absorption of water and nutrients at cellular level in the base portion of cuttings resulted in cell division and cell elongation under favorable condition as reported by Singh *et al*. (2003) [10].

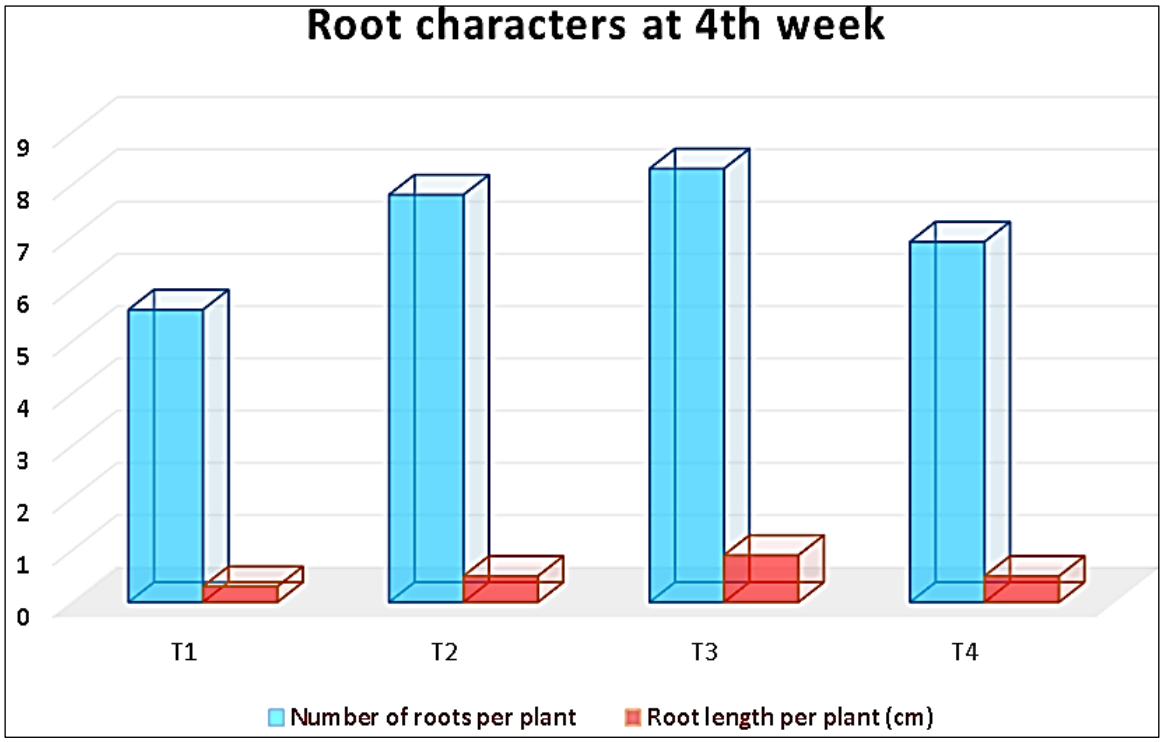

Fig 4: Effect of IBA in mango cuttings on Number of root and length of root

4. Conclusions

In past few decades the cost of the planting material was drastically increased due to unavailability or lack of plant production, the propagation technique needs skilled labor, suitable mother plant, scion for the specific area. This study focused to produce true to type plant materials through cuttings with low-cost production techniques. From this study, the efficient concentration of IBA for inducing rooting was identified, the concentration of IBA 3000 ppm may be used as rooting hormone to induce roots in mango cuttings. Bud sprout in mango was emerged between 10th day to 14th day. In later stages most of the buds were dried due to lack of relative humidity or reduction of water level in the cells so more intensive care should be followed in the after two weeks of planting of cuttings. The root emergence was observed after 4 weeks in the T3 treatment (3000 ppm of IBA). The root emergence was very minimal it could not able to measure the depth of penetration in the soil, so further study should be conducted to study root architecture system of mango cuttings in propagation methods. The survival percentage of mango cuttings was observed as 10% in T3 compared to all other treatments. Initially, the vegetative bud sprout was observed in all cuttings the but the survival rate was drastically reduced due to blockage of xylem column in the cut ends, this reduction may be due to influence of adverse or unfavorable environment so, the microclimate or control environmental condition will be identified in future. So, the researchers should focus more on propagation methodology to produce mango plants through cuttings. So, this study identified an alternate methodology and suitable stage propagation material to produce mango plants by using cuttings, this will be a most important technique to reduce expenditure in the production of mango plants

5. Acknowledgments

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