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Determine the influence of PGR's and rooting medium on rooting of marcottage

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Abstract
The effect of rooting medium (Soil+ VC+ Azospirillum) with IBA 5000ppm in terms of the minimum days taken to root initiation (19.67) followed by 21 days in (Soil + VC + PSB + IBA 5000ppm) While the maximum days noted under control (33.33) at 60 days after layering. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of percent of rooted layer (76%) followed by (71.67%) in Soil + VC + PSB + IBA 5000ppm while the lowest success percentage (56.33) in rooting was observed under control at 60 days after layering. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of number primary roots (9.67) followed by (9.00) roots in Soil + VC + PSB + IBA 5000ppm. Whereas, the minimum number of primary roots (3.0) was recorded under the treatment T1, T2, T3 and T4 at 60 days after layering. Th e effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of secondary roots (6.33) followed by (5.00) roots in Soil + VC + PSB + IBA 5000ppm while the minimum numbers of secondary roots (3.00) at 60 DAL were recorded under the treatment under control. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of length of layer (46.33 cm) followed by (43.33 cm) length in Soil + VC + PSB + IBA 5000ppm. Whereas, the minimum length of layer was noted (24.00cm) at 60 DAL under control. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of length of length of primary roots (4.47cm) followed by (4.30 cm) length of primary roots in Soil + VC + PSB + IBA 5000ppm. Whereas, the minimum length (2.0) of primary roots at 60 DAL with treatment under control. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of number of new emerged branches at 30 days (2.67), at 60 days (5.33), at 90 days (5.67), and at 120 days (6.33) followed by (2.33) at 30 days, at 60 days (3.00), at 90 days (4.67), and at 120 days (5.33) in Soil + VC + PSB + IBA 5000ppm while it was recorded minimum under control at 30, 60, 90 and 120 days.

Keywords: medium, azospirillum, layering, recorded, treatment

Introduction

The mango is believed to have been discovered as long as six thousand years in Eastern India. It originated from the Indian subcontinent and reached East Africa by 10th Century. It is commercially grown in more than 90 countries worldwide and is consumed both in fresh and processed form. Over one hundred varieties are produced worldwide which have similar properties but specific differences peculiar to each variety (Bally and Johanson, 2009)[1]. Mango is second the most important fruit in terms of area and production in the given sequence, banana (37.6%), mango (19.6%) and pineapple (12.1%), avocado (9.8%), pawpaw (5.4%), oranges (4.6%), water melon (4.2%) and passion fruit (3.7%) Annual report HCDA, (2013) [3]. Mango is the national fruit of India and is known as the 'King of Fruit' which is one of the most highly prized fruits of South Asia. It is also intimately connected with folklore and legends across many religions. The largest mango producing state in India is Utter Pradesh followed by Andhra Pradesh. The area under mango in India is 2516 thousand Million hectare and production is 18431 thousands MT with a productivity 7.3 MT per hectare NHB Database (2014) [5] and India's share is mango production 57%. In Madhya Pradesh mango has 14th rank in area and production and 7th rank in total fruit production. Mango (*Mangifera indica L.)* belongs to family "*Anacardiaceae*" which originated from South East Asia and consists of 69 species out of which 16 have edible fruits. Mango is an important commercial fruit crop of Tropical Region of India. There are hundreds of mango varieties distributed throughout the world. The mango leaves are long, leathery and fruit is a large, fleshy drupe, containing an edible mesocarp of varying thickness. The mesocarp is resinous and highly variable with respect to shape, size, color, presence of fiber and flavor. They have fibers which 'crackle' when they are crushed. The availability of mango in Madhya Pradesh is between mid april to July. Mango contain a chemical called mangiferin, which was used as a dye. Flowers

are both male and female and pleasant fragrant. Mango flowers are borne on terminal pyramidal panicles and are glabrous or pubescent. The inflorescence is rigid and erect, up to 30 cm long and is widely branched, usually tertiary, although the final branch which is always cymose. Fruits skin may be green, yellow, or red. The fruits have a small point, known as the beak. The fruit weights about 113.4 to 1360.80 gm with small to large flattened seed.

Materials and Methods

This chapter embodies a concise dissertation of the material and methods used during the course of investigation. The present investigation "Determine the influence of PGR's and rooting medium on rooting of Marcottage" was carried out during the year 2016-17 under the Agro-climatic conditions of Jabalpur, Madhya Pradesh. The details of material and methods adopted for the above investigation are as given below.

Preparation of solution of growth regulators

IBA 4000 PPM

Preparation of solution of growth regulators in the present experiment growth regulators was prepared in lanoline paste base. First of paste IBA with 4000ppm strength was prepared 0.4 gm of growth regulators was weighed on electrical balance and then dissolved in about 10.00 cc absolute alcohol. This solution was then thoroughly mixed with 99.60 gm of lanoline paste.

IBA 4500 PPM

Paste IBA with 4500ppm strength was prepared. 0.45 gm of growth regulators was weighed on electrical balance and then dissolved in about 10.00 cc absolute alcohol. This solution was then thoroughly mixed with 99.55 gm of lanoline paste.

IBA 5000 PPM

Paste IBA with 5000ppm strength was prepared. 0.50 gm of growth regulators was weighed on electrical balance and then dissolved in about 10.00 cc absolute alcohol. This solution was then thoroughly mixed with 99.50 gm of lanoline paste.

The details of different concentrations of plant growth regulators are given below:-

4000ppm: 0.40 gm IBA + 99.60 gm lanoline paste
4500ppm: 0.45 gm IBA + 99.55 gm lanoline paste
5000ppm: 0.50 gm IBA + 99.50 gm lanoline paste

Preparation of rooting media

Soil+ Vermi-compost+ Bio-fertilizer (PSB or Trico-derma or Azospirillum) were mixed in the ratio of 125gm: 500gm: 5gm by volume, then water is added and mixed thoroughly to develop a friable medium as given below-

1. Soil 125gm + Vermi-compost 500gm + PSB 5gm
2. Soil 125gm + Vermi-compost 500gm + Trico-derma 5gm
3. Soil 125gm + Vermi-compost 500gm + Azospirillum 5gm

Method of treatment

One year old branches about pencil thickness were selected. A ring of bark about 2.5-3 cm. in length was removed from selected shoot just below the bud without injuring the underlying wood and the respective rooting media was applied evenly around the incision portion then wrapped with polythene film and then tied with the help of jute rope.

Results and Discussion

In this chapter, an endeavour has been made to elicit the influence of various treatments of plant growth regulator IBA and rooting media on rooting and survival of air layers of mango. The experimental findings were completed, summarized, statistically analyzed and the same are given under suitable headings.

Days to root initiation

The mango selected shoots were treated with different IBA concentrations and rooting medium which affected the days to root initiation significantly at 60 days after application of treatments. The days to root initiation ranged from 19.67 to 33.33 days. The least days noted in treatment T16 (19.67) followed by T14 (21.00) which were at par with each other. While the maximum days noted under T1 (33.33).

Table 1: Effect of IBA and rooting medium on days to root initiation (prior to detachment) of Mango.

Treat. Symb.	Treatment combination	Days to root initiation
T1	P0M1	33.33
T2	P0M2	32.33
T3	P0M3	30.00
T4	P0M4	28.33
T5	P1M1	27.00
T6	P1M2	23.33
T7	P1M3	27.67
T8	P1M4	23.33
T9	P2M1	27.00
T10	P2M2	27.00
T11	P2M3	27.60
T12	P2M4	22.33
T13	P3M1	27.00
T14	P3M2	21.00
T15	P3M3	23.33
T16	P3M4	19.67
S. Em±		0.85
C.D.5% level		2.46

Rooting percentage (%)

The success in rooting of air layers was observed under different concentration of IBA and rooting medium at 60 days after layering. It was found significant and the maximum success percentage (76) of rooting was noted in T16 followed by T14 (71.67), while the lowest success percentage (56.33) in rooting was observed in treatment T1.

Table 2: Effect of IBA and rooting medium on rooting percentage (%) at 60 DAL.

Treat. Symb.	Treatment combination	Percentage of rooted layers (%)
T1	P0M1	56.33
T2	P0M2	59.00
T3	P0M3	59.33
T4	P0M4	61.00
T5	P1M1	63.00
T6	P1M2	64.67
T7	P1M3	66.00
T8	P1M4	67.00
T9	P2M1	62.67
T10	P2M2	62.00
T11	P2M3	62.00
T12	P2M4	70.00
T13	P3M1	64.00
T14	P3M2	71.67
T15	P3M3	67.67
T16	P3M4	76.00
S. Em±		1.13
C.D.5% level		3.27

Number of primary roots (per layer)

The numbers of primary roots were counted for each air layer under each treatment at 60 DAL. The analysis of variance exhibited significant impact of the treatments. All the treatments of IBA recorded significantly higher number of primary roots per air layer over control. Among all the treatment, T16 recorded the maximum number of primary roots (9.67) which were significantly higher than rest of the treatments followed by T14 (9.00) and which were at par with each other. Whereas, the minimum number of primary roots (3.0) was recorded under the treatment T1, T2, T3 and T4 at 60 days after layering.

Table 3: Effect of IBA, rooting media on number of primary roots at 60 DAL.

Treat. Symb.	Treatment combination	No. of primary root
T1	P0M1	3.00
T2	P0M2	3.00
T3	P0M3	3.33
T4	P0M4	3.67
T5	P1M1	6.33
T6	P1M2	7.00
T7	P1M3	7.00
T8	P1M4	7.00
T9	P2M1	5.67
T10	P2M2	5.33
T11	P2M3	5.00
T12	P2M4	8.67
T13	P3M1	6.33
T14	P3M2	9.00
T15	P3M3	8.00
T16	P3M4	9.67
S. Em±		0.23
C.D.5% level		0.68

Length of primary roots (cm)

The length of primary roots per air-layer at 60 days after layering was found to be significant due to various treatments. Different treatments significantly increased the length of primary roots as compared to control. The maximum length (4.47) of primary roots was recorded under T16 followed by T14 (4.30) which were at par with each other. Whereas, the minimum length (2.0) of primary roots at 60 DAL with treatment T1.

Table 4: Effect of IBA, rooting media on length of primary roots (cm) at 60 DAL.

Treat. Symb.	Treatment combination	Length of primary root (cm)
T1	P0M1	2.00
T2	P0M2	2.77
T3	P0M3	2.90
T4	P0M4	3.07
T5	P1M1	3.43
T6	P1M2	3.53
T7	P1M3	3.57
T8	P1M4	3.63
T9	P2M1	3.37
T10	P2M2	3.20
T11	P2M3	3.10
T12	P2M4	3.97
T13	P3M1	3.43
T14	P3M2	4.30
T15	P3M3	3.77
T16	P3M4	4.47
S. Em±		0.14
C.D.5% level		0.41

Number of secondary roots/layer

The analysis of variance showed the significant effect of various treatments of IBA on the number of secondary roots at 60 days after layering. The maximum number of secondary roots (6.33) were noted under T16 which was significantly higher than rest of the treatments while the minimum numbers of secondary roots (3.00) at 60 DAL were recorded under the treatment T1 and T2.

Table 5: Effect of IBA, rooting media on number of secondary roots at 60 DAL.

Treat. Symb.	Treatment combination	No. of secondary root
T1	P0M1	3.00
T2	P0M2	3.00
T3	P0M3	3.33
T4	P0M4	4.00
T5	P1M1	4.33
T6	P1M2	4.33
T7	P1M3	4.67
T8	P1M4	4.67
T9	P2M1	4.00
T10	P2M2	4.00
T11	P2M3	4.00
T12	P2M4	5.00
T13	P3M1	4.33
T14	P3M2	5.00
T15	P3M3	4.67
T16	P3M4	6.33
S. Em±		0.21
C.D.5% level		0.63

The days taken for rooting were influenced by the different imposed treatments. The days for rooting were minimized (19.67) due to the soil treatment with Vermi-compost+ Azospirillum +IBA 5000ppm followed by Soil+ Vermi-compost+ PSB+ IBA 5000ppm (23.33). It is clear from the results that when rooting media are treated with microbial inoculants and indol-3-butyric acid application on the selected shoots, the days were decreased for root initiation and number of primary roots, secondary roots, secondary roots and length of primary were increased significantly. These all parameters are promoted by the application of media treated with vermi-compost, the microbial inoculants with the application of indol-3-butyric acid. The combination of rooting media with Vermi-compost, azospirillum, and IBA affected significantly the rooting parameters as compared to rest of the treatments. The days to root initiation were decreased and minimized (19.67) while the maximum value rooting parameter *viz*. rooting percentage (76.00), number of primary roots (9.67), length of primary roots (4.47), number of secondary roots (6.33) were obtained with the application of Soil+ VC+ Azospirilum + IBA 5000ppm. However, other concentrations of IBA along with the similar media were also influenced significantly gave better result from rest of the treatments. The Soil+ VC+ Azospirilum + IBA 5000ppm gave better results than the lower concentration appeared to be an early & increasing tendency of rooting with an increasing concentration of IBA. The quality of auxin reaching the combial activity with suitable media having effective microbial inoculants which provides adequate rooting conditions may be adequate for initiating root primordial so the maximum performance was seen at higher concentration of IBA and soil containing Vermi-compost and Azospirillum. The maximum number of primary and secondary roots might be due to hormonal effect and rooting conditions of the media leading to accumulation of internal substances and their downwards movements. Regarding the number of secondary roots might be due to more cell division. In addition, *A. brasilence* can restrict the proliferation of other non-pathogenic rhizosphere bacteria Holguin and Bashan, (1996) [4]. These antibacterial activities of *Azospirillum* could be related to its already known ability to produce bacteriocins and siderophores (Shah *et al.*, 1992) [9].

The maximum mean length of primary and secondary roots suggesting that higher concentration of IBA with Soil, Vermi-compost and microbial inoculants might be due to addition of PGR's with soil better uptake of plant nutrients and production of growth promoting substances and suppression of deleterious bacteria which might have increase the rooting and their other parameters like number of roots, root length etc. The beneficial effect of azospirillum may derive both from its nitrogen fixation and stimulating effect on root development (Noshin *et al.*, 2008) [6].

The high concentration of IBA stimulated faster growth of roots resulting in maximum length as reported by Tyagi and Patel (2004) [11]. Similar results also have been reported by Sharma *et al*., (1991) [10]. The similar production of auxins by Azospirillum were also reported by Reynders and Tanaka, (1979) [8], Omay *et al*; (1992) [7] and comparatively early root initiation and further root development by the inoculation of rooting media with Azospirillum, Trico-derma with Vermi-compost in IBA treated shoots might be suppression of pathogens creating healthy condition for combial activity and root initiation and growth in many species as reported by Digby and Wannerman, (1965) [2].

Conclusion and Future prospects

On the basis of present investigation, it is concluded that the Soil+ Vermi-compost+ Azospirillum with IBA 5000ppm is proved to be the best in comparison to other rooting medium for mango air layers. The days to root initiation, rooting percentage, number of primary roots, number of secondary roots and length and primary roots per air layers after transplanting increased up to maximum extent due to the above mixtures of rooting medium.

Since on the basis of the result of present investigation no recommendation can be made it needs further research studies of the same experiment for at least three successive years in different environments. Following studies are also suggested to be undertaken in future-

1. Individual Bio-fertilizers may also be tried with coconut peat.
2. Effective concentration of GA3 may be tried with others PGR's like NAA etc.

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