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Assess the combined effect of PGR's and rooting medium on growth success & survival of layer

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Abstract
The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of length of layer (44.00, 44.67, 46.00, and 48.00) at 30, 60, 90 and 120 days respectively after transplanting whereas least length of layer noted (24.33, 25.00, 26.00, 27.33) at 30, 60, 90, and 120 days respectively under control. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of length of leaves was noted maximum (11.33, 13.67, 14.98 and 17.02) at 30, 60, 90 and 120 days respectively after transplanting whereas least length of leaves noted (5.82, 7.78, 9.98 and 10.51) at 30, 60, 90, and 120 days respectively under control. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of width of leaves was noted (3.00, 3.90, 4.35 and 4.53) at 30, 60, 90, and 120 DAT respectively. Though it was recorded minimum under control at 30, 60, 90 and 120 days period. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of number of new emerged leaves (5.67, 7.67, 9.00 and 12.00) at 30, 60, 90 and 120 DAT respectively was obtained followed by though it was recorded the minimum with treatment T1 (3.33, 4.00, 4.33 and 5.00) at 30, 60, 90 and 120 days respectively under control. The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of survival percentage (63.34%) while the least (43.66%) survival percentage was noted under control and treatment T2.The effect of rooting medium Soil+ VC+ Azospirillum with IBA 5000ppm in terms of success percentage (70.66%) followed by (62.66%) in Soil + VC + PSB + IBA 5000ppm while the success in rooting percentage was lowest (48.66%) under control.

Keywords: PGR's, survival of layer, Soil+ VC+ Azospirillum

Introduction

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. Ripe fruits can be sliced and canned or processed to juice, jams, jellies, nectars and preserves. Eastern and Asian cultures use unripe mangos for pickles, chutney, achar with different spices and recipes as per regional preferences. In India, unripe mangos are sliced, dried, and made into powder for amchoor, a traditional Indian preparation used for cooking. In India, flour is made from mango seeds. A ripe mango is known to be 14% sugar by weight and 0.5% acid by weight, with a sugar acid ratio of 28:1. Fresh mango is a good source of potassium. 100 g fruit provides 156 mg of potassium while just 2 mg of sodium. A ripe, medium size mango provides carbohydrates, fiber, vitamins A, B1, B6 and C, sodium, calcium, magnesium, zinc, copper, manganese, iron, phosphorus, potassium, pantothenic acid, and niacin. Mango is one of the most popular of all tropical fruits. Mangiferin, being a polyphenolic antioxidant and a glucosyl xanthone, it has strong antioxidant, anti lipid per-oxidation, immunomodulation, cardiotonic, hypotensive, wound healing, antidegenerative and antidiabetic activities. Ram and Sirohi [1989] reported that air layered trees gave the largest fruits compared to grafting and stooling. Fruit growers

raising of stocks for grafting require more time and it is cumbersome method. Looking to the problems related to the grafting, layering may be another option to get the true to type of planting material.

Material and methods

This chapter embodies a concise dissertation of the material and methods used during the course of investigation. The present investigation objective "Assess the combined effect of PGR's and rooting medium on growth success & survival of layer" 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 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.

Detachment of air layers

After 60 days of layering operation of the shoots were ready for detachment. These were detached by making a cut just below the lower end of the ringed surface with a sharp scateuer. The polythene covers were removed gently and the successful air layers were planted in well-prepared poly-bags as per the layout plan.

Pre planting observation

Root characters

Treated layers were detached after 60 days of operation and the following root characters were studied.

Rooting percentage

The number of rooted air layers was counted after detachment of air layered twinges from the mother plants after 60 days of operation. The data was Compiled successfully and rooting percent was calculated by following formula –

$$\text{Rooting \%} = \frac{\text{No of rooted layers}}{\text{Total no. of air layers}}$$

Number of primary roots

Primary roots were counted at 60 and 150 days of layering by taking 3 random samples from each treatment under each replication after detachment of air layers from the mother plant.

Maximum length of primary roots

The observations were recorded at 60 and 150 days of layering with the help of scale at time when detachment of air layered twinges from the parent plant. The length of primary root was measured in cm from base up to the tip.

Minimum length of primary roots

The minimum length of the primary root was measured in cm. with the help of measuring scale just after detachment. These observations were recorded after 60 and 150 days of layering.

Number of secondary roots

Secondary roots were counted at 60 and 150 days of layering by taking 3 random samples from each treatment under each replication after detachment of air layers from the mother plant.

Post planting observation

Establishment and growth characters

Rooted layers were planted in the well prepared poly-bags and observation were recorded on the following characters-

Survival % of air layers

After 150 days of transplantation the survival percentage was calculated by following formula.

$$\text{Survival \% of air layers} = \frac{\text{Total no. of survived layers}}{\text{Total planted layers}} \times 100$$

Length of shoot (plant height)

Length of shoot or plant height was measured in cm. after 30, 60, 90,120 days of planting with the help of meter scale in each treatment.

Number of branches

After 30, 60, 90,120 days of layering, the number of branches was counted in each treatment.

Number of leaves

The number of leaves per air layers was counted after 30, 60, 90,120, days of layering in each treatment.

Irrigation and weeding

Watering and weeding was carried out regularly and poly-Bags were kept clean at 7 days intervals so that there was no competition for moisture and nutrient.

Table 1: Record of cultural operations applied in the experiment

S. No	Date	Operation
1.	28-07-2016	Preparation of rooting media
2.	28-07-2016	Air- layer operation.
3.	27-09-2016	Preparation of polybags.
4.	28-09-2016	Separation of air layers from mother plants.
5.	28-09-2016	Planting of air layers in polybags.

Results and Discussion

This chapter deals with the findings of the experiment objective "Assess the combined effect of PGR's and rooting medium on growth success & survival of layer". The experiment was carried out during the year 2016-17. 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.

Growth character studies

Survival percentage of air layers (%)

The data of the table shows significant effect of various treatments on survival percentage of the layers. The treatment T16 noted the maximum (63.34%) survival percentage while, the least (43.66%) survival percentage was noted under treatment T1 and T2.

Table 2: Effect of IBA, rooting on survival percentage of air layers at 150 DAT.

Treat. Symb.	Treatment combination	Survival percentage (%)
T1	P0M1	43.66
T2	P0M2	46.66
T3	P0M3	47.00
T4	P0M4	47.33
T5	P1M1	52.66
T6	P1M2	54.00
T7	P1M3	54.33
T8	P1M4	56.00
T9	P2M1	52.66
T10	P2M2	51.66
T11	P2M3	51.33
T12	P2M4	57.00
T13	P3M1	53.33
T14	P3M2	57.33
T15	P3M3	57.00
T16	P3M4	63.33
S. Em±		0.93
C.D.5% level		2.70

Number of new emerged branches (per layer)

The maximum number of branches per air-layer (2.67, 5.33, 5.67 and 6.33) at 30, 60, 90 and 120 DAT respectively were obtained with T16 respectively followed by T14 (2.33) at 30 days which were at par with each other. Though it was recorded the minimum with treatment T1 at 30, 60, 90 and 120 days. The results in respect of this growth character (Table 4.7) showed that the number of branches per air-layer were significant with T16 at 30, 60, 90 and 120 DAT. This treatment combination proved to be significantly superior to rest of the treatment combinations with regard to number of new emerged branches.

Table 3: Effect of IBA and rooting medium on number of new emerged branches at 30, 60, 90 and 120 days after transplanting

Treat. Symb.	Treatment combination	Number of new emerged branches at			
		30DAT	60DAT	90DAT	120DAT
T1	P0M1	1.00	1.33	1.33	1.33
T2	P0M2	1.00	1.33	2.00	2.67
T3	P0M3	1.00	1.33	2.33	2.67
T4	P0M4	1.00	1.67	2.33	2.67
T5	P1M1	1.33	2.33	3.00	3.33
T6	P1M2	1.33	2.67	3.33	3.67
T7	P1M3	1.67	2.67	3.67	4.33
T8	P1M4	1.67	2.67	4.00	5.00
T9	P2M1	1.33	2.33	3.00	3.33
T10	P2M2	1.33	1.67	2.67	3.00
T11	P2M3	1.00	1.67	2.67	3.00
T12	P2M4	2.00	2.67	4.33	5.33
T13	P3M1	1.33	2.33	3.33	3.33
T14	P3M2	2.33	3.00	4.67	5.33
T15	P3M3	1.67	2.67	4.00	5.33
T16	P3M4	2.67	5.33	5.67	6.33
S. Em±		0.19	0.18	0.19	0.18
C.D.5% level		0.57	0.54	0.57	0.54

Number of new emerged leaves (per layer)

The maximum number of leaves per air-layer (5.67, 7.67, 9.00 and 12.00) at 30, 60, 90 and 120 DAT respectively was obtained with T16 though it was recorded the minimum with treatment T1 (3.33, 4.00, 4.33 and 5.00) at 30, 60, 90 and 120 days respectively. The results in respect of this growth character (Table 4.8) showed that the number of new emerged leaves per air-layer were significant with T16 at 30, 60, 90 and 120 DAT. This treatment combination proved to be significantly superior to rest of the treatment combinations with regard to number of new emerged leaves.

Table 4: Effect of IBA and rooting medium on number of new emerged leaves at 30, 60, 90 and 120 days after transplanting

Treat. Symb.	Treatment combination	Number of new emerged leaves at			
		30DAT	60DAT	90DAT	120DAT
T1	P0M1	3.33	4.00	4.33	5.00
T2	P0M2	4.00	4.33	5.00	5.00
T3	P0M3	3.67	4.00	4.67	5.33
T4	P0M4	4.33	5.00	5.67	6.33
T5	P1M1	4.67	5.00	6.67	8.00
T6	P1M2	4.00	6.33	7.33	8.67
T7	P1M3	3.67	4.67	6.33	8.33
T8	P1M4	4.00	4.33	6.00	7.00
T9	P2M1	3.67	5.00	6.33	8.00
T10	P2M2	4.67	5.00	6.33	8.67
T11	P2M3	3.33	4.00	4.33	5.67
T12	P2M4	3.67	5.00	6.33	7.33
T13	P3M1	3.33	5.00	6.67	8.33
T14	P3M2	4.00	4.67	6.67	8.00
T15	P3M3	4.33	5.00	7.00	10.33
T16	P3M4	5.67	7.67	9.00	12.00
S. Em±		0.25	0.25	0.29	0.24
C.D.5% level		0.74	0.75	0.85	0.72

Length of layer (after detachment)

The length of layers was also influenced significantly by the given treatments. The maximum length (46.33 cm) of layer

noted in treatment T16 at 60 DAL followed by T14 (43.33) & T12 (42.33) which were at par with each other. Whereas, the minimum length of layer was noted (24.00cm) at 60 DAL with treatment T1.

Table 5: Effect of IBA and rooting medium on length of layer (after detachment)

Treat. Symb.	Treatment combination	Length of layer (cm)
T1	P0M1	24.00
T2	P0M2	26.33
T3	P0M3	27.67
T4	P0M4	30.33
T5	P1M1	35.67
T6	P1M2	36.67
T7	P1M3	40.33
T8	P1M4	41.33
T9	P2M1	35.67
T10	P2M2	33.67
T11	P2M3	30.67
T12	P2M4	42.33
T13	P3M1	36.00
T14	P3M2	43.33
T15	P3M3	42.00
T16	P3M4	46.33
S. Em±		1.94
C.D.5% level		5.62

Length of layer (after transplanting)

The imposed treatments significantly affected the length of layers after transplanting. The maximum length of layer (44.00, 44.67, 46.00, and 48.00) at 30, 60, 90 and 120 days respectively after transplanting was noted in treatment T16 whereas least length of layer noted (24.33, 25.00, 26.00, 27.33) at 30, 60, 90, and 120 days respectively from treatment T1.

Table 6: Effect of IBA and rooting medium on length of layer (cm) at 30, 60, 90 and 120 days after transplanting

Treat. Symb.	Treatment combination	Length of layer (cm) at			
		30DAT	60DAT	90DAT	120DAT
T1	P0M1	24.33	25.00	26.00	27.33
T2	P0M2	27.33	28.33	29.67	31.33
T3	P0M3	28.33	24.67	31.33	33.00
T4	P0M4	30.00	30.67	32.00	33.67
T5	P1M1	36.00	37.00	39.33	41.00
T6	P1M2	37.67	38.67	39.67	41.67
T7	P1M3	41.00	42.33	43.67	44.67
T8	P1M4	41.67	42.67	43.67	45.67
T9	P2M1	35.00	36.67	37.00	39.00
T10	P2M2	33.67	35.00	36.67	37.67
T11	P2M3	31.00	32.33	33.67	35.00
T12	P2M4	42.00	43.00	44.33	46.00
T13	P3M1	36.67	38.33	39.33	41.33
T14	P3M2	43.33	44.67	45.67	47.00
T15	P3M3	41.67	43.00	44.00	46.00
T16	P3M4	44.00	44.67	46.00	48.00
S. Em±		1.30	1.28	1.04	1.31
C.D.5% level		3.78	3.71	3.03	3.81

Length of leaves (after transplanting)

The length of leaf was recorded after transplanting which was increased significantly due to application of treatments. The maximum length of leaves (11.33, 13.67, 14.98 and 17.02) at 30, 60, 90 and 120 days respectively after transplanting was noted in treatment T16 whereas the least length of leaves noted (5.82, 7.78, 9.98 and 10.51) at 30, 60, 90, and 120 days respectively from treatment T1.

Table 7: Effect of IBA and rooting medium on length of leaves at 30, 60, 90 and 120 days after transplanting

Treat. Symb.	Treatment combination	Length of leaves at			
		30DAT	60DAT	90DAT	120DAT
T1	P0M1	5.82	7.78	9.98	10.51
T2	P0M2	6.38	7.82	10.11	11.03
T3	P0M3	6.42	7.89	10.24	11.73
T4	P0M4	6.49	7.92	10.48	12.28
T5	P1M1	7.03	9.00	11.27	13.19
T6	P1M2	7.50	9.13	11.51	13.65
T7	P1M3	7.69	9.50	11.61	13.66
T8	P1M4	8.92	10.97	13.07	14.51
T9	P2M1	6.95	8.96	11.11	13.01
T10	P2M2	6.94	8.61	11.07	12.81
T11	P2M3	6.56	7.97	10.72	12.76
T12	P2M4	10.02	11.93	14.30	15.85
T13	P3M1	7.45	9.05	11.29	13.64
T14	P3M2	10.85	12.87	14.84	16.59
T15	P3M3	9.67	11.90	13.94	15.17
T16	P3M4	11.33	13.67	14.98	17.02
S. Em±		0.31	0.36	0.38	0.33
C.D.5% level		0.91	1.05	1.10	0.99

Width of leaves (after transplanting)

The maximum width of leaves (3.00, 3.90, 4.35 and 4.53) at 30, 60, 90, and 120 DAT respectively was obtained with application of the treatment T16 followed by T14 (2.99), T12 (2.98) at 30 days and T14 (4.52), T12 (4.45) at 120 days which were at par with each other. Though, it was recorded the minimum with treatment T1 at 30, 60, 90 and 120 days period. The (Table 4.9.3) treatment T5 proved to be significantly superior to rest of the treatments with regard to width of leaves.

Table 8: Effect of IBA and rooting medium on width of leaves at 30, 60, 90 and 120 days after transplanting

Treat. Symb.	Treatment combination	Width of leaves at			
		30DAT	60DAT	90DAT	120DAT
T1	P0M1	1.98	2.12	2.95	3.28
T2	P0M2	2.00	2.34	2.96	3.30
T3	P0M3	2.11	2.47	2.97	3.34
T4	P0M4	2.29	2.70	3.09	3.35
T5	P1M1	2.60	2.88	3.19	3.71
T6	P1M2	2.66	3.03	3.23	3.93
T7	P1M3	2.67	3.05	3.39	4.02
T8	P1M4	2.88	3.27	3.71	4.09
T9	P2M1	2.49	2.84	3.15	3.70
T10	P2M2	2.49	2.82	3.11	3.69
T11	P2M3	2.30	2.81	3.10	3.39
T12	P2M4	2.98	3.30	3.84	4.45
T13	P3M1	2.66	2.91	3.23	3.74
T14	P3M2	2.99	3.45	3.88	4.52
T15	P3M3	2.91	3.27	3.72	4.30
T16	P3M4	3.00	3.90	4.35	4.53
S. Em±		0.11	0.08	0.10	0.12
C.D.5% level		0.33	0.24	0.30	0.36

Leaf area index

The maximum leaf area index (0.299, 0.691, 1.033 and 1.852) at 30,60, 90, and 120 DAT respectively was obtained from the treatment T16 followed by T14 (0.256), T12 (0.245) at 30 days respectively which were at par with each other. While it was recorded the minimum with treatment T1 (0.094, 0.154, 0.284 and 0.338) at 30, 60, 90 and 120 days respectively. The results in respect of this growth character (Table 4.9.4) showed that the maximum width of leaves were significant with T16 at 30, 60, 90 and 120 DAT. This treatment combination proved to be significantly superior to rest of the treatment combinations with regard to leaf area index.

Table 9: Effect of IBA and rooting medium on leaf area index at 30, 60, 90 and 120 days after transplanting

Treat. Symb.	Treatment combination	Leaf area index at			
		30DAT	60DAT	90DAT	120DAT
T1	P0M1	0.095	0.154	0.284	0.338
T2	P0M2	0.099	0.171	0.305	0.395
T3	P0M3	0.108	0.213	0.325	0.457
T4	P0M4	0.118	0.215	0.340	0.527
T5	P1M1	0.144	0.274	0.464	0.762
T6	P1M2	0.179	0.283	0.484	0.799
T7	P1M3	0.180	0.331	0.492	0.807
T8	P1M4	0.231	0.332	0.649	0.947
T9	P2M1	0.139	0.265	0.454	0.686
T10	P2M2	0.134	0.258	0.411	0.668
T11	P2M3	0.125	0.227	0.351	0.621
T12	P2M4	0.245	0.410	0.774	1.200
T13	P3M1	0.149	0.282	0.483	0.786
T14	P3M2	0.256	0.503	0.867	1.395
T15	P3M3	0.231	0.390	0.657	1.180
T16	P3M4	0.299	0.691	1.033	1.852
S. Em±		0.042	0.024	0.037	0.026
C.D.5% level		0.121	0.069	0.109	0.078

Success percent (%)

The success percent in rooting of air layer of mango was observed under different concentration of IBA and rooting medium at 120 days after transplanting (Table 4.9.5). It was found significant. The success percentage of rooting was noted the maximum (70.66%) under T16 while the success in rooting percentage was the lowest (48.66%) in treatment T1.

Table 10: Effect of IBA and rooting medium on success percentage.

Treat. Symb.	Treatment combination	Success percentage
T1	P0M1	48.66
T2	P0M2	51.00
T3	P0M3	51.33
T4	P0M4	52.33
T5	P1M1	58.00
T6	P1M2	59.33
T7	P1M3	60.00
T8	P1M4	60.33
T9	P2M1	57.00
T10	P2M2	57.00
T11	P2M3	56.33
T12	P2M4	66.00
T13	P3M1	59.00
T14	P3M2	67.00
T15	P3M3	62.66
T16	P3M4	70.66
S. Em±		0.87
C.D.5% level		2.53

Enhanced microbial activity in the plant rhizo-sphere could have the acquisition of mineral nutrients either directly via mobilization or indirectly via effect on root morphology and physiology (Babalola 2010; dobbelaere *et al*. 2003; Vessey, 2003; Lucy *et al*. 2004 and Compant *et al*. 2005) [1, 3, 10, 6, 2].The interesting phenomena was noticed that trico-derma in combination with others has neither helped in early root initiation nor influenced the other parameters in better ways. Though rest of the other treatments significantly affected the rooting parameters. The early root initiation might be due to presence of IBA in the media and supporting action of the inoculants for production of growth promoting substances like similarly the soil rooting media, microbial inoculants with IBA application had marked influence on rooting of air layers.

Growth parameters

In growth parameters *viz*. number of new emerged branches, number of new emerged leaves, length of layer (after detachment), length of layer (after transplanting), length of leaves, width of leaves and success percentage recorded higher in treatment P3M4, (Soil+ VC+ Azospirilium+ IBA 5000ppm) and similarly affected by treatments those applied along with IBA whereas, the minimum value were observed under control. Azospirillum spp. is not considered to be a classic bio control agent of soil-borne plant pathogens.

Looking to the findings related to rooting & growth parameters show the significant influence of the imposed treatments resulted higher success percentage of layers. Tyagi & Patel (2004) [9] reported increase in number of leaves due to IBA application supports the findings. Similarly higher leaf area was recorded in treatment soil+ vc+ azospirilIum+ IBA

5000ppm followed by treatment Soil+ VC+ PSB+ IBA 5000ppm while the minimum values were recorded under control. This might be due to higher concentration of auxin, VC and bio-fertilizers leads to the best aireal growth.

The data obtained on growth parameters greatly influenced by different rooting media along with the application of indole-3-butyric acid. The parameters *viz*. emergence of new leaves, shoots, length of layer, length and width of leaves success & survival percentage of layers at 30,60,90, and 120 days after transplanting. Azospirillum directly benefits plants improving shoot and root development and increasing the rate of water and mineral uptake by roots (Gonzalez *et al*., 2005) [5]. The maximum values were recorded under Soil+ VC+ Azospirillum+ IBA 5000ppm while these above mentioned parameters were found the minimum due to using soil only. The treatment of Soil+ VC+ Azospirilium+ IBA 5000ppm had marked influence on all the growth parameters. Subsequently, another treatments *viz*. Soil+ VC+ Azospirillum+ IBA 5000ppm, Soil+ VC+ PSB+ IBA 5000ppm affected significantly the number of leaves, length of leaves, width of leaves, number of branches, length of layer, survival and success percentage. The mechanisms by which Azospirillum spp. can exert a positive effect on plant growth is probably composed of multiple effect including synthesis of phytohormoes, N2-fixation, nitrate reductase activity and enhancing minerals uptake (El-Komy *et al*, 2003) [4].

Bio-fertilizers play vital role in maintaining long term soil fertility and sustainability by fixing atmospheric nitrogen (N=N), mobilizing fixed macro and micro-nutrients or convert insoluble phosphorus in the soil into forms available to plants thereby increase their efficiency and availability. In the present study the emergence of new leaves, shoots, length of leaves, width of leaves, length of layer, leaf area, success and survival percentage of layers under Soil+ VC+ Azospirilium+ IBA 5000ppm may be owing to favourable effect on biochemical constitution of the tissues of the layer and auxins generally stimulate the movement of natural auxins and other nutrients support to the vegetative growth. This might be due to more number of primary and secondary roots length at this combination for better absorption of nutrients and moisture from the soil and ultimately resulted in higher success percentage (Tyagi and Patel 2004) [9]. Azospirillum plant association is accompanied by biochemical changes in roots, which in turn promote plant growth and tolerance to low soil moisture. The bacteria stimulate plant-growth even in the presence of several stresses such as drought (Noshin *et al*, 2008; Sivasakthivelan and Saranraj, 2013) [7, 8].

Conclusion and Future prospects

The maximum survival percentage, number of new emerged branches, number of new emerged leaves, length of layer, length of leaves, leaf area index, success percentage and width of leaves per air layer were noted with Soil+ Vermi-compost+ Azospirillum with IBA 5000ppm at 150 days after transplanting. However, this was followed by Soil+ VC+ PSB with IBA 5000ppm. The minimum of these parameters were recorded under soil treatment. The best rooting medium of vermin compost has been proved superior to soil in respect of these parameters.

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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