International Journal of Science and Research (IJSR)
ISSN (Online): 2319-7064
Index Copernicus Value (2013): 6.14 | Impact Factor (2013): 4.438

Effect of IAA and IBA on *In vitro* Rooting of Banana (*Musa paradisiaca*) Cv.Grand Naine

Miilion Paulos M[1], Varsha G. Khandagale[2], Bhagyashri H. Nadkarni[3]

[1]M.Sc. (Hort.) scholar, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth - Rahuri 413722 India

[2]Junior Research Assistant, State Level Biotechnology Centre, Mahatma Phule Krishi Vidyapeeth- Rahuri 413722 India

[3]M.Sc. (Hort.) scholar, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth - Rahuri 413722 India

Abstract: ***The present study was undertaken to study the effect of different concentrations of growth regulators of IAA (indole-3-acetic acid) (0.0, 0.5 and 1.0 mg/l) and IBA (indole-3- butyric acid) (0.0, 0.5, 1.0 and 1.5 mg/l) and their interaction on rooting. Half strength MS medium was used for all treatments. Days to root induction varied with different concentration of IAA and IBA. The short duration were recorded by 0.5 mg/l IAA – 8.9 days and 1.5 mg/l IBA – 9.4 days and interaction of both 0.5 mg/l IAA + 1.5 mg/l IBA has given almost a week root induction (7.33) days. The highest numbers of roots were produced by treatment 0.5 mg/l IAA which was 6.2 and 7.8 at 15 and 30 DAI, respectively. 1.5 mg/l IBA was produced 5.1 and 7.1 roots at 15 and 30 DAI respectively. In 0.5 mg/l IAA + 1.5 mg/l IBA combination was given 7.0 and 8.0 numbers of roots at 15 and 30 DAI respectively. In length of roots, it was observed that 0.5 mg/l IAA was produced longest root size, 5.7 and 6.7 cm at 15 and 30 DAI respectively. The same concentration of IBA produced 4.5 and 5.9 cm root length at 15 and 30 DAI respectively. In interaction, 0.5 mg/l IAA +0.5 mg/l IBA were produced 6.33 and 7.33 cm length in 15 and 30 DAI respectively.***

Keywords: Banana, *In vitro*, IAA, IBA, rooting, Grand naine

1. Introduction

Banana is one of the most important fruits in the world, both as a staple food as well as a major export commodity for many tropical and subtropical countries. The extensive basic work on the *in vitro* propagation of banana (Kodym and Zapata, 1999; Nandwani *et al*., 2000) had led to the technological development of *in vitro* mass production of different cultivars. Plant tissue culture techniques can potentially overcome some of the factors limiting traditional approaches to banana improvement.

Application of tissue culture technique is a tool to produce large number of disease free plants in limited period of time and space (Khanam, D *et al*., 1996). *In vitro* propagation of different cultivar required different culture media for shoot proliferation and root differentiation (Dore, S.R *et al*., 1983). However, there is still lack of information on in vitro rooting of banana. Now a day, the plant growth regulators are widely used in modern agriculture to promote rooting. Application of tissue culture technique is a tool to produce large number of disease free plants in limited period of time and space Khanam *et al.,* (1996).

Now a day, the plant growth regulators are widely used in modern agriculture to promote rooting. Widiastoety and Soebijanto, (1988) reported that good rooting and the best survival were obtained with IBA treatment in *Hibiscus rosa sinensis.* Kundu *et al.,* (1987) reported that indol 3-butyric acid (IBA) had a highly significant effect on the percentage success of rooting, number of root and length of root production *Ixora coccinia.* Viehman *et al.,* (2007) compared the influence of growth regulators on the root induction of the *Musa* genus plants cultivated within *in vitro* conditions. They used planting material 'Cavendish' cultivar. Different concentrations of growth regulators (naphthalene acetic acid, indole-3-acetic acid, 6-benzylaminopurine, 2.4-dichlorophenoxyacetic acid) used and as control ones MS and half concentrated MS media without addition of growth regulators. The induced roots were evaluated in conditions *in vitro* and *ex vitro*. The amount and length of the roots were evaluated, as well as the capacity of absorption of the roots by conductivity was determined. The experiments have proven that the most roots are created by using naphthalene acetic acid (5.4 μM), but the longest roots provide the control variant (MS medium). After 7 weeks of the transfer to *ex vitro* conditions the plants that were growing on medium with addition indole-3-acetic acid have the best vitality and root absorption.

The investigation was undertaken to standardize BAP with IAA and IBA concentration for *in vitro* rooting. Al-amin *et al.,* (2009) observed the effect of different concentration of IBA and IAA supplemented half strength MS-medium of banana cv. BARI Banana-I and the study reveals that the root numbers varied with different concentration of IBA and IAA, Highest number of roots produced by 0.5 mg/l IAA + 0.5 mg/l IBA.

Bhosale *et al.,* (2013) studied the effect of different concentration of growth regulators on rooting in different species of banana and standardized BAP with IAA and IBA concentration for *in vitro* rooting. He inoculated shoots developed on MS (Murashige and Skoog) medium with supplement combination of growth regulator with IAA and IBA and observed best rooting in BAP 1 mg/l + IBA 3 mg/l. *In vitro* multiplication of banana is normally carried in the presence of high cytokinins levels, which inhibit root formation and elongation. Addition of 200 mg/l charcoal enhanced rooting and stopped callus formation. It was also obvious from the result that incorporation of activated charcoal reduced the time taken for root initiation and

Licensed Under Creative Commons Attribution CC BY

further increased the root and shoot length (Shahnawaz *et al.*, 2014).

2. Materials and Methods

This experiment was undertaken at Mahatma Phule Krishi Vidyapeeth, State Level Biotechnology Centre, Tissue culture Laboratory, Rahuri India, during the period of June 2014 to September 2014. The healthy 4-6 months young sucker of Cv. Grand naine were collected, washed and excised properly. The excised explants treated with bavistin fungicide solution (2.5 g/l) and streptomycin (300 mg/l) for 30 minute. Then, they were washed with distilled water 2-3 times. Further surface sterilization was done by 0.1 mercuric chloride (HgCl2) and few drops of tween -20 followed 4-6 repeated wash were done to remove off detergents and traces. These explants were trimmed and aseptically inoculated on culture media for shoot initiation and proliferation.

After appropriate sub culturing well grown shoots were aseptically transferred for root induction. The root organogenesis was observed on half strength MS media used with two type of auxin IAA (at 0, 0.5 and 1.0 mg/l) and IBA (at 0, 0.5, 1.0 and 1.5 mg/l) and their interaction used to evaluate their effect on rooting of micro shoot. The data were arranged and analyzed by Factorial Completely Randomized Design; Data represented in count were transformed by squire root system.

3. Result and Discussion

3.1 Effect of IAA, IBA and interaction on days to rooting.

In this experiment the IAA level shown significant variation, it was observed that 0.5 mg/l IAA gave (8.9) days to induction, the shortest and control was resulted 12.8 days the longest among treatments. The effect of IBA level on days to rooting showed that 1.5mg/l IBA gave 9.4 days to induce root while control treatment observed 11.5 days and it was statistically non significant.

The average number of days required to show clearly rooted micro shoot were not statistically significant at 5% level The longest of days for rooting was recorded in half MS medium with control treatment (14.33) days followed 12.6 days in 0.0 mg/l IAA + 0.5 mg/l IBA. The earliest days to rooting observed in concentration of 0.5 mg/l IAA +1.5 mg/l IBA (17.3) days. In relation to this investigation, different researchers investigated on the influence of media composition on days to rooting. The purpose of multiplication stage is not simply to produce large number of shoots but also to yield high quality shoots that give minimal difficulties at these subsequent critical stages. Constantine, (1986) reported that the best quality control during multiplication, grading will be necessary to produce even sized shoots that will root synchronously.

3.2 Effect of IAA, IBA and interaction on number of roots.

The criteria for the achievement of optimal growth and rooting have included shoot number produced during any one culture. (Jones 1976, Lane and Mc Dongald 1982), rooting percentage (James and Thurbon, 1981: Jones and Hatfield, 1976) and the quality of rooting as measured by the number of roots per rooted shoots (James and Thurbon, 1977). With this idea the effect of media composition of IAA, IBA hormones were studied.

As regard to IAA levels on the number of roots concerned was significantly influenced both at 15 DAI and 30 DAI which was seen 6.2 and 7.8 respectively on media composition supplemented with 0.5mg/l IAA. Muhammad *et al.*, (2013) studied on different combination of auxin and they reported MS supplemented with 2.0mg/l IAA gave best result which produced 60% root induction. In case of IBA 1.5mg/l shown maximum number of roots 5.1 and 7.1 in 15 and 30 DAI, respectively on media composition supplemented with 0.5 mg/l IBA. In contrary Shahanawaz *et al.*, (2014) observed maximum rooting on MS medium of half strength supplemented with IBA 1.0mg/l and activated charcoal 200mg/l. In addition to this Viehman *et al.*, (2007) reported the highest number of roots 2.74 on media of 14.5 µm IAA and the lowest number of roots on 5.7µm IAA which was 0.88 in number.

From this investigation it was observed that by combination of hormones, maximum average number of root (7.0 and 8.0) at 15 and 30 DAI, respectively on the media composition of half strength MS with 0.5mg/l IAA + 1.5 mg/l IBA. The result followed by 0.5 mg/l IAA + 0.0 mg/l IBA produced 6.67 and 8.0 roots per explants at 15 DAI and 30 DAI respectively. This variation due to many environmental factors. (Gaulbert, (1969) reported continued rhizogenises is influenced by sugar, auxin, temperature and light.

The findings of Gubbuk and Pekmezci (2001). Molla *et al.*, (2004) obtained 8.28 number of roots per plantlet on 0.5 mg/l IBA followed by 6.33 roots, on 0.6 mg/l IBA. They also observed 3.89 and 3.97 number of roots in 0.2 mg/l IBA and 0.3 mg/l IBA, respectively. Molla *et al.*, (2004) obtained similar results. The results of the present experiment were found similar with the findings of Khanam *et al.*, (1996).

3.3 Effect of IAA, IBA and Interaction on Length of Roots

The length of root at different level of IAA is given in table 1. From revealed, data 0.5mg/l IAA produced long length of roots 5.7 and 6.7 cm in 15 and 30 DAI, respectively. The shortest was found in control treatment. The differences due to IAA levels were statistically significant. In other way Viehman *et al.*, (2007) studied root length and 2.9 µm IAA recorded 2.85 cm as longest root and 14.5 µm IAA produced short root length 2.23 cm. As regard to IBA level, 0.5 mg/l IBA shown long length of roots 4.5 and 5.9 in 15 and 30 DAI respectively, the combine effect among IBA level were not statistically significant.

Licensed Under Creative Commons Attribution CC BY

In this study different combination of media composition were prepared to assess their effect on root length. Based on this study the maximum average root length was observed on 0.5 mg/l IAA + 0.5 mg/l IBA (6.33 and 7.33cm) in 15 and 30 DAI, respectively. The minimum value recorded was 1.33 and 1.66cm in control treatment both 15 and 30 DAI respectively. The interaction effect was not statistically significant.

Similar results were obtained by Molla *et al.,* (2004) where they got 2.60-5.67 cm range of root length in 0.5 mg/l IBA. Habiba *et al.,* (2002), Khanam *et al.,* (1996) and Ali (1996) also reported more or less similar results. Therefore, the present result partially agreed with the findings of Gubbuk and Pekmezci, (2001).

Table 1: Effect of different concentration of IAA, IBA and interaction on mean days to root induction, number of roots and length of roots in banana Cv. Grand naine

Factors	Number of days to root induction	Number of roots		Length of roots	
A:- IAA Level		15DAI	30DAI	15DAI	30DAI
A1= IAA 0.0 mg/L	12.8 (3.64)a	2.0 (1.53)c	3.7(1.97)c	2.7bc	4.4bc
A2= IAA 0.5 mg/L	8.9 (3.05)bc	6.2 (2.57)a	7.8(2.87)ab	5.7a	6.7a
A3= IAA 1.0 mg/L	10.1(3.24)bc	4.5 (2.23)b	6.4(2.61)ab	3.1bc	4.7bc
SEm (±)	0.51	0.43	0.51	0.45	0.47
CD at 5%	1.5	1.2	1.50	1.32	1.39
B:- IBA Level					
B1= IBA 0.0 mg/L	11.5 (3.45)	4.0 (1.97)	5.0 (2.18)	3.6	4.6
B2= IBA 0.5 mg/L	11.3 (3.42)	3.8 (2.03)	5.8 (2.49)	4.5	5.9
B3= IBA 1.0 mg/L	10.1 (3.22)	4.2 (2.13)	6.0 (2.52)	4.1	5.7
B4= IBA 1.5 mg/L	9.4 (3.13)	5.1 (2.32)	7.1 (2.73)	3.2	4.8
SEm (±)	0.59	0.50	0.59	0.52	0.55
CD at 5%	NS	NS	NS	NS	NS
C:- Interaction					
A1B1	14.33 (3.845)	0.67 (0.998)	1.33(1.178)	1.33	1.66
A1B2	12.67 (3.624)	2.00 (1.559)	4.00(2.112)	3.57	5.16
A1B3	11.67 (3.480)	2.67 (1.739)	4.33(2.187)	3.67	5.83
A1B4	12.67 (3.628)	3.00 (1.836)	5.33(2.402)	2.33	5.00
A2B1	9.00 (3.079)	6.67 (2.676)	8.00(2.902)	6.00	7.16
A2B2	10.67 (3.332)	6.00 (2.529)	8.00(2.902)	6.33	7.33
A2B3	8.67 (3.015)	5.33 (2.387)	7.33(2.781)	5.67	6.83
A2B4	7.33 (2.790)	7.00 (2.722)	8.00(2.902)	5.00	5.83
A3B1	11.33 (3.439)	4.67 (2.255)	5.66(2.482)	3.50	5.16
A3B2	10.67 (3.332)	3.67 (2.016)	5.66(2.470)	3.67	5.30
A3B3	10.00 (3.238)	4.67 (2.270)	6.33(2.608)	3.00	4.66
A3B4	8.33 (2.971)	5.33 (2.407)	8.00(2.902)	2.50	3.66
SEm (±)	1.03	0.86	1.03	0.90	0.95
CD at 5%	NS	NS	NS	NS	NS
GM	10.6	4.30	6.0	3.88	5.30

: - All values in the brackets are transformed: All values with same letter are not significant.

4. Conclusion

Rooting under *in vitro* conditions needs serious follow up and care process in banana crops. Proper root initiation in this phase can help the future performance of *in vitro* raised plant lets. The half strength MS medium was used among various auxins and their combination for rooting study. The result of this study indicated that 0.5 mg/l IAA was found suitable for early rooting, to highest number of roots and good length of roots. Where, 1.5 mg/l IBA appropriate for rapid days to rooting and good number of roots, 0.5 mg/l IBA shown better response for best length of roots among other concentration. Carry over effect on interaction of 0.5 mg/l IAA + 1.5 mg/l IBA were performed better for fast root induction and number of roots as compared to other combination. 0.5 mg/l IAA + 0.5 mg/l IBA was best for length of roots. There was linear relation between individual effect of growth regulators and their interaction on effects for most parameters. Number of roots and length of roots were shown increasing trend from 15 DAI to 30 DAI.

5. Acknowledgment

Author thankful to Department of Irrigation and Water Management, MPKV-Rahuri for the supply of sucker and State Level Biotechnology Center, Plant Tissue Culture Laboratory at Mahatma Phule Krishi Vidyapeeth – Rahuri, India for the laboratory facilities provided for successful completion of this work.

References

[1] Ali, H. (1996). Effect of BAP and IBA on micropropagation of some banana cultivars. M.S. Thesis, Department of Horticulture, Bangladesh Agricultural University, Mymensingh. p 73

Licensed Under Creative Commons Attribution CC BY

[2] Al-amin M, Karim M., Amin M., Rahman S. and Mamun ANM (2009). *In vitro* micropropagation of banana (*Musa spp*.). Bangladesh J. Agric. Res. 34(4):645-659.
[3] Bhosale, U.P, Dubhashi, S.V. and Mali, N.S. (2013). *In vitro* rooting of different species of banana. Advances in Applied Science Research. 4(3):115-118.
[4] Constantine, D.R. (1986). Micropropagation in the commercial environment. In: Plant tissue culture and its application. P 175-186.
[5] Dore Swamy S.R., Srinivasa R.N.K, Chacko E.K. (1983). Tissue culture propagation of banana. Sci. Horticult., **18**: 247252.
[6] Gaulbert, R.J. (1969) Investigation on the root formation in the tissue of *Helianthus tubrosus in vitro*. Amer. J. Bot. 56(7):702-717.
[7] Gubbuk, H. and Pekmezci M. (2001). The effects of different hormone types and concentrations on propagation of different banana clones by meristem culture. Ziraat Fakultesi Dergisi, *Akdeniz Universitesi* **14**(1): 127-137.
[8] Habiba U., Reja S., Saha M.L. and Khan M.R.. (2002). Endogenous bacterial contamination during *in vitro* culture of table banana: Identification and prevention. *Plant Tissue Cult*. **12**(2): 117-124.
[9] James, D.J., and Thurbon, I.J. (1979) Rapid *in vitro* rooting of the apple root stock M9. J. Hort. Sci., 54: 309-311.
[10] Jones,O.P., and Hatfield S.D.S. (1976) Root initiation in apple shoots cultured *in vitro* with auxins and phenolic compounds. J. Hort. Sci., 51: 495-499.
[11] Khanam, D., Hoque, M.A Khan M.A. and Quasem, A. (1996). *In vitro* propagation of banana (*Musa spp*.) *Plant Tissue Culture*, 6; 89-94
[12] Kodym A, and Zapata FA (1999). Natural light as an alternative light source for the *in vitro* culture of banana (*Musa acuminate* cv. Grand Naine). Plant Cell Tissue Org. Cult. 55:141-145.
[13] Kundu, U.K., Farooque, A.M. Aditya D.K. and Mondal, M.F. (1987). Effect of IBA on propagation of *Ixora Coccinia L*. by stem cutting. *Bangladesh Hort*. 15: 7-10.
[14] Lane, M.D., and McDongald, J.M. (1982). Shoot tissue culture of apple: Comparative responses of five cultivar to cytokinin and auxin. Can. J. Plant Sci. 62:689-694.
[15] Molla, M.M.H., Dilafroza Khanam M., Khatun M.M., Al-Amin M. and Malek M.A. (2004). *In vitro* rooting and *Ex vitro* plantlet establishment of BARI Banana-I *(Musa* sp.) as influenced by different concentrations of IBA (Indole 3-butyric Acid). *Asian J. Plant Sci.* **3**(2):196-199.
[16] Nandwani D, Zehr U, Zehr BE and Barwale RB (2000). Mass propagation and *ex vitro* survival of banana Cv. Barsrail through tissue culture. Gartenbauwissenschaft. 65:237-240.
[17] Shahnawaz A., Akash S., Singh A.K., Wali V.K. and Preeti K. (2014). *In vitro* multiplication of banana (*Musa sp*.) cv Grand Naine. African J. of Biotechnol 13(27): 2696-2703.
[18] Viehman, N.I., Fernandez, C.E., Hnilick F., Robles, C.D., (2007). The influence of growth regulators on root induction *in vitro* of the *Musa genus*. Agricultura Tropica et Subtropica Vol. 40 (3)
[19] Widiastoety, D. and Soebijanto, (1988). Rooting of stem cutting of *Hibiscus rosa sinensis*. *Buletin Penilition Horticulture*, 16: 73-83.

Licensed Under Creative Commons Attribution CC BY