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Standardization of *ex vitro* Hardening in Traditional Banana Cultivar Karpura Chakkerakeli (AAB) of Andhra Pradesh

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ABSTRACT: An experiment was conducted on primary hardening in tissue culture banana cv. Karpura Chakkerakeli (AAB) plantlets at Dr. YSRHU-HRS, Kovvur, in the year 2022-23. Banana cv. Karpura Chakkerakeli (AAB) is choicest table variety in Godavari districts of Andhra Pradesh. Poor *in vitro* root induction and ex vitro survival are the major hindrance for its large scale commercial production. Therefore, the objective of the present investigation was to develop an efficient growth media and different containers for in vitro rooting and ex vitro performance. This experiment was conducted to find out suitable potting mixture and containers on hardening in shade net. In which different potting mixtures of M_1-red earth (2) + FYM (1) + coco peat (1), M_2- red earth (2) + FYM (1) + rice husk (1), M_3- red earth (2) + FYM (1) + sand (1), M_4-vermicompost (1) + coco peat (1), M_5-vermicompost (1) + rice husk (1), M_6 –Vermicompost (1) + sand (1) and two different containers C_1- poly bags and C_2- disposable plastic glass tested, the maximum Per cent rooting (92.63%), Number of primary root (9.50), Number of secondary roots (26.50) and Length of longest root (13.21) was recorded in $M_1 \times C_1$ treatment interaction and shows outstanding performances in field condition.

Keywords: Red earth, Vermicompost, sand, husk, Containers, Karpura Chakkerakeli (AAB).

INTRODUCTION

Edible bananas (*Musa* spp.) are the major staple food for rural and urban consumers in the tropical and subtropical countries and an important source of rural income. The genus Musa (Family: *Musaceae*, Order: *Zingiberales*). Originates in Asia (Stover and Simmonds 1987). The edible parts of banana are rich in carbohydrates, minerals, potassium, phosphorus and other nutritional elements. Cultivated banana is derived from two diploid species of genus Musa. M. *acuminate* (Malaysia) and M. *balbiciana* (India) parent genomes (George *et al.,* 2000).

Bananas are cultivated in more than 120 countries worldwide with an annual production of around 112 mt. It is the 4th largest consumed food crop in the world after rice, wheat, milk and milk products (Amar, 2000). Therefore, bananas and plantains are the important components of food security in the tropical world and they provide income to the farming community through local and International trade.

India ranks first in the world banana production, with a total annual production of 33.83 million tons and it contributes to a huge share of 38.4% of the total fruit production from an area of 9.16 lakh ha with productivity of 36.93 t/ha. Andhra Pradesh is one of the leading producers of banana in India and is grown in an area of 90.52 thousand ha with production and productivity of 7.32 million tons and 79.91 t/ha, respectively (NHB, 2020).

Various cytokinines, including benzyl amino purine (BAP), and Kinetin (Kin), were used in micropropagation to increase the number of shoots in bananas. It was observed that the type and its concentration affected the shoot multiplication according to previous studies on bananas. One of Cytokinines, which have been used in banana micropropagation in the last few years, is the derivatives of diphenyl urea, including Thidiazuron (TDZ) (Makara *et al.,* 2010). However, in banana cultivar Karpura Chakkerakeli (AAB) some of the abnormalities like less rooting percentage, production of unhealthy roots under in vitro conditions and weak pseudostems, lanky growth, higher mortality in ex vitro hardening are the major limitations which needs optimization to step-up the large-scale commercial QPM production. The benefit of any micro-propagation system can, however, only is fully realized by the successful transfer of plantlets from tissue-culture vessels to the ambient conditions found in ex vitro. The present study was therefore conducted with the objective to standardize the suitable potting media and containers for hardening.

Objectives:

1. To study the effect of growing media and containers on concurrent *ex vitro* rooting and hardening (CEVRH)

of micro shoots in banana cv. Karpura Chakkera Keli (AAB).

2. To optimize the primary and secondary hardening strategies for enhancing the survival and growth of rooted plantlets.

Observations recorded:

1. Percent rooting (%)
2. Number of primary roots
3. Number of secondary roots
4. Length of longest root

Methodology adopted. Total twenty plantlets were kept per treatment per replication. The data on various growth parameters were recorded from ten randomly selected plantlets in each treatment and in each replication from 30 days after planting. Five plants were uprooted at the end of hardening to record the data on shoot, root parameters, of the banana cv. Karpura ChakkeraKeli.

MATERIAL AND METHODS

Healthy and vigorous *In vitro* plants were selected plant kept in grown in under shade net pre plantlet were treated with 1 % bavasten water just dip in plant transfer in plants polythen bag potting mixture prepared various ratio (cocopeat, vermicompost, sand, rice husk, red soil and FYM) filled with poly bags and plastics glass and good accumulation percentage were recorded.

RESULTS AND DISCUSSION

Percentage of rooting (%). Effect of rooting media and containers and their interactions recorded significant difference on the percentage of rooting as given in (Table 1).

The highest percentage of rooting (90.19%) was recorded in red earth: cocopeat: FYM (2:1:1) (M_1) which was followed by red earth: FYM: sand (2:1:1) (M_3) (80.44%). The lowest percentage of roots (41.44%) was recorded in vermicompost: coco peat (1:1) (M_4). Among the containers, was exhibited disposable plastic glass (C_2) (69.88) where as minimum percentage of rooting was noticed (64.19) (C_1).

Among the interactions (M×C), the highest survival percentage of rooting (92.63%) was recorded red earth: FYM : cocopeat (2:1:1) + poly bags (M_1C_1), which was followed by red earth: FYM: cocopeat (2:1:1) + disposable plastic glass (M_1C_2) (87.75 %), whereas the minimum percentage of rooting (39.00) was recorded in vermicompost : coco peat (1:1) + poly bags (M_4C_1). Compared to containing media, red earth: FYM: cocopeat (2:1:1) + poly bags (M_1C_1) provided good drainage, hence more survival percent was registered. after hardening maximum survival percentage was observed in polybags (c_1) treatment. (Baby and Menon 2021). The region of absorption and enhances meristematic activity causing root cell division thereby contributing to enhanced root growth (Biswas *et al.*, 2018). Similar results were reported by Murali and Duncan (1995); Joolka *et al.* (2004); Vasane and Kothari (2006); Yadav *et al*. (2012) in acid lime, and Esakkimuthu and Shakila (2017) in banana.

Number of primary roots. Effect of different growing medium, was significant on the Number of roots per plantlet produced at the end of hardening. (Table 1).

The data pertaining to the number of primary roots per plantlet revealed that among growing medium used, significantly highest number of primary roots per plantlet (9.00) were recorded in, red earth, FYM and coco peat (2:1:1) (M_1) medium which was followed by (7.50) vermicompost and coco peat (1:1) (M_4) with the number of primary roots per recorded while, lowest number of primary roots per plantlet (4.0) (M_5)were found in vermicompost and rice husk (1:1).

The maximum number of primary of plantlets regenerated from shoot tip explants of banana cultivar were found on hardening media comprised of red earth + FYM + coco peat (2:1:1, v/v). These findings were in accordance with the reports given (Khatik *et al.*, 2019).

Number of secondary roots. The data pertaining to the number of secondary roots per plantlet revealed that among growing medium used, significantly highest number of secondary roots per plantlet (26.25) were recorded in, red earth, FYM and coco peat (2:1:1) medium which was followed by (14.25) red earth, FYM and sand (2:1:1) (M3) with the number of secondary roots per recorded while, lowest number of secondary roots per plantlet (9.25) were found in vermicompost and rice husk(1:1)(T5). Conducted a trial on primary hardening of tissue cultured banana and observed that in red earth, FYM and coco peat mixture maximum number of roots and root length was recorded. These findings were in accordance with the reports given by Saraswathi *et al.* (2014).

Length of longest root. The data regarding length of longest root revealed that among growing medium used, significantly longest length of root (11.75 cm) was recorded in red earth, FYM and coco peat (2:1:1)(M_1), followed by (7.92 cm) read earth, FYM and sand(2:1:1) (M_3) while shortest length of the root (6.23 cm) was recorded in vermicompost and rick husk (1:1)(M_5) medium.

Among the interactions between growing medium and containers (M×C), the highest length of longest root (13.21 cm) was recorded read earth, FYM and cocopeat (2:1:1) and poly bags (M_1C_1), which was followed by read earth, FYM and cocopeat (2:1:1) and disposable plastic glass (M_1C_2) (10.34 cm), whereas the minimum length of longest root (6.57 cm) was recorded in vermicompost and coco peat (1:1)and poly bags (M_4C_1). This was also supported by data on leaf area in the read earth, FYM and cocopeat media which was highest and in sufficient to grow more roots and hence rapid increase in root length was observed. These findings were in accordance with the reports given by Paunovic *et al.* (2013) in walnut, Fathy *et al.* (2010) in apricot Fernandez *et al.* (2016); Silue *et al.* (2017), in banana.

Table 1: Effect of containers and growing media on root growth parameters of banana cv. Karpura Chakkera Keli (AAB).

	Per cent rooting (%)			Number of primary roots			Number of secondary roots			Length of longest root		
Treatments	**C_1: Polybag**	**C_2: Disposable Plastic glass**	**Mean M**	**C_1: Polybag**	**C_2: Disposable Plastic glass**	**Mean M**	**C_1: Polybag**	**C_2: Disposable Plastic glass**	**Mean M**	**C_1: Polybag**	**C_2: Disposable Plastic glass**	**Mean M**
M_1	92.63 (9.65)	87.75 (9.39)	**90.19**	9.50 (3.16)	8.50 (3.00)	**9.00**	26.50	26.00	**26.25**	13.21	10.34	**11.75**
M_2	58.50 (7.68)	68.25 (8.29)	**63.38**	4.50 (2.24)	5.50(2.45)	**5.00**	11.50	10.50	**11.00**	6.97	6.65	**6.81**
M_3	78.00 (8.86)	82.88 (9.13)	**80.44**	6.50 (2.65)	6.00 (2.55)	**6.25**	17.50	11.00	**14.25**	7.90	7.93	**7.92**
M_4	39.00 (6.28)	43.88 (6.66)	**41.44**	8.50 (3.00)	6.50 (2.65)	**7.50**	12.00	15.00	**13.50**	6.57	7.24	**6.91**
M_5	48.75 (7.02)	58.50 (7.68)	**53.63**	4.00 (2.12)	4.00 (2.12)	**4.00**	10.00	8.50	**9.25**	5.76	6.70	**6.23**
M_6	68.25 (8.29)	78.00 (8.86)	**73.13**	5.00 (2.35)	5.50 (2.45)	**5.25**	10.50	15.00	**12.75**	7.26	6.77	**7.02**
Mean C	**64.19**	**69.88**	**67.03**	**6.33**	**6.00**	**6.16**	**14.67**	**14.33**	**14.50**	**7.95**	**7.61**	**7.78**
Factors	SEm+	CD at 5%		SEm +	CD at 5%		SEm +	CD at 5%		SEm +	CD at 5%	
Factor (M)	0.96	3.01		0.82	2.56		1.08	3.37		0.22	0.70	
Factor (C)	0.55	1.73		0.47	N/S		--	N/S		--	N/S	
Factor (M × C)	1.36	4.25		1.16	N/S		--	N/S		0.32	0.99	

M_1- Red earth (2) + FYM (1) + Coco peat (1)

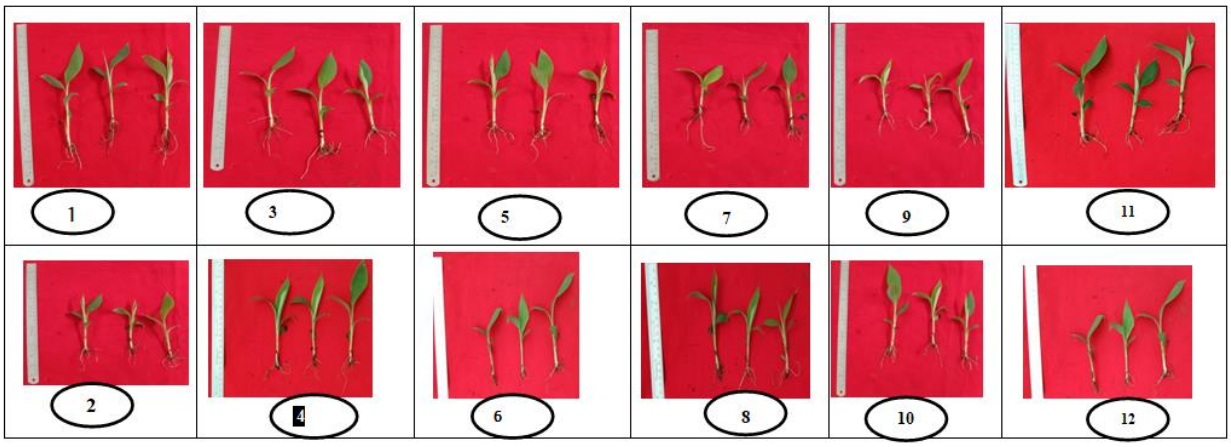
M_2- Red earth (2) + FYM (1) + Rice husk (1)

M_3- Red earth (2) + FYM (1) + Sand (1)

M_4- Vermicompost (1) + Coco peat (1)

M_5-Vermicompost (1) + Rice husk (1)

M_6 –Vermicompost (1)+ Sand (1)



1-M_1C_1- - Red earth (2) + FYM (1) + Coco peat (1) Poly bags

3-M_2 C_1- Red earth (2) + FYM (1) + Rice husk (1) and Poly bags

5- M_3 C_1- Red earth (2) + FYM (1) + Sand (1) and Poly bags

7- M_4- C_1Vermicompost (1) + Coco peat (1) and Poly bags

9- M_5 C_1 - Vermicompost (1) + Rice husk (1) and Poly bags

11- M_6 C_1- Vermicompost (1)+ Sand (1) and Poly bags

2-M_1C_2- - Red earth (2) +FYM (1) + Coco peat (1) and plastic glass in portrays

4- M_2C_2-Red earth (2) +FYM (1) + Rice husk (1) and plastic glass in portrays

6- M_3C_2-Red earth (2) +FYM (1) + Sand (1) and plastic glass in portrays

8- M_4 C_2Vermicompost (1) + Coco peat (1) and plastic glass in portrays

10 -M_5C_2- ermicompost (1) + Rice husk (1) and plastic glass in portrays

12- M_6C_2- Vermicompost (1) + Sand (1) and plastic glass in portrays

Fig. 1. Effect of containers and growing media on root growth parameters of banana cv. KarpuraChakkeraKeli (AAB).

CONCLUSIONS

Red earth and coco peat and FYM in poly bags was the best combination on maximum survival and also good rooting characters *viz.* percentage of rooting and primary and secondary rooting during hardening period in banana cv. Karpura Chakkarakeli (AAB).

REFERRENCES

Amar, K. R. (2000). Bananas international network for the improvement of banana and plantain international plant genetic resources institute. Montpellier, France, pp: 16.

Baby and Menon (2021). Chitosan: A potential bio stimulant. *Spice India*, *34*(2), 9- 12.

Biswas, S, Shivaprakash, M. K. and Maina, C. C. (2018). Biosynthesis of Phytohormones by Potassium Solubilising Bacteria Isolated from Banana Rhizosphere. *International Journal of Agriculture, Environment and Biotechnology*, *11*(3), 497-501.

Esakkimuthu, D. and Shakila, A. (2017). Effect of media on growth parameters of banana cv. poovan. *Asian Journal of Horticulture*, *12*(1), 132-135.

Fathy, M. A, Gabar, M. A. and El Shall, S. A. (2010). Effect of humic acid treatments on 'canino' apricot growth, yield and fruit quality. *Newyork Science Journal, 3*(2), 109-115.

Fernandez, M. B. M., Chavez, E. S., Montero, D. C., Garcia, A. C., Lopez, D. M., Ardisana, E. F. H. and Alvarez, S. P. (2016). Influence of vermicomposthumic acid on chlorophyll content and acclimatization in banana clone, *Enano Guantanamero. African Journal of Biotechnology, 15*(47), 2659-2570.

George, R., Domergue, R., Ferriere, N. and Cote, F. X. (2000). Morpho-histological study of the different constitutes of a banana (*Musa* AAA, cv, Grande naine) embryogenic cell suspension. *Plant Cell Rep*., *19*, 748-754.

Joolka, N. K., Singh, R. R. and Sharma, M. K. (2004). Influence of bio fertilizers, GA3 and their combinations on the growth of pecan seedlings. *Indian Journal of Horticulture*, *61*(3), 226-228.

Khatik, P. C, Saharan, V. and Kaushik, R. A. (2019). *In vitro* propagation of strawberry Via, Leaf. *International Journal of Current Advanced Research*, *8*(4), 18387-8393.

Makara, A. M., Rubaihayo, P. R. and Magambo, M. J. S. (2010). Carry-over effect of Thidiazuron on banana *in vitro* proliferation at different culture cycles and light incubation conditions. *African Journal of Biotechnology*, *9*, 3079–3085.

Murali, T. P. and Duncan, E. J. (1995). The effects of *in vitro* hardening using triazole on growth and acclimatization of banana. *Scientia Horticulturae, 64*, 243-251.

Paunovic, S. M., Miletic, R, Jankovic, D, Jankovic, S. and Mitrovic, M. (2013). Effect of humisol on survival and growth of nursery grafted (*Juglans regia* L.) plants. *Horticultural Science*, *40*(3), 111-118.

Saraswathi, M. S. S, Praveena, S, Uma, R., Thangavelu, Kannan, S., Backiyarani and Arivazhagan, T. (2014). Development of an efficient micropropagation technique for Musa cv. Udhayam (ABB). *Indian Journal of Horticultural*, *71*(4), 452-57.

Silue, O., Kouassi, K. M., Koffi, K. E., Kouakou, K. E. P. and Ake, S. (2017). Effect of adenine sulphate, casein hydrolysate and spermidine on *in vitro* shoot multiplication of two banana varieties (FHIA-21 and PITA-3). *African Journal of Biotechnology*, *16*(46), 2152-2159.

Stover, R. H. and Simmonds N. W. (1987). Bananas. Longman, Essex, UK.

Vasane, S. R. and Kothari, R. M. (2006). Optimization of secondary hardening process of banana plantlets. *Indian Journal of Biotechnology*, *5*, 394-399.

Yadav, R. K., Jain, M. C. and Jhakar, R. P. (2012). Effect of media on growth and development of acid lime seedling with or without azotobacter. *African Journal of Agricultural Research*, *7*(48), 6421-6426.

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