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Acclimatization of banana tissue plantlets (*Musa paradisiaca*) of various genotypes in poly house using different potting cultures

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ABSTRACT: *In banana, hardening of the in vitro rooted plantlets was done in the plastic sheet dome or poly house. For knowing the influence of various organic cultures on survival per cent, three organic cultures were tested. For commercial production of tissue culture plantlets of banana, maximum survival of plants is prime importance for fetching higher income. The banana varieties namely, Grand Naine (87.5%), Mahalaxmi (85.6%), Shrimanti (81.9%), and Basarai (83.7%) registered maximum survival in coco peat during first hardening in poly house followed by the vermiculite culture showed good survival of tender tissue culture shoots for all genotypes. The culture of farm yard organic manure was remained less effective than other cultures. Similarly, the highest plant height (cm) was recored in banana cultivars Grand Naine (14.5), Mahalaxmi (13.7), Shrimanti (12.6) and Basarai (13.5) in coco peat during first hardening followed by in vermiculite cultures in banana genotypes. After 15 days, the second hardening of tissue plantlets was carried out in net house (75% shadow). The maximum plant height (cm) was found in clay + sand + FYM in all the varieties of banana i.e. Grand Naine (31.2), Mahalaxmi (29.8), Shrimanti (27.0) and Basarai (28.7) followed by in the treatment clay + sand + coco peat i.e. G9 (26.0), Mahalaxmi (24.2), Shrimanti (22.4) and Basarai (23.6). The rapid hardening was observed in culture combination i.e. clay + sand + FYM that was beneficial for providing banana plants rapidly to farmer's community.*

Key words: *Acclimatization, Potting mixtures, Survival per cent, Growth*

INTRODUCTION

Banana is edible parthenocarpic (seedless) fruit and large herbaceous flowering plants. It is delicious, seedless and grown throughout the year. The fruit is variable in size, color and firmness, but is usually elongated and curved, with soft flesh rich in starch covered with a rind which may be green, yellow, red, purple, or brown when ripe. Banana is wonder berry, forming staple food of millions of people across the globe, providing a more balanced diet than any other fruit or vegetable. The cooking of green banana is become palatable and is a staple food in coastal region in India especially in the state of Kerala, while desert banana is used as eating fruit. Tissue culture is one of the best *in vitro* propagation techniques that increased rate of multiplication; produce clean disease free uniform propagules, increased crop yield, rapid selection easier transportation, and multiplication of elite genotypes and year round availability of planting materials. The plantlets of tissue culture are very delicate therefore they are not planted in the field without hardening in poly house. For that, particular practice require for maximization of survival and good growth of plantlets during acclimatization.

MATERIALS AND METHODS

The research experiment was conducted at Tissue Culture Laboratory, Department of Genetics and Plant Breeding, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat). Robust and disease free suckers of banana genotypes such as

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Grand Naine, Mahalaxmi, Shrimanti and Basarai were cleaned thoroughly by repeated washing, then trimmed and used as explants. The MS medium (Murashige and Skoog, 1962) was used as basal medium. The sterilizing techniques for sterile culture or media are incorporated to avoid contamination inside the laminar airflow cabinet. The trimmed suckers were treated with different solutions and then washed with 10 per cent solution of detergent for 10 minutes. MS medium with various auxin(s) and cytokinin(s) singly or combination were used in the trial for *in vitro* shoot multiplication and root induction. In vitro raised plantlets were acclimatized under maintaining of specific micro-climatic conditions i.e. poly house and net house. The data wea recorded on survival per cent and plant height (cm) in first hardening process under Poly House for 15 days under manage condition of temperature, humidity and photo period. After 15 days, second hardening process was initiated in Green Argo Shade Net House for 15 days. Plant height (cm) was further measured in different organic potting cultures. The Completely Randomized Design (CRD) design was used for data generated from experimentation as prescribed by Panse and Sukhatme (1985). Per cent values presented in the tables were Arc Sine transformed values.

RESULTS AND DISCUSSION

The results of the various experiments on acclimatization and growth of banana (*Musa paradisiaca* L.) genotypes conducted at the Banana Plant Tissue Culture Laboratory, Department of Genetics and Plant Breeding, N.M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat) are presented as below:

1. **Effect of Various Potting Mixtures on the Survival and Growth of Shoots of Different Banana Cultivars During First Hardening in Poly House:** In the initial stage, *in vitro* produced plantlets were required to acclimatize for greater survival in open condition. Plantlets with profuse roots were transferred in polytray containing different potting cultures and they were kept inside net house. High survival rate of banana tissue culture plantlets during hardening process is most advantageous for commercial tissue culture laboratories for generating maximum income. Different potting materials namely, coco peat, vermiculite and bio-compost were used as for high survival of plantlets under first hardening process (Table 1). Coco peat culture was found significantly superior for survival per cent in all the banana varieties i.e. Grand Naine (87.5%), Mahalaxmi (85.6%), Shrimanti (81.9%), and Basarai (83.7%) during first hardening in poly house followed by the vermiculite culture noticed good survival of tender tissue culture shoots for all genotypes i.e. Grand Naine (80.7%), Mahalaxmi (78.9%), Shrimanti (75.6%), and Basarai (76.8%). It was found that good aeration and high moisture holding capacity of cultures proved high survival of tissue culture plantlets placed in black trapezoidal trays. The survival rate of rooted shoots observed minimum in organic manure (FYM). The plant height (cm) was significantly superior in coco peat potting culture all banana genotypes *viz.,* Grand Naine (14.5), Mahalaxmi (13.7), Shrimanti (12.6) and Basarai (13.5) during first hardening followed by in vermiculite potting culture in all varieties *viz.,* Grand Naine (12.6), Mahalaxmi (12.1), Shrimanti (10.8) and Basarai (11.9). The remaining treatment namely, Clay + Sand + Organic manure (FYM) reported higher mortality and lower growth than other potting culture in most of all the varieties of banana. Among all the genotypes, Grand Naine and Mahalaxmi showed outstanding growth and survival as compared to others i.e. Shrimanti and Basarai in first hardening process.

2. **Effect of Various Potting Mixtures on Growth of Tissue Culture Plantlets of Different Banana Cultivars During Second Hardening Under Green Agro Shade Net:** After the completion of first hardening process, tissue plantlets were placed under second hardening process for 15 days in green agro net house (75% shadow). The combinations, such as clay + sand, clay + sand + coco peat and clay + sand + FYM were further tested for obtaining maximum plant height within short period of time in second hardening. The potting mixture clay + sand + FYM showed significantly the highest plant height (cm) in all the genotypes of banana i.e. Grand Naine (31.2), Mahalaxmi (29.8), Shrimanti (27.2) and Basarai (28.7) during the second hardening process followed by in the treatment clay + sand + coco peat i.e. Grand Naine (26.0), Mahalaxmi (24.2), Shrimanti (22.4) and Basarai (23.6) (Table 2). The third potting mixture only clay + sand proved as weak culture which registered less plant height in all the varieties of banana as compared to other potting mixture. The satisfactory plant height was observed in minimum days in potting mixture:

Table 1
Response of Potting Cultures on the Survival and Growth of Shoots of Different Banana Genotypes During First Hardening in Poly House

Observation Period: 15 Days

Sr. No.	*Treatment*	*Grand Naine*		*Mahalaxmi*		*Shrimanti*		*Basarai*	
		Survival (%)	*Plant Height (cm)*	*Survival (%)*	*Plant Height (cm)*	*Survival (%)*	*Plant Height (cm)*	*Survival (%)*	*Plant Height (cm)*
*T_1	Coco peat	69.3 (87.5)	14.5	67.7(85.6)	13.7	64.8(81.9)	12.6	66.1(83.7)	13.5
T_2	Vermiculite	63.9(80.7)	12.6	62.6(78.9)	12.1	60.3(75.6)	10.8	61.2(76.8)	11.9
T_3	Clay + Sand + Organic manure (FYM)	62.1(78.2)	11.8	61.1(76.8)	10.6	59.4(74.2)	9.6	60.2(75.4)	10.3
	SE.M±	0.24	0.06	0.32	0.09	0.14	0.05	0.18	0.11
	CD at 5%	0.767	0.202	0.997	0.286	0.452	0.177	0.584	0.355
	CV%	0.86	1.14	1.13	1.72	0.53	1.17	0.68	2.17

Note: *Survival per cent: Values in parenthesis are original mean values whereas outside values are Arc Sine transformed values.

Table 2
Response of Potting Cultures on Growth of Tissue Culture Plantlets of Different Banana Cultivars During Second Hardening under Green Agro Shade Net

Observation Period: 15 Days

Sr. No.	*Treatment*	*Grand Naine Plant Height (cm)*	*Mahalaxmi Plant Height (cm)*	*Shrimanti Plant Height (cm)*	*Basarai Plant Height (cm)*
T_1	Clay + Sand	21.0	20.0	19.6	20.2
*T_2	Clay + Sand + Coco peat	26.0	24.2	22.4	23.6
*T_3	Clay + Sand + Organic manure (FYM)	31.2	29.8	27.2	28.7
	SE.M±	0.69	0.09	0.08	0.15
	CD at 5%	0.215	0.302	0.269	0.487
	CV%	0.59	0.88	0.85	1.46

clay + sand + FYM that aided in quick distribution of tissue culture plants from green house to the banana growers for plantation in field. Due to the differing in physiological peculiarities of *in vitro* raised plantlets, it is difficult to adjust with natural environment. On transplanting, excessive water loss from the plantlets has been recorded which was attributed to the improper development of cuticle and slowness of stomatal response to water stress (Brainerd and inside culture vessels (Ziv, 1986). The problem may be aggravated if the vascular connection between the root and shoot is improper (Fabbri *et al.,* 1994). The abnormal leaf morphology may be attributed to the high humidity. Therefore, a period of humidity acclimatization was considered necessary for the newly transferred plantlets to adapt to the natural environment, during which the plantlets undergo a morphological and physiological adoption enabling them to develop typical terrestrial plant water control mechanism (Grout and Aston, 1977 and Sutter *et al.,* 1985).

For the establishment and growth of *in vitro* produced plantlets, physical, chemical and biological properties of potting mixture are play crusial role. Babylatha (1993) reported that soil: sand: organic culture potting mixture found better than others for banana *cv.* Basarai. In sugarcane, same treatment had given better results in second hardening process of sugarcane tissue plantlets as compare other potting cultures (Patel S.R., 2007) as well as in banana (Patel N. B., 2007). The differential response may be attributed to the conditions of acclimatization used. The direct hardening using the potting mixture as compared to present investigation procedure of primary hardening followed by secondary hardening where potting mixtures were examined by Babylatha (1993). Mixing soil, sand and FYM might have helped in giving better grip for roots, ample aeration and sufficient organic matter. The research results are in accordance with above scientists who used same acclimatization procedure and cultures for *in vitro* banana plantlets. Soil: Sand: FYM (1:1:1 v/v/v) potting mixture was the best for acclimatization of papaya and tuberose as reported by Naik (1997) and Thosar (1997), respectively.

The growth and yield of such plants should also be better than conventional propagation. Tissue culture is one of the elegant tool and commercially acceptable to assure a reasonable percentage of plants

survival in the field. Though a detailed field study could not be undertaken, the plants raised using the protocol developed in the present investigation were transplanted in the field.

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