Optimization of the Conditions for Acclimatization of Micro-Propagated Pineapple Propagules

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Abstract

Pineapple is one of the major tropical fruit crop in Sri Lanka which has high demand in both local and export market. However, growers are unable to supply fresh pineapples to meet the current demand in the country due to improper propagation techniques. Micropropagation, is the most suitable method of propagation of pineapple which could produce healthy pineapple propagules in large numbers within a limited time period. Acclimatization (hardening) is a critical process during the micropropagation. If conditions for the acclimatization were not optimized, tissue cultured pineapple propagules may not be able to survive under field conditions. The present study was carried out to investigate the most suitable container size, potting mixture and fertilizer type needed for the acclimatization process for pineapple cv.*Mauritius* propagules The optimum growth: leaf length, plant height, number of leaves and leaf width were observed when pineapple propagules were grown in potting mixture of compost: coir dust: burned paddy husk in pots with volume of 15 cm diameter and 20 cm height . The highest growth was observed in the pineapple propagules treated with all purpose fertilizer and lowest was observed when plants treated with Lilly fertilizer.

Key words: Pineapple cv *Mauritius*, Acclimatization, Growth Parameters, Potting Mixture

Introduction

Pineapple (*Ananas cosmosus*) has become one of the leading commercial fruit crops in Sri Lanka. The cultivar *Mauritius* is commonly grown locally and has a high demand in the local and international market as a fresh fruit due to its excellent fruit quality. It is also used for processing where the best grade is the skinned, cored fruit sliced cross -wise and packed in syrup. However, growers are unable to cope with the existing demand for fresh pineapples due to the lack of fast propagation systems operated in Sri Lanka. Pineapple is propagated mainly by vegetative methods using crowns, slips, and suckers taken from the mother plant. This ensures true to type plants resulting in a homogenous plantation. Seeds are utilized only in breeding programs that produced through hand pollination Suckers are commonly used for commercial planting than slips and ratoons. Suckers can be obtained almost throughout the year but especially after harvesting. Since suckers originate at different heights of the plant as well as at different times, they show wide variation in size at the time harvest. This variability in size can influence the time taken for floral initiation, uniformity of growth, synchrony of fruit ripening and time of harvesting.

Tissue culture is one of the promising methods use for mass propagation of pineapple which could produce healthy, uniform plantlets with higher fruit taste and vigor. However, at the end of the process of micropropagation, plants must undergo acclimatization or hardening phase. Acclimatization is very important step in micro propagation, since tissue cultured plants lack cuticle and do not have ability to withstand extreme environmental conditions. If the process of hardening or acclimatization has not been properly optimized tissue cultured plantlets may not survived under field conditions. The current research was carried out to find out most suitable method for acclimatization/ hardening the tissue cultured plantlets. The influence of different container size, potting media and different fertilizer mixtures on survival and growth enhancement of micropropagated pineapple plantlets were examined in this study.

Materials and Methods

The experiment was carried out at Plant Virus Indexing Center (PVIC) of the Department of

Agriculture, Homagama. All potted pineapple plants were maintained in net house during investigation period. Four hundred and fifty (450) rooted, four months old tissue cultured *Mauritius* pineapple plants in uniform size was obtained from the Tissue Culture Laboratory of the PVIC. The effect of treatments: different container size, potting mixtures and fertilizer mixtures leaf length, plant height, number of leaves and leaf width were determined at month intervals during the acclimatization period for 6 months.

Effect of container size on growth parameters of pineapple plants: Pineapple propargules were planted in containers with three different volumes as: (a) 12 cm diameter 18 cm height (b) 10 cm diameter 15 cm height (c) 15 cm diameter 20 cm height with ten replicates. The above mentioned growth parameters were recorded monthly throughout the acclimatization period.

Effect of container size on growth parameters of pineapple plants: Pineapple propargules were planted using five different potting media, mixed in equal amounts: (a) Control- soil: coir dust (b) soil: coir dust: burned paddy husk (c) soil: coir dust: paddy husk (d) sand: coir dust: compost: burned paddy husk (e) compost: coir dust: burned paddy husk. The same growth parameters were recorded monthly throughout the acclimatization period.

Effect of different fertilizer mixtures on growth parameters of pineapple plants: Pineapple propargules grown in the soil and coir dust mixture were separately treated with three (03) different types of fertilizers: Lily fertilizer, albert solution and all purpose fertilizer and the same growth parameters were recorded monthly. Each treatment consisted with 10 plants. After planting pineapple plants were laid out according to randomize complete block design.

Results and Discussion

Effect of potting mixture on growth parameters: It was found that the significantly highest leaf length and width, plant height and leaf number per plant were observed when planted in compost: coir dust: burned paddy husk potting mixture. Pineapple propagules planted in sand: coir dust: compost: burned paddy husk mixture also showed better growth than propagules planted in other potting mixtures. There were some recorded evidences indicating that burned paddy husk leaches 'silicon' to the medium that would enhance the growth of pineapple propagules during the period of acclimatization. However, the paddy husk when used in raw form in the potting mixture has not resulted in an increase of growth parameters. This may be due to the lower leaching ability of raw rice husk during this period. The lowest growth was

Table1. The Effect of different potting mixtures on growth parameters of pineapple cv *Mauritus* propagules during acclimatization period.

Potting mixtures	Growth parameters			
	Leaf length(cm)	Leaf width(cm)	Plant height(cm)	No. of leaves
(a) Soil: coir dust	0.2[a]	0.5[a]	1[a]	0.5[a]
(b) Soil :coir dust: burned paddy husk	0.5[a]	0.1[a]	1.5[b]	1a
(c) Soil: coir dust :paddy husk	0.1[a]	0.25[a]	0.75[a]	0.25[a]
(d) Sand: coir dust: compost: burned paddy husk	1.5[b]	1.5[b]	2[b]	1.5[b]
e) Compost: coir dust: burned paddy husk	2[b]	2[b]	3[b]	2[b]

Within each column, values with different supercripts are significantly different at P≤0.05 level

recorded in plants that had been planted in soil: coir dust: paddy husk medium.

The effect of fertilizer mixture on growth of pineapple propagules: The pineapples plants treated with all purpose fertilizer had highest leaf length, plant height, number of leaves and leaf width and lowest was observed when the plants were treated with Lilly fertilizer (data not shown).There were no significantly change in the growth parameters observed when the plants treated with N P K (20: 20:20 ratio) or Albert solution. The All purpose fertilizer and Albert solution contains N P K in 1:1:1 and 1:2:1 ratio respectively. This ratio may benefit the growth enhancement of pineapple propargules during this period. The Lilly fertilizer has N:P:K (4:1:2) ratio which may not support the growth of roots and plant.

The effect of container volume on growth of pineapple propagules: When Pineapple propagules planted in pots with the largest volume: 15cm diameter 20cm height had highest values of all growth parameters observed. Lowest growth enhancement was observed when the potting mixture of 12 cm diameter 18 cm height was used. This may be due to the higher water holding capacity of the potting mixture which favors the growth of propagules. Folliot and Marchall (1991) also recommended that the use of relatively large containers for improved growth of pineapple propagules. It has been reported by Baldotto et al (2010) the combination of humic acids and endophytic bacteria could be a useful technological approach to reduce the critical period of acclimatization in Pineapple propagules.

References

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