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Short communication

Effects of Type and Size of Stem Cutting and Propagation Media for Rapid Multiplication of Pineapple (*Ananas comosus*)

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ABSTRACT. *Production of proper planting materials of pineapple is crucial as the performance of plants developed depend on material planted. Hence the present research was undertaken at the Uva Wellassa University, Badulla (Up Country Intermediate Zone) from December 2007- March 2008 to evaluate a multiplication technique for pineapple via stem cuttings.*

The effects of type of cutting, size of cutting and propagation media on pineapple propagation were investigated. Stem was divided into three parts to obtain mature, semi-mature and immature cuttings. Shoot growth of mature, semi-mature and immature cuttings was evaluated and effect of cutting size on propagation was studied using longitudinally split stem cuttings (8, 6, 4 and 2 cm). As the media, sand: coir dust (1:1), sand: partially burnt paddy husk (1:1), sand: partially burnt paddy husk (1:2), sand: cow dung (1:1) and sand were compared for total number of shoots per cutting, average and total weight of shoots and average number of leaves per shoot. The experimental design was completely Randomized Design.

The highest weight of shoots per cutting was recorded in semi-mature cutting. The cutting size 8 cm gave the highest number of shoots per cutting and highest weight per shoot. Sand: coir dust (1:1) was superior to other media regarding average and total weight of shoots per cutting followed by sand: partially burnt paddy husk (1:2). Considering overall results, it can be concluded that longitudinally split stem sections of 8 cm were the best for pineapple multiplication. Sand: coir dust (1:1) can be considered as the best medium for this purpose.

INTRODUCTION

Pineapple (*Ananas comosus* L. [Merr.]) is one of the best-known of all tropical fruits which has a ready demand in the local and international market due to its pleasant taste and flavor. The total extent of pineapple in Sri Lanka is about 4,750 ha producing a total of 35,000 mt/year and 70 % of which is produced in the Kurunegala and Gampaha districts. Pineapple can successfully be grown in Colombo, Galle, Moneragala and Badulla districts as well (Sulaiman, 2004) and exported mainly to the USA and the Maldives. The common variety grown in Sri Lanka is 'Mauritius'. Pineapple variety 'Kew' is used for canning which is somewhat sour than mauritius. Pineapple can be intercropped with coconut and rubber.

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Expansion of pineapple cultivation is limited due to the lack of sufficient planting materials. Production of proper planting materials is crucial as the performance of plants developed depend on material planted. Pineapple is commonly propagated from suckers or slips.

Basal Suckers arising from underground parts of the plant are commonly used. Slips arise from the fruiting stem and stem suckers arise from the stem. The crown which is on the top of the fruit also can be used. The time taken for the fruit initiation is depends on the type of planting material. Plants grown from basal suckers produce fruits in about 12-14 months, whereas those from stem suckers take about 16-18 months. Crowns will take over two years to produce fruits (Anonymous, 2000). Both in suckers and slips, larger planting material resulted in more vigorous plants. Mass propagation of pineapple planting materials is possible through tissue cultural techniques under *in vitro* conditions.

Number of planting materials produced from a single mother plant is limited through the methods discussed earlier except tissue culture. These suckers can be infected with mealy bugs and associated viruses. Tissue culture propagation is not popular because there is no sustainable demand for such material due to the small size of holdings and irregular planting periods (Heenkenda, 1993). Decapitation is another technique for pineapple multiplication. According to Heenkenda (1993) approximately 4 suckers can be produced from a plant with more than 31 mature leaves.

There is an alternative mass propagation technique for pineapple using stem cuttings under *in vivo* conditions. Longitudinally split stem sections can be used for this purpose and after several propagation cycles it is possible to get large number of planting materials. The similar study has been conducted by Weerasinghe and Siriwardana (2006) and resulted 1000 suckers in 16 months from a single mother plant. This research was undertaken to evaluate the possibility of multiplying pineapple using stem cuttings under *in vivo* conditions with different propagation media and different cutting types.

MATERIALS AND METHODS

The research was conducted at the Uva Wellassa University, Badulla (Up Country-Intermediate Zone) from December 2007- March 2008. Longitudinally split stem sections of pineapple variety Mauritious were taken for all the experiments. The research comprised 3 sets of experiments designed according to Completely Randomized Design (CRD).

Effect of cutting type on pineapple propagation

The effect of cutting type on pineapple propagation was investigated using 3 treatments namely mature, semi-mature and immature (3 stem sections /replicate). Stem was divided in to three parts; basal, middle, and upper parts of stem were considered as mature, semi-mature and immature cuttings respectively. All the stem cuttings (6 cm) were placed in sand trays.

Effect of cutting size on pineapple propagation

Pineapple stem cuttings of 8, 6, 4 and 2 cm sizes were selected as the four treatments and they were placed in sand trays (3 stem sections /replicate) to evaluate the growth of shoots. Semi-mature cuttings were selected for this experiment as it performed.

Effect of different media on pineapple propagation

Five propagation media namely sand: coir dust (1:1), sand: partially burnt paddy husk (1:1), sand: partially burnt paddy husk (1:2), sand: cow dung (1:1) and sand were compared using 3 replicates per each. Considering the results of previous experiment, semi-mature cuttings (6 cm) of the variety Mauritious were used.

Data collection and analysis

Total number of shoots per cutting, total weight of shoots, average weight of a shoot and average number of leaves per shoot were recorded eight weeks after establishment. The data were analyzed according to ANOVA using SAS. Count data (leaf number) was analyzed by CATMOD procedure (log linear model). Means were separated using LSD procedure.

RESULTS AND DISCUSSION

Effect of cutting type on pineapple propagation

Total shoot weight per cutting and average shoot weight per cutting

Four weeks after establishment of slices, auxiliary buds started to force out as suckers. Semi-mature cutting was superior to the other two treatments with respect to total shoot weight per cutting and average shoot weight per cutting (Figure 1). (Significant at p= 0.05). There was no significant difference among the treatments mature and immature cuttings.

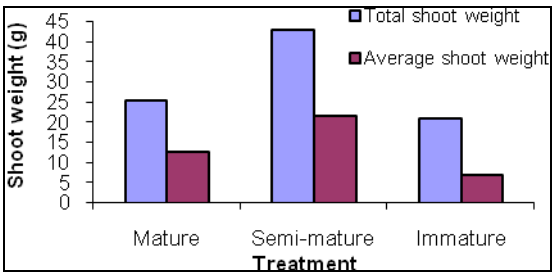

Figure 1. Total and average shoot weight (g) per cutting at eight weeks after establishment as affected by the cutting type.

Number of shoots per cutting and number of leaves per shoot

At 8 weeks after establishment, the numbers of shoots of mature, semi-mature and immature were 2, 2, and 3 respectively which were not significantly different. Similarly, the numbers of leaves per shoot in mature, semi-mature and immature cuttings were 13, 13 and 14 respectively, which were not significantly different.

Semi – mature stem cuttings were best for propagation as they contain both natural hormones and food reserves at optimum concentrations. Although immature cuttings are rich in natural phytohormones, they lack enough food reserves (Agbo and Obi, 2007). A mature cutting is fully hardened and contains no newly expanding growth (Anonymous, 2004a).

Mature cuttings may have ample amount of food reserves. They may not contain natural phytohormones at sufficient concentrations. All these factors may be accountable for the higher performances of semi – mature cuttings.

Effect of cutting size on pineapple propagation

Total shoot weight per cutting and average shoot weight per cutting

Total shoot weight per cutting and average shoot weight per cutting were significantly different among treatments (p= 0.05).The cutting size 8 cm gave the highest total shoot weight per cutting (80.6 g) followed by the cutting size 6 cm (26.8 g). Cutting sizes 4 and 2 cm had total shoot weight 13.5 and 8.7 g/cutting respectively that were not significantly different.

Number of shoots per cutting

The effect of cutting size on number of shoots per cutting was statistically significant among treatments (p= 0.05). The highest number of shoots per cutting (3) was recorded in the cutting size 8 cm, followed by 1 shoot/cutting in all other treatments.

Effect of different propagation media on pineapple propagation

The substrate or the propagation media has an impact on the success of pineapple propagation via stem cuttings. Total shoot weight per cutting was significantly different among treatments (p=0.05). Propagation medium, sand: coir dust (1:1) (T1) was superior to other media with respect to total weight of shoots per cutting followed by the medium, sand partially burnt paddy husk (1:2) (T3) (significant at p=0.05).There was no significant difference among the treatment sand : partially burnt paddy husk (1:1) (T2) and sand : partially burnt paddy husk (1:2) (T3) with respect to total shoot weight per cutting. Significantly higher shoot weight per cutting was found in the medium sand: coir dust (1:1) (T1) followed by sand: partially burnt paddy husk (1:2) (T3). The lowest shoot weight per cutting was recorded in the medium sand: cow dung (1:1). The difference in average number of shoots per cutting and number of leaves per shoot were not statistically significant among treatments (p= 0.05) (Table 1).

Table 1. Variation of shoot growth among different propagation media at eight weeks after establishment.

Treatment	shoots/cutting (#)	leaves / hoot(#)	Shoot weight (g) /cutting	
			Total	Average

Sand : coir dust (1:1)	3	16	115.19 [a]	39.29 [a]
Sand : partially burnt paddy husk (1:1)	3	11	82.11 [b]	13.07 [c]
Sand : partially burnt paddy husk (1:2)	5	13	83.15 [b]	27.63 [b]
Sand : cow dung (1:1)	2	11	22.75 [d]	7.90 [d]
Sand	4	12	60.25 [c]	17.70 [c]

Note: Values with the same letter are not significantly different at the p=0.05

The Plate 1 shows the variation in shoot growth of pineapple in different propagation media

T1 – sand : coir dust (1:1)

T2 – sand : partially burnt paddy husk (1:1)

T3 – sand : partially burnt paddy husk (1:2) T4 – sand : cow dung (1:1)

T5 – sand

Plate 1. Variation in shoot growth of pineapple as affected by the propagation medium at eight weeks after establishment.

Overall results of the present study revealed that the best cutting type for pineapple multiplication is semi-mature cutting and the best substrate for multiplication process is sand: coir dust (1:1). The lowest performance was observed in the sand: Cow dung (1:1) treatment. However highest number of shoots per cutting (5 shoots/cutting) was recorded in sand: partially burnt paddy husk (1:2). Nguyen (2004) identified the best substrate for stem cuttings as burnt rice husk: sand (l:1) which gave the highest propagation rate (15.2 shoots per mother plant per 75 days. There was some discoloration of the leaves in the treatment Sand: Cow dung (1:1). This may be due to nutrient toxicities or some toxicants. Water and air balance in the medium is very important in plant propagation. Stability of components with minimal decomposition during propagation is necessary as changes in particle size also change the air and water balance in the substrate (Anonymous, 2004b). The medium should provide proper drainage as water logging condition may cause rotting of cuttings. Sand is a good medium when considering the drainage properties. Coir dust has superior structural stability, water absorption ability and drainage, and cation exchange capacity (Meerow, 2007). So mixing of different types of substrates is very important to have a medium with optimum drainage and aeration (NC State University, 2004).

To initiate rooting, these small shoots should be separated and transferred into a secondary nursery. This will also enhance the emergence of new shoots from the remaining stem cuttings in the primary nursery as well. Additional research is needed to find out the total number of shoots that can be produced from a single mother plant after several multiplication cycles. A similar study has been conducted by Weerasinghe and Siriwardana (2006) using only sand as propagation medium and resulted 1000 suckers in 16 months from a single mother plant.

CONCLUSIONS

Sand : coir dust (1:1) is the best propagation medium for pineapple multiplication via stem cuttings and semi-mature cutting is ideal for this purpose. The selection of best cutting size for propagation depends on the availability of stem cuttings and the other facilities. With the increase in cutting size, number of shoots and their weights increases. For further evaluation, field trials should be carried out to investigate yield performances of pineapples propagated through stem cuttings. Combination effect of media and type of cutting can be experimented.

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