EFFECT OF PLANTING MEDIA ON GROWTH OF PINEAPPLE CV. MADU SEEDLINGS BY STEM CUTTING TECHNIQUE

(KESAN MEDIA TANAMAN TERHADAP PERTUMBUHAN BENIH NANAS KV. MADU MENGGUNAKAN TEKNIK KERATAN BATANG)

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ABSTRACT

Generally, pineapple sucker is used as the main planting material for commercial cultivation of pineapple. Pineapple sucker is usually obtained either from the stalk or the stem of a pineapple plant. Research to study the effect of planting media using mineral soil as the main component for the mixture on the growth of sucker by stem cutting technique was conducted. The objective of this research is to study the effects of mineral soil-based mixed planting media on the growth of pineapple suckers produced cultivated via stem cutting of Madu pineapple. The research was conducted at the Pineapple Nursery of the Faculty of Sustainable Agriculture, UMS Sandakan, from March 2019 until September 2019. The treatments used in this research were, soil as T1 (100%); Soil: coco peat as T2 (1:1,v/v); Soil:peat soil as T3 (1:1,v/v); Soil:sand as T4 (1:1,v/v). The data obtained showed there is a significant difference in the number of a successfully germinated sucker. However, no significant difference was detected for the sucker growth parameters. Planting media T3, soil: coco peat recorded the highest number of successfully germinated suckers (12.25). Meanwhile, for growing media, suggested T2 soil: peat soil was recorded the highest for root length (15.53 cm), leaf number (18.00), and stem diameter (2.18 cm) at 60 days after transplant (DAT).

Keywords: Ananas comosus, Planting media, mineral soil, stem cutting

1. Introduction

Pineapple is monocotyledonous perennial plants. Madu pineapple or *Nanas Madu* (*Ananas comosus* L. Merr cv. Madu) is a well-known cultivar from the Queen group, which is highly favoured in Sabah due to its high sugar content and cultivated only for fresh consumption. It is widely recognized as *'Nanas Moris'* in Peninsular Malaysia and '*Nanas Sarikei'* in Sarawak (Pareek and Sharma, 2017). The pineapple contributes more than 20% of the world's tropical fruit production. Pineapple is considered the third-largest tropical fruit crop following banana and citrus because of its large-scale production, controlled by multinational companies operating in various countries which produce pineapple (Wilson, 2016).

Pineapples are grown on various aerated and well-drained soils with a soil pH varying from 4.5 to 5.5. The plant is a xerophyte and has adapted to withstand drought cycles. It can be propagated to obtain pineapple seedlings using the stem cutting technique, which is primarily used as an alternative method for growing suckers intended to be used as planting materials during a shortage of seedlings.

A good planting media is capable of securing and maintaining plant growth so that they can undergo healthy growth and development. Soil is a critical medium since it serves as a source of nutrients and water that is then absorbed by plant roots. Furthermore, planting media enables the exchange of gasses between the roots and the soil. Planting media, therefore, dramatically affects the quality of plant growth, particularly those placed in nurseries during its early stages of development and growth. The quality of pineapple planting materials obtained

from nurseries affects its transplantation performance into the field and the overall agricultural product (Mahmoud *et al*., 2019).

Commercially the pineapple plant is propagated without new gene combinations through vegetative material. Common material types formed by the plants naturally, or referred to as conventional planting material, include crowns, slips, hapas, and suckers. Under field or nursery conditions, non-conventional planting material can be obtained by applying different techniques. Plantlets get by sectioning parts of the plant, which allow lateral buds to grow along the stem of the mother plant. Seedlings can also be produced through the gouging and stimulation of lateral bud growth (Reinhardt *et al*., 2017).

The Malaysian Pineapple Industrial Board has projected that in the year 2020, the supply of Malaysian pineapple will increase to 700,000 metric tons compared to 350,000 metric tons back in 2013. Approximately 23,000 hectares of land will be required to support the production volume for nine different pineapple cultivars (Bernama, 2014). Every year, the pineapple industry needs around 70 million suckers, and the amount is expected to grow due to increasing demands (Amar *et al.,* 2015). Hence, this research was carried out to study the effects of mineral soil-based mixed planting media on the growth of pineapple suckers produced cultivated by stem cutting of Madu pineapple.

2. Materials and Methods

Experimental site

The research was conducted at the Faculty of Sustainable Agriculture, Universiti Malaysia Sabah, Sandakan Campus, from March to September 2019 inside the pineapple nursery facility under rain shelter structure.

Stem preparation and treatment

Mature stem cuttings of *Ananas comosus* L. Merr. Cv. Madu after fruits harvested stage were obtained from pineapple farm at Kampung Takuli, Beaufort, Sabah. Freshly harvested pineapple stem was cleaned and cleared from leaves, adventitious roots, and debris. A disc-form stem cut with 5 cm thickness was dipped into the fungicide-insecticide solution for 15 minutes to control fungi and mealy bugs. Three hours after the treatments, the treated stem cut was sowing into a planter box filled with respective media treatments, and each planter box consists of five stem cut with the planting distance at 10cm x 10cm.

After 60 days of sowing, the emergence of sucker was transplanted into polybags (10.6cm x 9cm x 14.4cm and volume of 1.4 litres) filled with each media tested. At this stage, four replication of sucker was used to test the growth performance for another 60 days. The study of four treatments with four replications was arranged in a completely randomized design. Stem cuttings were subjected to four treatments, as follows:

Soil 100% as T1
Soil: coco peat (1:1,v/v) as T2
Soil: peat soil (1:1,v/v) as T3
Soil: sand (1:1,v/v) as T4

Cultural practice

To make sure the optimum development of pineapple sucker from stem cuts, several essential practices such as watering at least once a day, fertilization at growth performance stage with NPK green (15:15:15), weeding and pest control were applied when needed.

Data collection and analysis

The first observations were done on the number of successfully germinated suckers at 60 days after sowing from planter box media, and subsequent observations were done at 60 days after transplanted from polybag. Data were collected on plant height, cm/ seedling, stem diameter, cm/ seedling, root length, cm/ seedling, number of leaves, and elongation of leaf. The data were subjected to analysis of variance and least significant difference tests at $P \leq 0.05$ were used to test for the significant effects of growing media on the parameters measured.

3. Results and Discussions

To study the effects of mixture mineral soil-based planting media on the growth of pineapple sucker propagated by stem cutting technique at the nursery level, four types of media were used. Soil 100%; soil:peat soil (1:1); soil:coco peat (1:1); and soil:sand (1:1). Planting media T3, recorded the highest successful germinated sucker (mean=12.5) with a significant mean difference at $p \leq 0.05$. However, the growth variables did not have a significant difference. Variables plant height and leaf elongation obtained the highest reading from planting media T4. Meanwhile, planting media T2 recorded the highest reading for root length, leaf number, and stem diameter.

Table 1 Mean effect of planting media on successfully germinated sucker of Madu pineapple seedlings at 60 days after sowing (DAS) and root length at 60 days after transplanted (DAT).

Type of planting media	Number of successful germinated sucker/ stem cut	Root length (cm)
T1: soil (100%)	7.5±1.04b	11.88ns
T2: soil + peat soil (1:1,v/v);	7.25±2.05b	15.53
T3: soil + coco peat (1:1,v/v);	12.5±1.04a	15.52
T4: soil + sand (1:1,v/v);	4.25±0.85b	13.73

The same letter indicates that there is no significant difference ($p>0.05$)
Note: ± *Standard error*

Table 2 Mean effect of planting media on plant height and leaf elongation of Madu pineapple seedlings at 15, 30, 45, and 60 DAT.

Type of planting media	Plant height (cm)				Leaf elongation (cm)			
	15	30	45	60	15	30	45	60
T1	9.75ns	9.93ns	9.98ns	10.05ns	5.85ns	5.93ns	5.93ns	5.98ns
T2	8.00	8.18	8.28	8.40	5.30	5.35	5.38	5.43
T3	9.13	9.35	9.50	9.48	5.55	5.60	5.58	5.68
T4	10.53	10.73	10.83	10.85	6.23	6.30	6.40	6.48

ns: *not significant at (p>0.05);*

Table 3 Mean effect of planting media on stem diameter and leaf number of Madu pineapple seedlings at 15, 30, 45, and 60 DAT.

Type of planting media	Stem diameter (cm)				Leaf number (seedling)			
	15	30	45	60	15	30	45	60
T1	1.68ns	1.85ns	2.00ns	2.15ns	12.00ns	14.25ns	14.75ns	15.75ns

T2	1.68	1.85	2.05	2.18	14.50	16.25	16.75	18.00
T3	1.73	1.83	1.95	2.18	13.00	15.00	15.75	16.00
T4	1.55	1.65	1.75	1.98	12.50	15.00	16.00	16.50

ns: *not significant at (p>0.05);*

The small-sized stem cutting used is most likely to be the reason for the slow growth during the initial cultivation stage and, thus, showed no significant value. The same outcome was also experienced by Pegoraro (2014). Growing and increasing the number of suckers require a well-prepared nursery bed with good drainage and aeration (Collins, 1960). Since it affects the anchorage ability and the nutrient as well as water holding capacity of the medium, these physical characteristics of the growth medium affect the emergence and vigour of seedling with a consequent effect on the quality of seedlings produced (Baiyeri 2005).

The data obtained indicated more favourable growth conditions in T2 and T3 media compared to the other media. Longest roots were found in the T2 and T3 media, suggesting that the media provided more favourable growth conditions, which better-promoted sucker growth than other media. According to Walliser and Oster (2013), good drainage and sufficient water holding capacity as well as the ability to provide physicochemical support to seedlings with that of the best potting media. Mulugeta (2014) also emphasized the use of a high-quality potting media that can satisfy the needs of a seedling growth phase for proper growth to occur within a limited space of a polybag or planter box. An example of a common suitable media is sawdust, which can promote the development of a healthy root system and, subsequently, better production of sucker and high field survivability. T3 has properties similar to sawdust media, as used by Shiyam et al. 2016, showed growth patterns resulting in suckers with long roots. In another view, Reinhardt et al., 2017 emphasized, hardpans of the mineral soil need to be eliminated to prepare an adequate growth environment and deep pineapple root system during the mixing of the media for sucker cultivation.

Single substrate media like coco peat has a high-water holding capacity, which results in poor aeration at the root zone, which also affects the oxygen exchange process in the region. This physical characteristic is not suitable for the development and growth of plant roots (Wan and Desa, 2017). The planting media T3 has reduced the problems associated with high water holding capacity in the growing medium since it has improved aeration and drainage. Results are in line with those published by (Ranawana and Eeswara, 2008).

Additional fertilizer also has a significant effect on the number of leaves produced (Correia et al., 2009) as well as leaf elongation. Pineapple suckers supplied with optimum amounts of nutrients have higher metabolic performance. Generally, growing media with high surface area is unable to retain nutrients from fertilizer due to leaching. Based on the study, the presence of mineral soil in the planting media T4 may prevent nutrients from direct leaching. Even though there is no overtly visible effect from the growing media mixture on the number of leaves of the suckers within 60 DAT all the stems' suckers were recorded to undergo an increase in leaves number and leaves elongation. However, there were no significant differences for both leaves number and elongation among the treatment.

Based on the results, the stem diameter of pineapple suckers in T2, the mixture of soil: peat soil showed the highest reading compared to the other planting medium mixture. The stem diameter can be associated with its food storage capacity. High food storage capacity gives an advantage to the sucker, especially when increasing the number of leaves (Pegoraro, 2014).
Notably, on the 60 DAS, the pineapple sucker with the highest reading for height was from media treatment T4, (10.85cm). Media mixture with more surface area is unable to retain nutrients from fertilizer application due to leaching. The rate of leaves elongation showed no significant difference. However, T4 recorded the highest reading for leaf elongation after 60

DAS. The leaf structure of the pineapple sucker in T4 is also reported to be narrow and tapered, resulting in longer leaves.

4. Conclusion

Therefore, a single growing media and two types of mixed mineral soil-based media do not have a significant effect on the growth of pineapple suckers except germination of the sucker, where it indicated the production of seedling of a stem cut. Hence, T2 media (soil: peat soil) has considered having the potential to be used as the best media mix for the growth of Madu pineapple seedlings because it records the highest number of leaves, stem diameter, and longest root length which are very important for sucker's growth.

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