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The effect of different planting materials ratios on the growth of foliage plants

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Abstract Growing foliage plants in the containers using soil-based growing media poroved to be a good alternative for the home garden, especially where land is limited. The results revealed that the plant height, the leaf number, the leaf width, and the leaf length of five types of plants in the growing media mixtures of leaf compost: coconut husk chips: coconut coir: sand ratio 2:1:1:1 were higher than other treatments. Therefore, it could suitable use for planting media to reduce the production cost of foliage plants.

Keywords: Indoor plants, Soil mixed, Leaf compost

Introduction

Ornamental plants serve as a significant diversity of fascinating plants, along with cut flowers, cut foliage, potted plants, bedding plants, indoor plants, outdoor plants, which may be herbaceous, biennials, or perennials in their growth character. Thus, the ornamental plants bring a feeling of beauty to our environment. as people often use foliage plants in rooms to change the working environment. In recent years, arranging plants in offices has become widespread in the hope of enhancing the atmosphere of the indoor environment. (Riaz *et al*., 2002; Memon *et al*., 2013; Mintz, 1972) and economically relevant in horticultural trade worldwide. They are also being utilized by humans (Simpson and Ogorzaly, 2001) and the desire for ornamental plants for personal and ceremonial work has been proliferated (Lawson, 1996).

Growing media, or potting soil mixes, have been become a popular for decades and heavily used in cut flower production to increase for commercial production (Maloupa *et al*., 1992). The planting mixture are used to produce the flower and ornamental plant in a greenhouse that should have four basic functions: aeration and watering, providing the right anchor for maximum root

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growth, plant care, and producing adequate nutrient reservoirs (Tariq *et al*., 2012). Now various organic elements like peat moss, green compost, animal manures, coco peat, and inorganic/mineral potting substrates for instance sand, gravel, perlite, and silt are being utilized for domestic and commercial purpose. Several types of research recommended that it is comfortable to handle the soilless potting materials and beneficial for plant growth and development compared to soil environments (Yasmeen *et al*., 2012). The five types of foliage plants should be cultivated in porous soils that comprised organic matter with good aeration, drainage and sufficient water holding capacity of soil for appropriate growth (Thomas, 2009). In addition to interesting colors and shapes, the plants can filter the air and reduce the number of toxic substances in the buildings by absorbing the formaldehyde toxins from the indoor air. In the study of NASA, approximately 50 different plant species have been identified with the ability to absorb the toxins, such as *Philodendron*, *Monstera*, and *Epipremnum* (Wolverton *et al.*, 1984).

Nevertheless, the results of specific scientific research on this particular ornamental plants are impaired when considering the aesthetic importance of the aesthetic foliage plants, and the role of planting materials for the growth. This study was arranged to examine the capability of various composing planting materials which consisted of leaf compost, coconut husk chips, coconut coir, and sand in different ratios testing for the five cultivars of the foliage plant growth.

Materials and methods

Study area and media preparation

All the experiments were conducted under greenhouse conditions in the Landscape Unit, King Mongkut's Institute of Technology Ladkrabang, Bangkok, Thailand, between March 2019 to October 2019. The experiment was arranged in a completely randomized design (CRD), replicated three times with three pots per planting media. The planting media included six treatments as follows: 1) commercial soil mixed, 2) mixed leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1), 3) mixed leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1), 4) mixed leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1), 5) mixed leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2), and 6) mixed leaf compost: coconut husk chips: coconut coir: sand ratio (2:1:1:1). The planting media of commercial soil mixed were assigned to the controlled treatment.

Plant preparation

Tip and stem cuttings were used to propagate the plants in this experiment. The tip cutting generally was cut from the tip of the plant which length about 20-25 cm. (2-3 stem nodes) in *Philodendron burle-marxii* G.M. Barroso. Besides, the *Monstera adansonii*. was cut around 15 cm. (3-4 stem nodes). The *Epipremnum aureum* 'Bunting Lime' was cut between 16-17 cm. (3-4 stem nodes.). The *Ctenanthe burle-marxii* was divided the rhizomes by about 3-4 leaves per a new rhizome. While the *Polyscias guilfoylei* (W. Bull) L.H. Bailey 'Quinquefolia' stem was cut about 4-5 cm. (3-4 stem nodes).

Growing media analysis

Growing media on physical properties were analyzed which followed by the methods of Gessert (1976). The porosity, bulk density, and moisture content were calculated by the formula: porosity % = cups of drained water/ total volume of the pot (cups). Moisture content % = percent porosity - percent air space.The electrical conductivity (EC) of the saturation extract was measured by using a corning conductivity meter (220 pH/EC meter). About 250g of soil was saturated with distilled water, the paste could stand for an hour, and pH was recorded by Orion research digital pH/millivolt meter with a glass electrode using buffers of pH 4.0 and 9.0 for standardizing the instrument.

Plant growth analysis

All growth parameters of the growth of five types of the plants were determined at the physiological maturity and are as follows: The plant height in a unit of a centimeter (or cm) was determined stretching from the base of the ground to the tip of the plant, The number of leaf per plant, leaf width, and leaf length.

Statistical analyses

All growth parameters of five types of plants were examined by using the statistical analysis system Statistix 10 program. The comparison of treatment means was done by using the Least Significant Differences (LSD) at the 0.05 probability level.

Results

Planting material properties

The growing media physical properties resulted in that difference before and after planting. The pH value in the mixtures the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) was initially at 6.66 and increased to 7.93 with the highest pH from pH 7.3 increased to 8.36 that found in leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1). The results indicated that the maximum EC value (0.53 mS/cm, decreased to 0.14 mS/cm.), (0.49 mS/cm, decreased to 0.21 mS/cm), (0.46 mS/cm, decreased to 0.14 mS/cm), (0.35 mS/cm, decreased to 0.17 mS/cm) and (0.32 mS/cm, decreased to 0.12mS/cm) which were found in the commercial soil mixed, the leaf compost: coconut husk chips : coconut coir: sand (2:1:1:1), the leaf compost: coconut husk chips : coconut coir: sand (1:1:1:2), the leaf compost: coconut husk chips : coconut coir: sand (1:1:2:1) and the leaf compost: coconut husk chips : coconut coir: sand (1:1:1:1) respectively. The minimum EC value (0.24 mS/cm, decreased to 0.13 mS/cm) depicted in the leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1) (Table 1). The maximum moisture content (37.8%, decreased to 36.32%) which was found in the leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1), followed by the commercial soil mixed (37.77%, decreased to 36.74%) and the leaf compost: coconut husk chips: coconut coir: sand 2:1:1:1 ratio (36.51%, decreased to 37.64%) while the minimum moisture content (31.43%, decreased to 31.02%) was depicted in the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1) (Table 1).

The results for porosity was found the best in the commercial soil mixed (41.12%, increased to 44.09%) followed by leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) (40.53%, increased to 43.98%). The minimum porosity was found in the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2) (35.03%, increased to 35.53%). The maximum bulk density (21.63 g/cm^3, decreased to 20.31 g/cm^3) was found in the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2), followed by the leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1) (18.52.63 g/cm^3, decreased to 15.84 g/cm^3), followed by the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) (17.42 g/cm^3, decreased down 16.8 g/cm^3) while the minimum bulk density (11.02 g/cm^3, increased to 14.32 g/cm^3) was depicted in the commercial soil mixed (Table 1).

Table 1. Physical properties of growing media using before planting and for 12 weeks after planting

Planting material composition	pH		EC (mS/cm)		Moisture content (%)		Porosity (%)		Bulk density (g/cm^3)	
	Before	After	Before	After	Before	After	Before	After	Before	After
Commercial soil mixed	7.03	8.73	0.53	0.14	37.77	36.74	41.12	44.09	11.02	14.32
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1)	7.03	8.16	0.32	0.12	31.43	31.02	39.82	39.41	15.58	15.4
Leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1)	7.16	8.23	0.24	0.13	35.15	35.56	39.35	43.21	16.42	14.01
Leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1)	7.36	8.36	0.57	0.17	37.8	36.32	40.15	42.78	18.52	15.84
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2)	6.86	8.26	0.46	0.14	36.94	36.15	35.03	35.53	21.63	20.31
Leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1)	6.66	7.93	0.49	0.21	36.51	37.64	40.54	43.98	17.42	16.8

Plant growth

The plant height of *Philodendron burle-marxii* G.M. Barroso was significantly different ($P<0.05$) when planted in different growing media. The plant grown on the commercial soil mixed were the tallest (72.33 cm), while on the planting media of leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) were the shortest (47.46 cm). However, the plant height of *Epipremnum aureum* 'Bunting Lime' was not significantly different under various planting media with the range from 97.33 - 121.5 cm (Table 2). While the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) gave the tallest plant height in *Monstera adansonii* (91.88 cm) and *Ctenanthe burle-marxii* (31.16 cm).

The number of *Philodendron burle-marxii* G.M.Barroso leaf and *Epipremnum aureum* 'Bunting Lime' was significantly different when cultivated in various planting materials. The plant grew on the mixed proportion of the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) were the highest (21 number/plant and 22 number/plant), respectively. however, the number of *Monstera adansonii* and *Ctenanthe burle-marxii* leaves did not vary significantly under various planting media, with the range from 12.50 - 16.33 number/plant and 20.83 - 25 number/plant respectively (Table 3).

Table 2. The plant height of *Philodendron burle-marxii* G.M. Barroso, *Monstera adansonii*, *Epipremnum aureum* 'Bunting Lime'and *Ctenanthe burle-marxii* after planting in different growing media for 12 weeks

Planting material composition	**Plant height** (cm)			
	Philodendron	***Monstera***	***Epipremnum***	***Ctenanthe***
Commercial soil mixed	72.33 a	68.53c	105.58	32.70a
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1)	58.88b	84.98ab	106.83	31.50a
Leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1)	48.65c	76.18bc	97.33	26.16b
Leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1)	51.71c	69.31c	107	26.83b
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2)	47.86c	76.56bc	100.67	27.16b
Leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1)	47.46c	91.88a	121.5	31.16a
C.V. (%)	7.61	13.99	13.94	11.36
$LSD_{0.05}$	4.89	12.85	ns	3.91

Different letters demonstrate a significant difference ($P<0.05$) between treatments. The significant difference was determined by using the LSD test.
ns= no significant difference/ non-significant.

Regarding the different growing media showed the significant difference in the leaf width of *Philodendron burle-marxii* G.M.Barroso, *Epipremnum aureum* 'Bunting Lime'and Ctenanthe burle-marxii were observed. It was recorded that the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) presented the maximum leaf width at 11.86 cm, 12.65 cm, and 11.85 cm respectively (Table 4). While leaf width of *Monstera adansonii* was not significantly different under various media with the range from 9.71 - 10.68 cm (Figure 2).

Table 3. The number of *Philodendron burle-marxii* G.M.Barroso, *Monstera adansonii*, *Epipremnum aureum* 'Bunting Lime'and *Ctenanthe burle-marxii* leaf after planting in the different growing media for 12 weeks

Planting material composition	Number of Leaves			
	Philodendron	*Monstera*	*Epipremnum*	*Ctenanthe*
Commercial soil mixed	20.50a	15.16	17.33b	27.33
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1)	18.33a	15.00	17.16b	26.16
Leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1)	15.16b	14.33	16.83b	24.83
Leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1)	20.16a	12.50	16.33b	23.83
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2)	20.33a	13.00	17.83b	20.83
Leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1)	21.00a	16.33	22.00a	25.00
C.V. (%)	13.34	16.5	9.29	15.99
$LSD_{0.05}$	3.02	ns	1.96	ns

Different letters demonstrate a significant difference ($P<0.05$) between treatments. The significant difference was determined by using the LSD test.
ns= no significant difference/ non-significant.

The results on the leaf length of *Philodendron burle-marxii* G.M.Barroso, *Monstera adansonii*, *Epipremnum aureum* 'Bunting Lime' and *Ctenanthe burle-marxii* indicated that the treatment combination leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) showed the significant superiority with the maximum leaf length at 25.13 cm, 26.18 cm, 19.48 cm, and 18.65 cm, respectively, and followed by all treatments (Table 5). While the minimum leaf length of these four plants observed in the leaf compost: coconut husk chips: coconut coir: sand in other ratios; *Philodendron* noted at ratio 1: 1: 2: 1, *Monstera* remarked at ratio 1: 2: 1: 1, *Epipremnum* found at ratio 1: 1: 1: 1, and *Ctenanthe* distinguished at ratio 1: 1: 1: 2.

Table 4.The leaf width of *Philodendron burle-marxii* G.M.Barroso, *Monstera adansonii*, *Epipremnum aureum* 'Bunting Lime'and *Ctenanthe burle-marxii* after planting in different growing media for 12 weeks

Planting material composition	**Leaf width** (cm)			
	Philodendron	*Monstera*	*Epipremnum*	*Ctenanthe*
Commercial soil mixed	9.38c	9.71	10.80b	10.95b
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1)	9.78bc	10.16	10.48b	10.06c
Leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1)	10.75b	9.81	11.33b	11.38ab
Leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1)	10.35bc	9.88	10.91b	11.06b
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2)	10.75b	10.36	10.66b	11.15ab
Leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1)	11.86a	10.68	12.65a	11.85a
C.V. (%)	7.90	9.03	9.71	5.89
$LSD_{0.05}$	0.97	ns	1.27	0.76

Different letters demonstrate a significant difference ($P<0.05$) between treatments. The significant difference was measured by using the LSD test.
ns= no significant difference/ non-significant.

The plant height of *Polyscias guilfoylei* (W.Bull) L.H. Bailey 'Quinquefolia' was appeared to be significantly different ($P<0.05$) under various planting media. The plant grown on the mixed proportion of leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) was the tallest (22.11 cm), while the plant grown on the commercial soil mixed and the leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1) were the shortest (18.88 cm and 19.10 cm, respectively) (Figure 1).

The number of the node were significantly different ($P<0.05$) under various planting media in the medium of leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2) in which they obtained the highest new node per plant (6.50 number/plant), followed by the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) (6.33 number/plant), the leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1) (5.66 number/plant), the leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1) (5.33 number/plant), the leaf

compost: coconut husk chips: coconut coir: sand (1:1:1:1) (4.83 number/plant), and the commercial soil mixed (4.50 number/plant), respectively.

Table 5. The leaf length of *Philodendron burle-marxii* G.M.Barroso, *Monstera adansonii*, *Epipremnum aureum* 'Bunting Lime'and *Ctenanthe burle-marxii* after planting in different growing media for 12 weeks

Planting material composition	**Leaf length** (cm)			
	Philodendron	*Monstera*	*Epipremnum*	*Ctenanthe*
Commercial soil mixed	22.46bc	23.13bc	17.16cd	16.80c
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1)	22.46bc	23.90bc	17.00d	16.76c
Leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1)	23.41abc	22.43c	18.31b	18.16ab
Leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1)	21.36c	23.80bc	17.91bcd	17.08bc
Leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2)	23.98ab	23.95b	18.06bc	16.60c
Leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1)	25.13a	26.18a	19.48a	18.65a
C.V. (%)	7.82	5.29	4.77	5.47
$LSD_{0.05}$	2.13	1.49	1.01	1.11

Different letters indicate a significant difference ($P<0.05$) between treatments. The significant difference was determined by using the LSD test.
ns= no significant difference/ non-significant.

The results of canopy width of *P. guilfoylei* (W.Bull) L.H. Bailey 'Quinquefolia' Hanst were significantly different ($P<0.05$) under various planting media in the plant grown on the mixed proportion of the leaf compost: coconut husk chips: coconut coir: sand (1:2:1:1) which obtained the highest of canopy width at 24.81 cm, followed by the leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1) (24.23 cm), the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2) (23.66 cm), the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:1) (23.25 cm), and the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) (23.11 cm) respectively, while commercial soil mixed were the shortest (21.16 cm) (Figure 1).

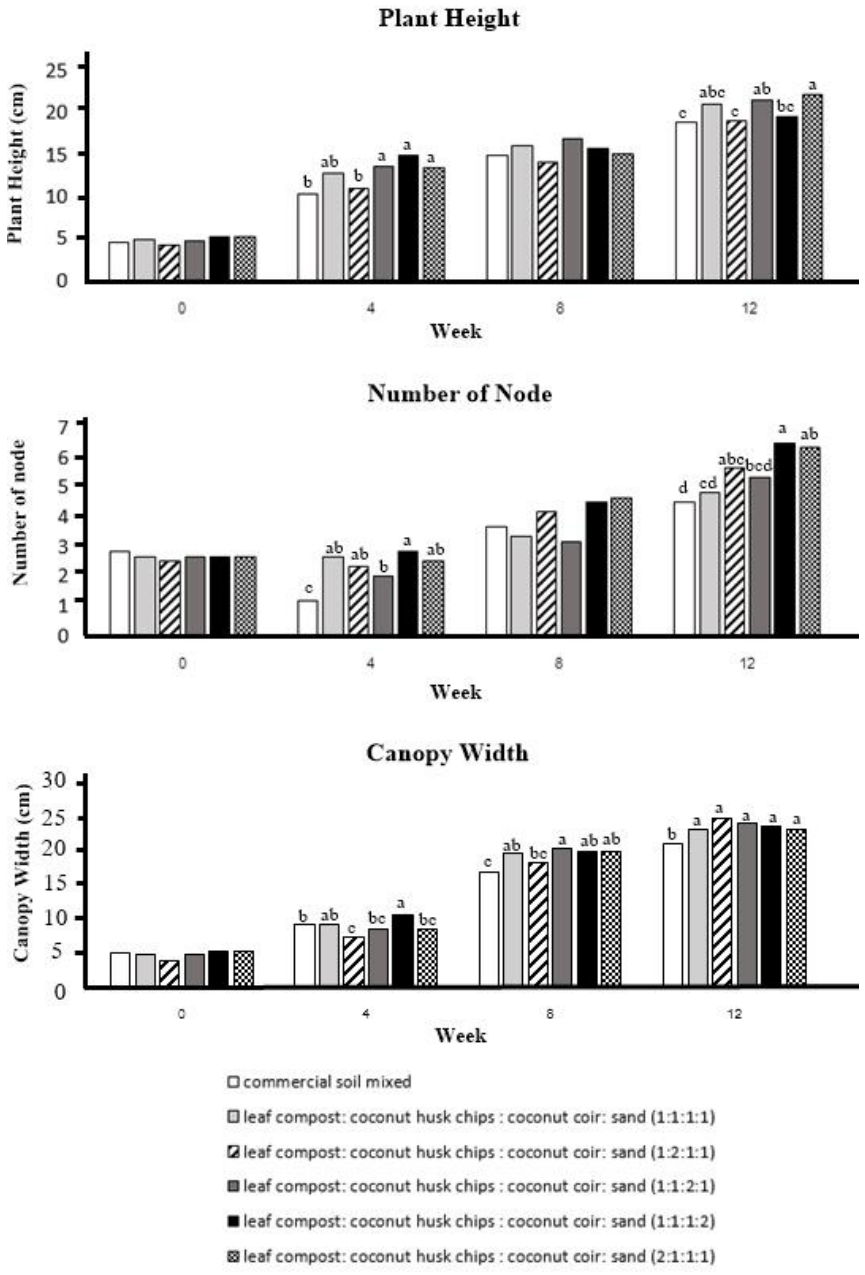

Figure 1. The growth of *Polyscias guilfoylei* (W.Bull) L.H. Bailey 'Quinquefolia' Hanst at 12th week after planting: means with the same letter above graph are not significantly different at P<0.05 by the LSD

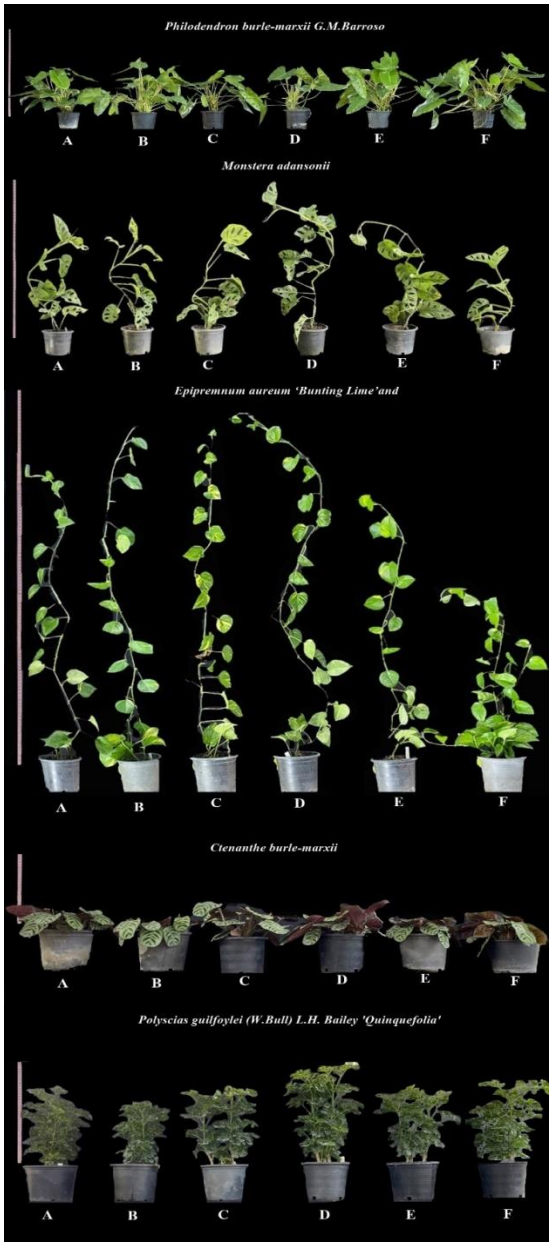

Figure 2. The growth of five foliage plants types at the 12th week after planting: A) commercial soil mixed, B) leaf compost: coconut husk chips: coconut coir: sand ratio 1:1:1:1, C) leaf compost: coconut husk chips: coconut coir: sand ratio 1:2:1:1, D) leaf compost: coconut husk chips: coconut coir: sand ratio 1:1:2:1, E) leaf compost: coconut husk chips: coconut coir: sand ratio 1:1:1:2, F) leaf compost: coconut husk chips: coconut coir: sand ratio 2:1:1:1

Discussion

This study was observed that the five varieties of the foliage plants grew and learned out the good merging of planting material that had a constructive resulting on the plant growth. It was noticed that the vegetative growth and the plant biomass were firmly affected on the plants grown under all different planting material ratios more than the control. Nevertheless, the comparative performance of all potting combinations revealed that the leaf compost: coconut husk chips: coconut coir: sand 2:1:1:1 ratio were acclaimed to be the most suitable composition because it significantly improved the total growth and the biomass of the foliage plant. The planting material is used regularly to allow seedlings to grow better and germinate faster in nurseries and potted plants (Baiyeri, 2003; Younis *et al.*, 2008). From these results, it was considered that the potting media with a mixture of organic leaf compost, coconut husk chips, coconut coir, and sand showed faster growth when compared to media commercial soil mixed treatment. The mixing of all planting material had a greatly affected. The maximizing performance in the plant height was noticed in the pots mixed with the leaf compost: coconut husk chips: coconut coir: sand ratio 2:1:1:1 ratio. This was mostly because of the acidity-alkalinity values (or pH values) of the planting materials with the range from 6.30-6.90 which was very applicable for the growth of five types of foliage plants concerning the plant height. This pH value was compatible with the report from Soil, Fertilizer and Environment Academic Development Programme (n.d.) that cited that the appropriate soil pH could release the elements of which nitrogen, phosphorus, potassium, calcium, and magnesium are necessary to the plants. While the soil pH was more than 7.80 that could obstruct the discharge of the previous elements, except potassium. These findings are concerned in the research results of Shah *et al*. (2006) where FYM, leaf compost, and silt at 1:1:1 ratio as the growing substrates for *Ficus binnendijkii* c.v. Amstel Queen that gave the highest plant height. Results are followed the finding of Riaz *et al*. (2008) who investigated the early seedling germination in *Zinnia elegans* under the influence of silt, compost, and leaf manure media. It is recommended to balance planting materials for ornamental plants to get the maximum plant height.

A good potting mix should have enough water to protect the plant from stress at the selected irrigation frequency must not hold too much water as this will reduce the aeration porosity (Thompson *et al*., 2001). The suitable water

capacity to avoid water loss, nutrient leaching, and runoff. The media with a total water capacity of more than 35% was most satisfactory for growing plants in general nurseries (Krucker, 2003). The maximum Moisture content (37.8%) was found in the leaf compost: coconut husk chips: coconut coir: sand (1:1:2:1), followed by the commercial soil mixed (37.77%) and the leaf compost: coconut husk chips: coconut coir: sand 1:1:1:2 ratio (36.94%) Moisture content (36.51%) in the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1). These results were also supported by Gouin (1995), who studied other horticultural crops in the nursery where coco fiber was combined with different sediment mixtures to increase the ability to retain water. The results for porosity were found best (41.12%) in the commercial soil mixed followed by the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1)(40.54%). The minimum porosity (35.03%) was found in the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2). The symptoms of low aeration like less vigorous growth, smaller leaves dark was observed in the leaf compost: coconut husk chips: coconut coir: sand (1:1:1:2). The higher total porosity means less tightness and more aeration. This results in better root growth and infiltration of plants into the soil. These discoveries were encouraged by the results were supported by the results of De-Boodt and Verdonek (1971) and Paul and Lee (1976) who reported that the aeration was developed in silt and sand with the addition of organic improvement.

The electrical conductivity (EC) of diverse growing media ranged from 0.24 - 0.53 mS/cm.The EC was determined the electric current (Hershey and Sand, 1993). EC is an indicator of normal or normal plant growth. The EC of diverse growing media in the study did not affect the abnormal plant height, the number of leaves per plant, the leaf width, and the length of five types of foliage plants. The study was agreed with Poole *et al.* (1981) which recommended that EC values should range between 0.63 to 1.56 mS/cm for media used on container-grown plants and EC values > 3.5 mS/cm can be adversely affected on the seedling growth.

Leaf area and the number of leaves are essential components for growth, which directly target plant photosynthetic activation (Younis *et al.*, 2015). Results investigated that the leaf area was significantly increased by treating plants with different growing media compositions when compared to the control one, nevertheless, the plants are grown in the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) had the highest leaf area expansion among the treatment comparison. These results are related to Hussain *et al.*

(2017) who also distinguished the maximum leaf area and the number of leaves in *Caladium* in which they used media silt, perlite, and leaf compost. Furthermore, Nowak and Strojny (2003) on Khayyat *et al*. (2007) on Pothos got the maximum leaf area in plants when they were grown in different mixed materials. All these results are comparable to Riaz *et al*. (2008) who noticed the maximum number of side shoots in growing media on the leaf compost, sand, and leaf manure as composition.

It concluded that the growth of five types of foliage plants was the best in the medium of leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) as it gave the highest plants. These five types of foliage plants species are grown on the leaf compost: coconut husk chips: coconut coir: sand (2:1:1:1) gave the plant height, the leaf number, the leaf width, and the leaf length significantly different ($P<0.05$). That may be due to the addition of the four appropriately proportioned planting ingredients in the medium. This combination maintains a good balance between moisture retention and good drainage.

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