

DETERMINING THE MOST SUITABLE GROWING MEDIUM AND IRRIGATION WATER AMOUNT NEEDED FOR THE PRODUCTION OF SOME FOLIAGE ORNAMENTAL PLANTS

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Scientific J. Flowers & Ornamental Plants,
10(1):43-62 (2023).

Received:

20/1/2023

Accepted:

15/2/2023

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ABSTRACT: Two separate factorial experiments arranged in a completely randomized design replicated thrice were conducted in a plastic house at the Tropical Farm of Kom Ombo district, Aswan Governorate, during 2021 and 2022 seasons to study the effect of growing mixture included sand (S) alone as a control, S + loam, S + farmyard manure (FYM) compost and S + River Nile weed (RNW) compost (each mixture was tested either at 1:1 or 2:1 volumetric ratio), water amounts of 200, 300 and 400 ml/plant (pot) and their interactions on vegetative and root growth, chemical composition, dry matter production and water use efficiency of two foliage pot-plants, common handling in Egypt, named *Dracaena marginata* Lam. ‘Bicolor’ and *Schefflera actinophylla* (Endl.) Harms. The results showed that mean values of various vegetative and root growth characters of both plant species were significantly improved due to planting in the different growing mixtures used in the study with the dominance of planting in S + FYM compost (1:1, v/v) medium which gave the highest means of all investigated parameters in the two seasons. Planting in S + loam (1:1, v/v) and in S + RNW compost (1:1, v/v) mixture occupied the 2nd and 3rd rank, respectively, whereas planting in the sand amended with either loam or RNW compost at a ratio of (2:1, v/v) attained the least improvement. Increasing the amount of irrigation water from 200 ml to either 300 or 400 ml/plant significantly raised values of different growth traits to maximum, with non-significant differences between these two levels in most cases during both seasons. So, increasing water volume from 300 ml to 400 ml did not cause any extra improvement in growth parameters. Hence, combining between planting in S + FYM compost (1:1, v/v) growing medium and irrigation with either 300 or 400 ml water/plant recorded the maximum means of growth parameters over all the other combinations in the two seasons. A similar trend was also obtained concerning concentrations of chlorophyll a, b, carotenoids, N, P and K in the leaves of the two studied plants. Likewise, production of dry matter was maximized by planting in S + FYM compost (1:1, v/v) mixture, elevating irrigation water quantity to either 300 or 400 ml/plant and their interactions. Thus, the best water use efficiency (WUE) was achieved also by the interactions previously stated. From these findings, it can be advised to plant both *Dracaena marginata* ‘Bicolor’ and *Schefflera actinophylla* plant species in the sand fortified with FYM compost at equal volumetric ratio and irrigated them with

only 300 ml of water/plant, once every other day during the active growing season to get the best growth performance and picturesque foliage pot-plants.

Keywords: *Dracaena marginata*, *Schefflera actinophylla*, water amounts, sand, farmyard manure, River Nile weed, compost.

INTRODUCTION

Components of the growing medium and irrigation water quantity suitable for maximum growth are considered the major effective factors on growth performance and quality of foliage ornamental plants. This truth was documented by the experimental results of Saadawy *et al.* (2005) on schefflera, Shahin *et al.* (2007) on *Agave americana* cv. Marginata, Abdel-Fattah *et al.* (2008) on schefflera, El-Sayed and El-Shal (2008) on schefflera, El-Sayed *et al.* (2009) on *Nephrolepis exaltata*, Shahin *et al.* (2009) on tuberose, Saadawy *et al.* (2011) on *Ficus* ‘Hawaii’, Shahin *et al.* (2012) on *Schefflera*, El-Sayed *et al.* (2013) on *Euonymus japonicus* cv. Aureus, Nofal *et al.* (2014) on *Hymenocallis speciosa*, O'Meara *et al.* (2014) on *Hydrangea macrophylla* and *Gardenia jasminoides*, Said (2016) on *Duranta erecta* var. variegata, El-Fauly *et al.* (2020) on *Asparagus densiflorus* ‘Myers’, El-Ghazaly *et al.* (2021) on *Gasteria carinata* var. *verucosa*, Shahin and Sayed (2021) on *Ochna serrulate*, Shahin *et al.* (2021) on *Ranunculus asiaticus* var. Orange, El-Haddadi *et al.* (2022) on *Tetraclinis articulata*, Heidari *et al.* (2022) on lily and Scagel and Bryla (2022) on Rhododendron.

Dracaena marginata Lam. ‘Bicolor’ and *Schefflera actinophylla* (Endl.) Harms. (syn. *Brassaia actinophylla* Endl.) maybe among popular foliage ornamental potted plants in Egypt, which need great care for the selection of their growing medium and irrigation water amount. The former belongs to family Agavaceae, natives to Madagascar and is mainly used for decoration of the low-light intensity places and its stem resin used in varnish and photoengraving. It has a thin and slender stem up to 3 m height and characterized by its narrow sword-shaped

leaves, purple margins and somewhat concave towards base. The latter belongs to family Araliaceae, natives to Australia with an evergreen umbrella foliage. Hence, it was called Australian umbrella. It can be used outdoors as an evergreen decorative tree up to about 10-12 m height, but it is widely used indoors as decorative foliage pot-plants (Brickell, 1997).

Therefore, this study aims to choose the most reliable growing medium mixture and irrigation water quantity necessary for the production of both dracaena ‘Bicolor’ and Australian schefflera as pot-plants with the best growth performance and high quality.

MATERIALS AND METHODS

Two independent pot experiments were performed under plastic house conditions at the Tropical Farm of Kom Ombo district, Aswan Governorate, Upper Egypt during the two successive seasons of 2021 and 2022 to find out the most suitable growing medium and the best irrigation water volume needed for irrigating this medium to obtain maximum growth and quality of both dracaena ‘Bicolor’ and Australian schefflera which are common foliage pot-plants in Egypt.

Thus, transplants of both *Dracaena marginata* ‘Bicolor’ and *Schefflera actinophylla* were carefully selected to be uniform as possible (21±1 cm height for dracaena transplants and 15±1 cm height for schefflera) were transplanted on 15th March during both seasons in 16-cm-diameter plastic pots (one transplant/pot) filled up to 2 cm under the pot rim with one of the following growing media: sand alone (S) as a control, S + loam at either 1:1 or 2:1 (v:v) ratios, S + farmyard manure (FYM) compost at either 1:1 or 2:1 volumetric ratios and S +

River Nile weed (RNW) compost, at either 1:1 or 2:1 volumetric ratios. Some physical and chemical properties of the sand and loam, farmyard manure and River Nile weed compost are shown in Tables (1), (2) and (3), respectively. Temperature and RH inside the plastic house during the course of the study were ranged between 31.8–48.7 °C and 60–95%, respectively.

Immediately after transplanting, all the pots were irrigated with 300 ml of fresh water per pot day after day till the first of April, as they were irrigated once day by day with the following water amounts till the end of the experiment on September, 30th for each season: 200, 300 and 400 ml/pot. Each treatment of media was combined factorially with each one of water amounts to form twenty-one combined treatments.

The layout of this experiment was a factorial experiment in a completely randomized block design (Mead *et al.*, 1993). Since the first factor was the medium type which contained seven treatments, while the second factor was irrigation water

amount included three treatments. Each treatment included three replicates and each replicate contained three plants. All plants received the normal agricultural practices whenever needed.

At the end of each season, the following data were recorded for both plant species used in the study: plant height (cm), stem diameter at the base (cm), number of leaves/plant as well as fresh and dry weights (g) of leaves, stem and roots. Fresh leaf samples were taken from the middle part of the plant for each treatment to determine the concentrations of chlorophyll a, b and carotenoids (mg/g f.w.) according to the method of Sumanta *et al.* (2014). Dry leaf samples were used to assess the percentages of nitrogen, phosphorus and potassium according to the methods described by Chapman and Pratt (1974). Furthermore, water use efficiency (WUE) for each level of irrigation water amount used in the study was calculated from such equations: $WUE = \frac{\text{total amount of water (ml)/plant/season}}{\text{total amount of dry matter (g)/plant/season}}$ to determine the quantity of water needed for

Table 1. Physical and chemical properties of the sand and loam used during both seasons.

Soil type	Particle size distribution (%)				S.P. (%)	E.C. (ds/m)	pH	SAR	Cations (meq/L)				Anions (meq/L)		
	Coarse sand	Fine sand	Silt	Clay					Ca ⁺⁺	Mg ⁺⁺	Na ⁺	K ⁺	HCO ₃ ⁻	Cl ⁻	SO ₄ ⁻
Loam	10.96	45.83	20.56	22.65	35.00	3.26	8.21	3.75	17.50	9.33	21.36	0.79	3.75	10.50	34.73

Table 2. Physical and chemical properties of FYM compost used during both seasons.

O.M. (%)	O.C. (%)	C/N ratio	E.C. (ds/m)	pH	Macro-elements (%)				Micro-elements (ppm)				
					N	P	K	Ca	Mg	Zn	Fe	Mn	Cu
25.80	23.28	12.58	3.76	7.88	1.85	0.71	2.30	0.26	0.79	21.00	1620	330	54

Table 3. Chemical composition of the River Nile weed (RNW) compost used during both seasons.

Peptide (%)	Polysaccharides (%)	Hydrocarbons (%)	Silicate (%)	Mg (OH) ₂ (%)	Minerals (µg/g d.w.)											
					Ca	K	Na	Fe	Zn	Mg	Cu	Mn	Pb	Cd	Ni	Co
15.3	42.8	39.4	1.86	0.64	195.3	113.0	185.0	1.4	1.01	18.3	0.38	62.0	n.d.	2.0	10.4	0.06

the production of one gram dry matter of either dracaena 'Bicolor' plant or Australian schefflera one cultured in each growing medium used in this trial (every plant species irrigated 92 times during the course of the study).

Data were then tabulated and only the morphological ones were statistically analyzed using the Assistant Software program of Silva and Azevedo (2016) and the means were compared using Duncan's New Multiple Range Test (Steel and Torrie, 1980).

RESULTS

1. Effect of growing medium type, irrigation water amount and their interactions on growth and chemical composition of *Dracaena marginata* Lam. 'Bicolor' plant:

a. Effect on vegetative and root growth parameters:

According to data tabulated in Tables (4, 5, 6, 7 and 8) it can be concluded that mean values of plant height, stem diameter, number of leaves/plant, root length as well as fresh and dry weights of leaves, stem and roots were significantly increased in response to planting in different tested medium types in this study compared to planting in sand alone (control). Planting in sand + FYM (1:1) medium gave the highest means over all the other media in the two seasons. The second rank was occupied by planting in sand + loam (1:1) medium, and then planting in sand + RNW compost (1:1) one. In general, the least improvement in growth was acquired by amending the sand with either loam or RNW compost at the ratio of 2:1, by volume. Besides, increasing amount of irrigation water from 200 ml to either 300 or 400 ml significantly improved the values of different growth traits mentioned before. However, there were no significant differences between both treatments (300 or 400 ml) in both seasons.

Accordingly, the best combined treatments were the combination between

planting in the mixture of sand + FYM (1:1, v/v) and irrigation with either 300 or 400 ml water volume, as these two combinations recorded the utmost high means over all the other combinations in the two seasons.

Also, combining between both planting in sand + FYM (1:1) medium + 200 ml irrigation water level and planting in sand + loam (1:1) medium + irrigating with either 300 or 400 ml water level came at the second position giving valuable results that can be taken into account when producing on commercial scale.

b. Effect on chemical composition of the leaves:

A similar trend to that obtained in the case of vegetative and root growth parameters was also attained regarding concentrations of some active constituents in the leaves, as shown in Tables (9, 10 and 11). Where contents of chlorophyll a, b and carotenoids (mg/g f.w.) and the percentages of N, P and K were markedly improved as a result of mixing loam, FYM compost and RNW one with the sand at any ratio. The highest concentrations, however, were scored by applying the three aforementioned amendments at a ratio of 1:1, by volume, with the superiority of planting in the sand + FYM (1:1) medium that registered the highest values of the previously mentioned constituents in most causes of both seasons. Likewise, both 300 and 400 ml of water quantities greatly raised concentrations of different chemical measurements to higher values than those of 200 ml water treatment without major differences in between, except for chlorophyll a content in the two seasons and chlorophyll b one in the only first season, which were slightly higher by 300 ml water level than those recorded by 400 ml one.

Also, interactive treatments exerted a pronounced effect on the chemical composition of the leaves, especially interacting between sand + any used additives at equal volumetric ratio (1:1, v/v) and watering with either 300 or 400 ml water

Table 4. Effect of medium type, irrigation water amount and their interactions on plant height and stem diameter of *Dracaena marginata* Lam. ‘Bicolor’ plant during 2021 and 2022 seasons.

Media	Plant height (cm)			Water amount (ml)				Mean
	200	300	400	Mean	200	300	400	
				First season: 2021				
Sand (S)	30.5 h	31.7 h	32.0 h	31.4 G	0.33 e	0.35 e	0.34 e	0.34 G
S + loam (1:1)	50.3 c	56.0 b	56.1 b	54.1 B	0.63 c	0.75 b	0.78 b	0.72 B
S + loam (2:1)	35.8 g	39.2 f	39.0 f	38.0 E	0.41 e	0.55 c	0.55 c	0.50 E
S + FYM (1:1)	57.6 b	62.1 a	62.5 a	60.7 A	0.69 b	0.85 a	0.86 a	0.80 A
S + FYM (2:1)	38.5 f	44.5 e	44.3 e	42.4 D	0.50 d	0.63 c	0.61 c	0.58 D
S + RNW (1:1)	43.5 e	48.3 d	48.1 d	46.6 C	0.52 d	0.68 b	0.70 b	0.63 C
S + RNW (2:1)	31.6 h	35.1 g	34.6 g	33.8 F	0.37 e	0.50 d	0.49 d	0.45 F
Mean	41.1 B	45.3 A	45.2 A		0.49 B	0.62 A	0.62 A	
				First season: 2022				
Sand (S)	30.9 h	31.5 h	31.6 h	31.3 G	0.32 e	0.33 e	0.33 e	0.33 G
S + loam (1:1)	51.0 c	56.3 b	56.5 b	54.6 B	0.65 c	0.77 b	0.79 b	0.74 B
S + loam (2:1)	35.5 g	39.6 f	39.3 f	38.1 E	0.43 de	0.56 c	0.55 c	0.51 E
S + FYM (1:1)	58.3 b	62.5 a	62.1 a	61.0 A	0.70 b	0.87 a	0.86 a	0.81 A
S + FYM (2:1)	38.9 f	44.7 e	44.5 e	42.7 D	0.51 de	0.63 c	0.63 c	0.59 D
S + RNW (1:1)	44.1 e	48.6 d	48.5 d	47.1 C	0.54 de	0.69 b	0.72 b	0.65 C
S + RNW (2:1)	31.2 h	34.7 g	34.1 g	33.3 F	0.35 e	0.51 d	0.48 d	0.45 F
Mean	41.4 B	45.4 A	45.2 A		0.50 B	0.62 A	0.62 A	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 5. Effect of medium type, irrigation water amount and their interactions on number of leaves and root length of *Dracaena marginata* Lam. ‘Bicolor’ plant during 2021 and 2022 seasons.

Media	No. leaves/plant			Water amount (ml)				Mean
	200	300	400	Mean	200	300	400	
				First season: 2021				
Sand (S)	10.11 g	11.58 g	11.00 g	10.90 E	21.10 h	21.50 h	21.36 h	21.32 F
S + loam (1:1)	15.71 d	21.00 b	20.11 b	18.94 B	30.76 de	36.91 b	36.80 b	34.82 B
S + loam (2:1)	12.50 f	15.61 d	15.50 d	14.54 D	21.80 h	23.83 g	24.21 f	23.28 E
S + FYM (1:1)	1.00 c	24.67 a	25.00 a	22.56 A	33.17 c	38.50 a	38.10 a	36.59 A
S + FYM (2:1)	12.33 f	18.40 c	17.56 c	16.10 C	21.63 h	27.30 e	26.98 e	25.30 D
S + RNW (1:1)	14.01 e	19.63 b	20.10 b	17.91 B	25.70 f	31.50 d	31.73 d	29.64 C
S + RNW (2:1)	10.31 g	12.33 f	13.00 f	11.88 E	21.00 h	25.33 f	23.96 g	23.43 E
Mean	13.28 B	17.60 A	17.47 A		25.02 B	29.27 A	29.02 A	
				First season: 2022				
Sand (S)	10.33 g	11.50 g	11.18 g	11.00 F	21.30 h	21.61 h	21.50 h	21.47 F
S + loam (1:1)	16.21 d	21.70 b	21.50 b	19.80 B	31.20 de	36.67 b	37.10 b	34.99 B
S + loam (2:1)	12.50 f	16.33 d	16.00 d	14.94 D	22.31 h	24.23 g	24.17 g	23.57 E
S + FYM (1:1)	19.10 c	25.50 a	25.60 a	23.40 A	33.53 c	38.56 a	38.90 a	37.00 A
S + FYM (2:1)	13.25 f	18.00 c	18.76 c	16.67 C	22.10 h	27.50 e	27.33 e	25.64 D
S + RNW (1:1)	14.81 e	21.33 b	22.63 b	19.59 B	26.10 f	31.90 d	31.78 d	29.93 C
S + RNW (2:1)	10.50 g	14.95 e	13.96 f	13.14 E	21.50 h	26.00 f	24.36 g	23.95 E
Mean	13.81 B	18.47 A	18.52 A		25.43 B	29.50 A	29.31 A	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 8. Effect of medium type, irrigation water amount and their interactions on roots fresh and dry weights of *Dracaena marginata* Lam. ‘Bicolor’ plant during 2021 and 2022 seasons.

Media	200			300			400		
	Roots F.W. (g)			Roots D.W. (g)			Mean		
	Water amount (ml)								
	200			200			200		
	300			300			300		
	400			400			400		
	Mean			Mean			Mean		
	First season: 2021								
Sand (S)	9.9 h	10.7 h	10.4 h	10.3 G	5.0 h	5.7 gh	5.3 h	5.3 F	
S + loam (1:1)	20.9 c	25.5 b	26.0 b	24.1 B	10.1 d	12.3 b	12.5 b	11.6 B	
S + loam (2:1)	12.7 g	17.8 e	17.5 e	16.0 E	6.2 g	8.1 e	8.6 e	7.6 E	
S + FYM (1:1)	25.3 b	30.9 a	31.3 a	29.2 A	12.0 b	15.5 a	14.9 a	14.1 A	
S + FYM (2:1)	15.9 f	21.6 d	21.2 d	19.6 D	7.4 f	11.0 c	10.8 d	9.7 D	
S + RNW (1:1)	17.8 de	23.9 c	24.5 c	22.1 C	8.5 e	11.5 c	11.7 c	10.6 C	
S + RNW (2:1)	10.8 h	17.1 e	16.4 f	14.8 F	5.3 h	7.8 ef	8.1 e	7.1 E	
Mean	16.2 B	21.1 A	21.1 A		7.8 B	10.3 A	10.3 A		
	First season: 2022								
Sand (S)	10.5 h	11.5 h	11.0 h	11.0 G	5.3 h	5.5 h	5.6 b	5.5 E	
S + loam (1:1)	21.3 c	25.5 b	26.3 b	24.7 B	10.3 d	12.5 b	12.6 e	11.8 B	
S + loam (2:1)	13.0 g	18.4 e	18.5 e	16.6 E	6.5 g	8.4 e	8.8 a	7.9 D	
S + FYM (1:1)	25.5 b	31.5 a	31.3 a	29.4 A	12.1 b	15.4 a	15.5 c	14.3 A	
S + FYM (2:1)	16.3 e	21.7 d	21.9 d	20.0 D	7.5 f	10.8 c	11.3 c	9.9 C	
S + RNW (1:1)	18.1 de	24.3 c	24.8 c	22.4 C	8.3 e	11.1 c	11.0 e	10.1 C	
S + RNW (2:1)	11.2 h	17.5 e	16.9 f	15.2 F	5.3 h	8.5 e	8.0 a	7.3 D	
Mean	16.6 B	21.6 A	21.5 A		7.9 B	10.3 A	10.4		

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 9. Effect of medium type, irrigation water amount and their interactions on chlorophyll a and b concentrations of *Dracaena marginata* Lam. ‘Bicolor’ plant during 2021 and 2022 seasons.

Media	200			300			400		
	Chlorophyll a (mg/g F.W.)			Chlorophyll a (mg/g F.W.)			Mean		
	Water amount (ml)								
	200			200			200		
	300			300			300		
	400			400			400		
	Mean			Mean			Mean		
	First season: 2021								
Sand (S)	1.201	1.300	1.287	1.263	0.876	0.899	0.886	0.887	
S + loam (1:1)	2.053	3.105	3.069	2.742	1.581	1.910	1.880	1.790	
S + loam (2:1)	1.358	2.310	2.335	2.001	1.017	1.241	1.263	1.174	
S + FYM (1:1)	2.510	3.551	3.367	3.143	2.010	2.231	2.250	2.164	
S + FYM (2:1)	1.623	2.411	2.440	2.158	1.510	1.336	1.391	1.293	
S + RNW (1:1)	2.312	3.240	3.218	2.923	1.323	1.552	1.510	1.462	
S + RNW (2:1)	1.261	1.593	1.591	1.482	0.901	1.023	1.039	0.988	
Mean	1.760	2.501	2.473		1.266	1.456	1.317		
	First season: 2022								
Sand (S)	1.206	1.376	1.293	1.292	0.900	0.934	0.916	0.917	
S + loam (1:1)	2.095	3.100	3.084	2.760	1.610	1.911	1.895	1.805	
S + loam (2:1)	1.289	2.325	2.400	2.005	1.036	1.301	1.279	1.205	
S + FYM (1:1)	2.563	3.601	3.533	3.232	2.009	2.310	2.293	2.204	
S + FYM (2:1)	1.546	2.433	2.318	2.099	1.176	1.357	1.368	1.300	
S + RNW (1:1)	2.361	3.251	3.202	2.971	1.343	1.548	1.550	1.480	
S + RNW (2:1)	1.188	1.960	1.951	1.700	0.903	1.051	1.100	1.018	
Mean	1.750	2.578	2.554		1.283	1.488	1.486		

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 10. Effect of medium type, irrigation water amount and their interactions on carotenoids and nitrogen concentrations of *Dracaena marginata* Lam. 'Bicolor' plant during 2021 and 2022 seasons.

Media	Water amount (ml)				200	300	400	Mean
	200	300	400	Mean				
Carotenoids (mg/g F.W.)				N (%)				
First season: 2021								
Sand (S)	1.036	1.058	1.045	1.046	0.71	0.76	0.75	0.74
S + loam (1:1)	1.202	1.331	1.340	1.291	1.37	1.67	1.69	1.58
S + loam (2:1)	1.123	1.250	1.265	1.213	1.03	1.33	1.31	1.23
S + FYM (1:1)	1.580	1.699	1.701	1.660	1.49	1.79	1.80	1.69
S + FYM (2:1)	1.451	1.558	1.546	1.518	1.16	1.46	1.45	1.36
S + RNW (1:1)	1.303	1.411	1.409	1.374	1.25	1.58	1.55	1.46
S + RNW (2:1)	1.071	1.170	1.181	1.141	0.78	1.18	1.21	1.06
Mean	1.252	1.354	1.355			1.40	1.39	
First season: 2022								
Sand (S)	1.050	1.067	1.070	1.062	0.83	0.94	0.96	0.91
S + loam (1:1)	1.225	1.350	1.361	1.312	1.36	1.70	1.70	1.59
S + loam (2:1)	1.143	1.271	1.210	1.208	1.00	1.31	1.36	1.22
S + FYM (1:1)	1.395	1.573	1.566	1.511	1.53	1.85	1.83	1.74
S + FYM (2:1)	1.480	1.566	1.590	1.545	1.18	1.50	1.51	1.40
S + RNW (1:1)	1.321	1.430	1.397	1.383	1.30	1.65	1.58	1.51
S + RNW (2:1)	1.076	1.108	1.163	1.116	0.90	1.21	1.23	1.11
Mean	1.241	1.338	1.337		1.16	1.45	1.45	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 11. Effect of medium type, irrigation water amount and their interactions on phosphorus and potassium concentrations of *Dracaena marginata* Lam. 'Bicolor' plant during 2021 and 2022 seasons.

Media	Water amount (ml)				200	300	400	Mean
	200	300	400	Mean				
P (%)				K (%)				
First season: 2021								
Sand (S)	0.068	0.078	0.071	0.072	0.90	0.98	0.95	0.94
S + loam (1:1)	0.211	0.323	0.310	0.281	1.26	1.38	1.37	1.34
S + loam (2:1)	0.110	0.187	0.181	0.159	1.05	1.17	1.15	1.12
S + FYM (1:1)	0.301	0.385	0.400	0.362	0.14	1.53	1.48	1.45
S + FYM (2:1)	0.132	0.218	0.203	0.184	1.18	1.20	1.21	1.20
S + RNW (1:1)	0.153	0.267	0.281	0.234	1.20	1.29	1.33	1.27
S + RNW (2:1)	0.079	0.146	0.150	0.125	1.03	1.11	1.10	1.08
Mean	0.151	0.229	0.228		1.14	1.24	1.23	
First season: 2022								
Sand (S)	0.081	0.095	0.086	0.087	0.93	1.05	1.00	0.99
S + loam (1:1)	0.220	0.351	0.347	0.306	1.25	1.40	1.40	1.35
S + loam (2:1)	0.121	0.196	0.187	0.168	1.08	1.20	1.19	1.16
S + FYM (1:1)	0.310	0.400	0.391	0.367	1.37	1.53	1.48	1.46
S + FYM (2:1)	0.133	0.229	0.241	0.201	1.15	1.20	1.22	1.19
S + RNW (1:1)	0.171	0.286	0.300	0.252	1.23	1.35	1.33	1.30
S + RNW (2:1)	0.088	0.161	0.170	0.140	1.00	1.14	1.16	1.10
Mean	0.161	0.245	0.246		1.14	1.27	1.25	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

level, as these different interactions replaced giving the higher values of various constituents, but the upper hand in both seasons was for the interaction between planting in sand + FYM (1:1) medium and irrigation with either 300 or 400 ml water amount which mostly gave the highest concentrations.

c. Effect on dry matter production and water use efficiency (WUE):

It is evident from data presented in Table (12) that production of dry matter was noticeably increased by planting in the different growing media prepared in such work regardless of the amount of irrigation water used to reach maximum by planting in sand + FYM (1:1) growing medium, which gave 51.11, 60.6 and 59.9 g dry matter/plant/season by irrigation with 200, 300 and 400 ml water amounts, respectively in the first season, and gave 55.4, 61.0 and 61.2 g/plant/season in the second one, and followed by planting in sand + loam (1:1) growing mixture and thereafter by planting in sand amended with RNW compost at a ratio of 1:1, by volume.

Thus, the least water amount used for production 1 g of dry matter was attained by planting in the growing mixture of sand + FYM compost (1:1, v/v). followed by planting in sand + loam (1:1) and then by planting in sand + RNW compost (1:1) medium.

Accordingly, the highest WUE was obtained from planting in sand consolidated with FYM compost at an equal volumetric ratio for each, where planting in such growing mixture consumed only 476.61 ml of water to produce 1 g of D.M. /plant/season in the first season, while in the second one consumed only 461.97 ml. In general, the best WUE gained by growing mixture used in this study took the following descending order: sand + FYM (1:1) mixture > sand + loam (1:1) mixture > sand + RNW (1:1) mixture.

2. Effect of growing medium type, irrigation water amount and their interactions on growth and chemical composition of *Schefflera actinophylla* (Endl.) Harms plant.

a. Effect on vegetative and root growth parameters:

A similar response to that of dracaena 'Bicolor' occurred as well regarding Australian schefflera, where different growing media used in this investigation caused significant increments in the mean values of various vegetative and root growth traits to reach maximum by planting in the mixture of sand + FYM (1:1, v/v) which gave tallest plant, thickest stem, highest No. leaves/plant, longest root and heaviest fresh and dry weights of different plant organs compared to planting in sand standalone all other media used in the two seasons (Tables, 13, 14, 15, 16 and 17). On the other hand, the minimal improvement was noticed in plants raised either in sand + loam (2:1) mixture or in sand + RNW compost (2:1) one, whereas planting in both sand + loam (1:1) and sand + RNW (1:1) growing mixtures achieved reliable gains which can be taken into consideration from a commercial point of view.

Likewise, elevating irrigation water volume from 200 ml to either 300 or 400 ml/plant showed a great increase in the means of various growth criteria, but these two higher water amounts were statistically at par with each other for all growth parameters measured in the two seasons. So, combining between planting in a mixture of sand fortified with FYM compost (1:1, v/v) and water quantity of either 300 or 400 ml/plant resulted the best growth performance over all the other combined treatments in both seasons. Moreover, interacting between planting in sand + loam (1:1, by volume) mixture and irrigating with either 300 or 400 ml/plant, as well as between planting in sand + FYM 91:1) mixture and 200 ml irrigation water quantity hastened growth characters to some extent

Table 12. Water use efficiency by *Dracaena marginata* Lam. ‘Bicolor’ plant under various media, water amounts and their interactions during 2021 and 2022 seasons.

Total amount of water (ml)/plant/season	Medium type	Total D.M. (g)/plant/season		WUE (ml/g D.M.)	
		2021	2022	2021	2022
18400 ml (for 200 ml water treatment)	Sand (S)	20.70	21.20	888.89	867.93
	S + loam (1:1)	45.31	46.00	406.09	400.00
	S + loam (2:1)	26.70	27.51	689.14	668.85
	S + FYM (1:1)	51.11	55.40	360.01	332.13
	S + FYM (2:1)	31.73	32.21	579.89	571.25
	S + RNW (1:1)	37.20	37.50	494.62	490.67
	S + RNW (2:1)	21.70	21.70	847.93	847.93
27600 ml (for 300 ml water treatment)	Sand (S)	22.20	22.00	1243.24	1254.55
	S + loam (1:1)	52.90	53.70	521.74	513.97
	S + loam (2:1)	34.61	35.71	797.46	772.89
	S + FYM (1:1)	60.60	61.00	455.45	452.46
	S + FYM (2:1)	40.91	41.11	674.65	671.37
	S + RNW (1:1)	46.70	46.30	591.01	596.11
	S + RNW (2:1)	29.71	31.10	928.98	887.46
36800 ml (for 400 ml water treatment)	Sand (S)	21.60	21.90	1703.70	1680.37
	S + loam (1:1)	53.51	54.10	687.72	680.22
	S + loam (2:1)	34.80	35.81	1057.47	1027.65
	S + FYM (1:1)	59.90	61.20	614.36	601.31
	S + FYM (2:1)	40.81	41.70	901.74	882.50
	S + RNW (1:1)	46.30	46.11	794.82	798.09
	S + RNW (2:1)	30.11	30.30	1222.19	1214.52
Medium mean	Sand (S)	21.50	21.70	1278.61	1267.62
	S + loam (1:1)	50.57	51.27	538.52	531.40
	S + loam (2:1)	32.04	33.01	848.02	823.13
	S + FYM (1:1)	57.20	59.20	476.61	461.97
	S + FYM (2:1)	37.82	38.34	718.76	708.37
	S + RNW (1:1)	43.40	43.30	626.82	628.29
	S + RNW (2:1)	27.17	27.70	999.70	983.30

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* Number of irrigation times during each season = 92 times, hence the total amount of water for 200, 300 and 400 ml water treatments = 18400, 27600 and 36800 ml, respectively.

Table 13. Effect of medium type, irrigation water amount and their interactions on plant height and stem diameter of *Schefflera actinophylla* (Endl.) Harms plant during 2021 and 2022 seasons.

Media	Plant height (cm)			Water amount (ml)				Mean
	200	300	400	Mean	200	300	400	
First season: 2021								
Sand (S)	21.9 i	24.8 h	25.0 h	23.9 G	0.42 e	0.48 e	0.49 e	0.46 E
S + loam (1:1)	36.2 e	41.5 c	41.7 c	39.8 B	0.68 c	0.80 b	0.81 b	0.76 B
S + loam (2:1)	29.1 g	33.8 f	33.5 f	32.1 E	0.56 d	0.63 c	0.64 c	0.61 C
S + FYM (1:1)	44.6 b	52.7 a	52.9 a	50.1 A	0.75 b	0.90 a	0.89 a	0.85 A
S + FYM (2:1)	30.5 g	36.8 e	37.0 e	34.8 D	0.51 d	0.60 d	0.60 d	0.57 D
S + RNW (1:1)	33.1 f	38.6 d	38.0 d	36.6 C	0.60 d	0.68 c	0.70 c	0.66 C
S + RNW (2:1)	25.1 h	29.5 g	29.5 g	28.0 F	0.50 e	0.55 d	0.60 d	0.55 D
Mean	31.5 B	36.8 A	36.8 A		0.57 B	0.66 A	0.68 A	
First season: 2022								
Sand (S)	21.7 k	23.0 k	22.6 k	22.4 G	0.43 e	0.46 e	0.45 e	0.45 E
S + loam (1:1)	36.5 e	42.3 c	42.5 c	40.4 B	0.70 c	0.81 b	0.81 b	0.77 B
S + loam (2:1)	29.5 i	34.6 f	35.0 f	33.0 E	0.55 d	0.65 c	0.65 c	0.62 C
S + FYM (1:1)	45.0 b	53.5 a	53.3 a	50.6 A	0.76 b	0.90 a	0.92 a	0.86 A
S + FYM (2:1)	31.3 h	37.2 e	37.5 e	35.3 D	0.52 d	0.63 c	0.61 d	0.59 D
S + RNW (1:1)	33.5 g	39.0 d	38.7 d	37.1 C	0.58 d	0.67 c	0.68 c	0.64 C
S + RNW (2:1)	25.4 j	29.5 i	30.1 h	28.3 F	0.48 e	0.55 d	0.56 d	0.53 D
Mean	31.8 B	37.0 A	37.1 A		0.57 B	0.67 A	0.67 A	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 14. Effect of medium type, irrigation water amount and their interactions on number of leaves and root length of *Schefflera actinophylla* (Endl.) Harms plant during 2021 and 2022 seasons.

Media	No. leaves/plant			Water amount (ml)				Mean
	200	300	400	Mean	200	300	400	
First season: 2021								
Sand (S)	7.00 i	7.53 i	7.40 i	7.31 G	21.50 g	23.00 f	23.10 f	22.53 G
S + loam (1:1)	13.10 e	19.81 b	19.96 b	17.62 B	36.56 c	41.80 b	41.33 b	39.90 B
S + loam (2:1)	8.36 h	13.30 e	14.00 e	11.89 E	23.25 f	29.11 e	28.86 e	27.11 E
S + FYM (1:1)	16.33 c	23.50 a	22.76 a	20.86 A	40.50 b	46.83 a	46.90 a	44.74 A
S + FYM (2:1)	10.00 g	15.16 d	16.10 c	13.75 D	27.66 e	32.00 d	32.21 d	30.62 D
S + RNW (1:1)	11.56 f	16.33 c	16.58 c	14.82 C	31.31 d	36.50 c	36.91 c	34.91 C
S + RNW (2:1)	7.11 i	11.50 f	11.50 f	10.04 F	21.75 g	26.93 e	27.50 e	25.39 F
Mean	10.49 B	15.31 A	15.47 A		28.93 B	33.74 A	33.83 A	
First season: 2022								
Sand (S)	7.33 i	7.90 i	7.50 i	7.58 G	21.33 h	24.50 g	24.10 g	23.31 G
S + loam (1:1)	13.55 e	20.61 b	20.10 b	18.09 B	37.03 c	41.30 b	41.56 b	39.96 B
S + loam (2:1)	8.53 h	14.00 e	14.33 e	12.29 E	24.00 g	29.48 e	29.39 e	27.62 E
S + FYM (1:1)	16.85 c	24.10 a	24.33 a	21.76 A	41.00 b	47.50 a	47.39 a	45.30 A
S + FYM (2:1)	10.56 g	15.50 d	16.21 d	14.09 D	28.11 e	33.00 d	32.71 d	31.27 D
S + RNW (1:1)	12.10 f	16.50 c	17.20 c	15.27 C	31.76 d	37.81 c	37.50 c	35.69 C
S + RNW (2:1)	7.76 i	11.50 f	11.80 f	10.35 F	21.30 h	26.10 f	27.61 f	25.00 F
Mean	10.96 B	15.73 A	15.93 A		27.79 B	34.24 A	34.32 A	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 17. Effect of medium type, irrigation water amount and their interactions on roots fresh and dry weights of *Schefflera actinophylla* (Endl.) Harms plant during 2021 and 2022 seasons.

Media	Roots F.W. (g)			Water amount (ml)				Mean
	200	300	400	Mean	200	300	400	
				First season: 2021				
Sand (S)	10.33 h	11.10 h	10.71 h	10.71 G	5.81 g	6.50 g	6.10 g	6.14 G
S + loam (1:1)	26.00 c	31.03 b	31.10 b	29.38 B	13.01 c	15.46 b	15.60 b	14.69 B
S + loam (2:1)	12.90 g	17.76 e	17.93 e	16.20 E	6.43 g	8.90 e	8.86 e	8.06 E
S + FYM (1:1)	29.86 b	34.76 a	34.80 a	33.14 A	14.79 b	17.38 a	17.50 a	16.56 A
S + FYM (2:1)	16.75 e	21.90 d	21.72 d	20.12 D	8.33 e	10.81 d	11.00 d	10.05 D
S + RNW (1:1)	21.81 d	26.73 c	26.91 c	25.15 C	10.90 d	13.38 c	13.50 c	12.59 C
S + RNW (2:1)	10.46 h	14.78 f	14.64 f	13.29 F	6.00 g	7.35 f	7.31 f	6.89 F
Mean	18.30 B	22.58 A	22.54 A		9.33 B	11.40 A	11.41 A	
				First season: 2022				
Sand (S)	10.50 h	11.00 h	10.63 h	10.71 G	5.90 g	6.63 g	6.17 g	6.23 G
S + loam (1:1)	26.50 c	31.38 b	31.40 b	29.76 B	13.50 c	15.86 b	15.78 b	15.05 B
S + loam (2:1)	13.20 g	18.15 e	18.50 e	16.62 E	6.81 g	9.45 e	9.51 e	8.59 E
S + FYM (1:1)	30.11 b	35.71 a	35.43 a	33.75 A	15.27 b	17.69 a	17.80 a	16.92 A
S + FYM (2:1)	17.23 e	22.53 d	22.35 d	20.70 D	8.71 e	11.23 d	11.10 d	10.35 D
S + RNW (1:1)	22.10 d	27.30 c	27.50 c	25.63 C	11.30 d	13.80 c	13.76 c	12.95 C
S + RNW (2:1)	10.91 h	15.13 f	15.10 f	13.71 F	6.31 g	7.50 f	7.50 f	7.10 F
Mean	18.65 B	23.03 A	22.99 A		9.69 B	11.74 A	11.66 A	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

occupying thereby the second rank. The better media can be used temporarily in production when FYM compost is not available.

b. Effect on chemical composition of the leaves:

Similarly, were those results of chlorophyll a, b and carotenoids contents (mg/g f.w.) and the percentages of N, P and K listed in Tables (18, 19 and 20), which were greatly improved in response to planting in mixtures amended with either additives employed in such trial at any ratio. However, the excellence was for planting in sand amended with FYM compost at equal volumetric ratio (1:1, v/v) which mostly gave the highest values of previously named constituents relative to the control medium (sand alone) and the other growing mixtures used in the first and second seasons. Several other mixtures used in such work, especially sand + loam (at any ratio), sand + RNW

compost (1:1, v/v) and sand + FYM compost (2:1, v/v) mixtures improved concentrations of the abovenamed constituents to considerable values.

Besides, irrigation with either 300 or 400 ml of water/plant markedly hastened contents of the measured constituents to values higher than those fulfilled by 200 ml/plant water level. However, 300 ml water volume attained some better means than 400 ml one in both seasons. As a result, combining between sand + FYM (1:1, v/v) for planting and either 300 or 400 ml of water/plant for irrigation acquired the utmost high values of active constituents qualified in most cases of both seasons. Furthermore, many other combinations recorded better chemical composition as mentioned before.

c. Effect on dry matter production and water use efficiency (WUF):

Results of dry matter production (g/plant/season) and WUE (ml/g D.M.)

Table 18. Effect of medium type, irrigation water amount and their interactions on chlorophyll a and b concentrations of *Schefflera actinophylla* (Endl.) Harms plant during 2021 and 2022 seasons.

Media	Water amount (ml)				Water amount (ml)			
	200	300	400	Mean	200	300	400	Mean
	Chlorophyll a (mg/g F.W.)				Chlorophyll a (mg/g F.W.)			
	First season: 2021							
Sand (S)	2.136	2.310	2.234	2.227	1.170	1.355	1.370	1.298
S + loam (1:1)	3.511	4.367	4.401	4.093	1.711	2.201	2.231	2.048
S + loam (2:1)	2.450	2.795	2.916	2.654	1.110	1.670	1.638	1.473
S + FYM (1:1)	3.910	4.955	4.688	4.518	1.920	2.431	2.376	2.242
S + FYM (2:1)	2.621	3.100	3.066	2.929	1.343	2.910	2.960	2.404
S + RNW (1:1)	3.125	3.669	3.610	3.468	1.833	2.316	2.300	2.150
S + RNW (2:1)	2.101	2.336	2.511	2.316	1.215	1.733	1.756	1.568
Mean	2.836	3.362	3.347		1.472	2.088	2.090	
	First season: 2022							
Sand (S)	2.138	2.276	2.211	2.208	1.156	1.313	1.278	1.249
S + loam (1:1)	3.372	3.900	3.795	3.689	1.694	2.235	2.283	2.071
S + loam (2:1)	2.371	2.685	2.710	2.589	1.251	1.633	1.589	1.491
S + FYM (1:1)	3.946	4.876	4.779	4.531	1.963	2.510	2.481	2.318
S + FYM (2:1)	2.591	3.121	3.158	2.957	1.440	2.951	2.911	2.434
S + RNW (1:1)	3.210	3.701	3.733	3.548	1.797	2.345	2.374	2.172
S + RNW (2:1)	2.311	2.501	2.510	2.441	1.246	1.753	1.800	1.600
Mean	2.848	3.293	3.271		1.507	2.106	1.960	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 19. Effect of medium type, irrigation water amount and their interactions on carotenoids and nitrogen concentrations of *Schefflera actinophylla* (Endl.) Harms plant during 2021 and 2022 seasons.

Media	Water amount (ml)				Water amount (ml)			
	200	300	400	Mean	200	300	400	Mean
	Carotenoids (mg/g F.W.)				N (%)			
	First season: 2021							
Sand (S)	1.078	1.166	1.179	1.141	1.150	1.393	1.410	1.318
S + loam (1:1)	1.795	2.414	1.997	2.069	2.131	2.800	2.737	2.556
S + loam (2:1)	1.145	1.469	1.510	1.375	1.510	1.936	1.855	1.767
S + FYM (1:1)	2.150	2.638	2.498	2.429	2.410	2.921	2.937	2.756
S + FYM (2:1)	1.353	1.799	1.583	1.578	1.793	2.150	2.107	2.017
S + RNW (1:1)	2.031	2.452	2.567	2.350	2.126	2.573	2.791	2.497
S + RNW (2:1)	1.271	1.400	1.533	1.401	1.338	1.516	1.564	1.473
Mean	1.546	1.906	1.838		1.780	2.184	2.200	
	First season: 2022							
Sand (S)	1.125	1.203	1.193	1.174	1.117	1.376	1.355	1.283
S + loam (1:1)	1.696	1.967	2.103	1.922	2.153	2.765	2.633	2.517
S + loam (2:1)	1.330	1.510	1.631	1.490	1.555	1.977	1.894	1.809
S + FYM (1:1)	1.918	2.186	2.313	2.139	1.891	2.810	2.769	2.490
S + FYM (2:1)	1.411	1.836	1.579	1.609	1.588	2.105	2.110	1.934
S + RNW (1:1)	1.816	1.999	2.076	1.964	2.036	2.361	2.433	2.277
S + RNW (2:1)	1.305	1.556	1.516	1.459	1.310	1.507	1.560	1.459
Mean	1.515	1.751	1.773		1.664	2.129	2.108	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

Table 20. Effect of medium type, irrigation water amount and their interactions on phosphorus and potassium concentrations of *Schefflera actinophylla* (Endl.) Harms plant during 2021 and 2022 seasons.

Media	P (%)			Water amount (ml)				
	200	300	400	Mean	200	300	400	Mean
First season: 2021								
Sand (S)	0.098	0.135	0.116	0.116	1.100	1.113	1.110	1.108
S + loam (1:1)	0.218	0.309	0.341	0.289	1.136	1.510	1.365	1.337
S + loam (2:1)	0.106	0.201	0.207	0.171	1.101	1.143	1.151	1.132
S + FYM (1:1)	0.314	0.418	0.415	0.382	1.301	1.520	1.538	1.453
S + FYM (2:1)	0.118	0.217	0.210	0.182	1.200	1.352	1.305	1.286
S + RNW (1:1)	0.205	0.306	0.238	0.250	1.133	1.261	1.360	1.251
S + RNW (2:1)	0.103	0.215	0.162	0.160	1.106	1.145	1.163	1.138
Mean	0.166	0.257	0.241		1.154	1.292	1.285	
First season: 2022								
Sand (S)	0.110	0.147	0.151	0.136	1.110	1.130	1.136	1.125
S + loam (1:1)	0.197	0.278	0.301	0.253	1.380	1.681	1.671	1.577
S + loam (2:1)	0.136	0.176	0.188	0.167	1.110	1.413	1.420	1.314
S + FYM (1:1)	0.310	0.389	0.365	0.355	1.430	1.718	1.801	1.650
S + FYM (2:1)	0.153	0.199	0.203	0.185	1.312	1.516	1.509	1.446
S + RNW (1:1)	0.171	0.251	0.231	0.218	1.355	1.613	1.605	1.524
S + RNW (2:1)	0.133	0.194	0.173	0.167	1.121	1.170	1.156	1.149
Mean	0.173	0.234	0.230		1.260	1.463	1.471	

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* There is no significant difference among means having the same letters in the same column or row according to DMRT at 5% level.

presented in Table (21) exhibited a similar behavior to obtained in case of dracaena ‘Bicolor’ plant, as dry matter production was improved under the different water amounts by planting in the different growing media formalized in both seasons, with the mastery of S + FYM (1:1, v/v) medium which maximized the mean values of this parameters to 56.31, 64.71 and 63.88 g/plant/season in the first season, and to 57.32, 65.03 and 64.82 g/plant/season in the second one by 200, 300 and 400 ml water quantities, successively. Planting in S + loam (1:1, v/v) and S + RNW compost (1:1, v/v) occupied the 2nd and 3rd ranks, consecutively.

Hence, the least values of irrigation water used for production 1 g of dry matter (WUE) were attained by the abovementioned three growing media, with the dominance of S + FYM (1:1, v/v) medium because planting in such medium consumed only 443.12 and 437.72 ml of irrigation water in the first and second seasons, respectively to be already the least water volume consumed for production of 1 g D.M. compared to

other media used in the two seasons. Accordingly, the highest WUE obtained by growing media employed in such trial can be scaled-down as follows: sand + FYM (1:1, v/v) medium > sand + loam (1:1, v/v) medium > sand + RNW (1:1, v/v) medium.

From the previous gains, it can be proposed to planting both *Dracaena marginata* ‘Bicolor’ and *Schefflera actinophylla* plant species in sand amended with FYM compost at equal volumetric ratio (1:1, v/v) and irrigated them with 300 ml of irrigation water/plant (pot), day after day during the active growing season to obtain the best growth, high quality and better WUE.

DISCUSSION

The results of such work exhibited that providing the sand with any additives used at any ratio hastened growth and quality of pot *Dracaena marginata* ‘Bicolor’ and *Schefflera actinophylla* plants, especially when applied at 1:1 by volume ratio which scored better results than 2:1 ratio. This may

Table 21. Water use efficiency by *Schefflera actinophylla* (Endl.) Harms plant under various media, water amounts and their interactions during 2021 and 2022 seasons.

Total amount of water (ml)/plant/season	Medium type	Total D.M. (g)/plant/season		WUE (ml/g D.M.)	
		2021	2022	2021	2022
18400 ml (for 200 ml water treatment)	Sand (S)	22.09	22.25	832.96	826.97
	S + loam (1:1)	46.45	47.81	396.13	384.86
	S + loam (2:1)	28.22	28.99	652.02	634.70
	S + FYM (1:1)	56.31	57.32	326.76	321.01
	S + FYM (2:1)	30.16	31.05	610.08	592.59
	S + RNW (1:1)	39.53	39.58	465.47	464.88
	S + RNW (2:1)	22.79	23.63	807.37	778.71
27600 ml (for 300 ml water treatment)	Sand (S)	25.39	26.35	1087.04	1047.44
	S + loam (1:1)	55.47	56.32	497.57	490.06
	S + loam (2:1)	35.68	36.58	773.54	754.51
	S + FYM (1:1)	64.71	65.03	426.52	424.42
	S + FYM (2:1)	38.54	38.88	716.14	709.88
	S + RNW (1:1)	48.46	49.70	569.54	555.33
	S + RNW (2:1)	29.53	30.49	934.64	905.22
36800 ml (for 400 ml water treatment)	Sand (S)	23.46	23.84	1568.63	154.63
	S + loam (1:1)	55.30	55.92	665.46	658.08
	S + loam (2:1)	35.57	36.82	1034.58	999.46
	S + FYM (1:1)	63.88	64.82	576.08	567.73
	S + FYM (2:1)	38.23	38.76	962.60	949.43
	S + RNW (1:1)	48.68	49.62	755.96	741.64
	S + RNW (2:1)	29.87	30.77	1232.01	1195.97
Medium mean	Sand (S)	23.65	24.15	1162.88	1139.35
	S + loam (1:1)	52.41	53.35	519.72	511.00
	S + loam (2:1)	33.16	34.13	820.05	796.22
	S + FYM (1:1)	61.63	62.39	443.12	437.72
	S + FYM (2:1)	35.64	36.23	762.94	750.63
	S + RNW (1:1)	45.56	46.30	596.99	587.28
	S + RNW (2:1)	27.40	28.30	991.34	959.97

* FYM: farm yard manure compost; RNW: River Nile Weed compost.

* Number of irrigation times during each season = 92 times, hence the total amount of water for 200, 300 and 400 ml water treatments = 18400, 27600 and 36800 ml, respectively.

be due to the higher manurial value of potting organic compost, such as FYM and RNW composts that luxuriously supply the plants with various nutrients required for good and healthy growth (Abdel-Fattah *et al.*, 2008). Besides, the well composted organic wastes usually improve texture and structure of the growing mixtures, electrical conductivity (EC), pH, organic matter and organic carbon contents, fertility and cation exchange capacity (CEC), plus improving total porosity and the water holding capacity (WHC) of the mixture, consequently water and nutrient available for the plants (Farhain *et al.*, 2022). In this regard, Saadawy *et al.* (2005) found that potting medium of bagasse compost significantly gave the tallest schefflera plants, the highest No. leaves, the heaviest fresh and dry roots weight. It also raised shoot fresh and dry weights and concentrations of total chlorophyll, total carbohydrates, N and P to the maximum values, but the highest K % was noticed in plants grown in broad bean straw medium. Likewise, Abdel-Fattah *et al.* (2008) mentioned that a mixture of sand + FYM (1:1, v/v) increased the means of *Schefflera actinophylla* growth attributes to maximum, while that was true for chlorophyll a, b, carotenoids, N, P, K, Fe, Mn and Zn concentrations by planting in sand + FYM + chicken manure (1:1:1, v/v/v) mixture.

The loam as a natural soil conditioner improves texture and porosity of the potting medium and increases its CEC, WHC and fertility. Thus, more water and nutrients become more available uptaking by roots, and that of course leads to activate assimilation which produces more constituents and drier biomass (Handreck and Black, 2022). In this concern, Shahin *et al.* (2007) recommended to culture of *Agave americana* cv. Marginata suckers in sand + 10% loam + 10% chicken manure compost as a most reliable potting medium for best growth, sucker production and high water use efficiency. El-Sayed *et al.* (2009) declared that vegetative and root growth characters of *Nephrolepis exaltata* fern plant as well as chlorophyll a, b, and carotenoids

contents and total carbohydrates concentrations were greatly improved by planting in sand + clay + peatmoss (1:1:1, by volumes) mixture, but higher N, P and K concentrations were attained by planting in sand + clay + spent mushroom compost (1:1:1, by volumes) one. On *Brassaia actinophylla* and *Euonymus japonicus* foliage pot-plants, Shahin *et al.* (2012) pointed out that consolidating the sand with either 25% loam or 25% FYM compost significantly improved the values of their vegetative and root growth traits and leaf content of pigments, N, P and K with the mastery of FYM compost.

Regarding the effect of water supply, many workers decided that irrigation the plants with the proper water quantity may reduce or prevent the formation of abscisic acid (ABA) which reduced root growth, increases defoliation decreases mineral uptaking, inhibits the whole growth and finally may be plant death (Hoffman *et al.*, 1999). On the other side, providing the plant with the suitable water requirements increases auxins and gibberellins levels, simultaneously with reduces ABA level, which might activate meristems and encourage cell division, elongation and enlargement plus increasing metabolites formation, and that will be reflected well on enhancing the growth and biomass production of plant organs (Dosmann *et al.*, 1999). Moreover, Scagel and Bryla (2022) emphasized that the suitable irrigation frequency and water volume save enough water needed for promoting growth, flowering and nutrient uptake of three container-grown *Rhododendron* cultivars 'Catawbiense Album', 'Gibraltar' and 'P.J.M.' during the following growing season.

In general, the previous results can be supported by those revealed by Saadawy *et al.* (2011) on *Ficus nitida* 'Hawaii', Nofal *et al.* (2014) on *Hymenocallis speciosa*, O'Meara *et al.* (2014) on *Hydrangea macrophylla* and *Gardenia jasminoides*, Said (2006) on *Duranta erecta* var. variegata, El-

Fauly *et al.* (2020) on *Asparagus densiflorus* 'Myers', El-Ghazaly *et al.* (2021) on *Gasteria carinata* var. *verucosa*, Shahin and Sayed (2021) on *Ochna serrulate*, Shahin *et al.* (2021) on *Ranunculus asiaticus* var. Orange, El-Haddadi *et al.* (2022) on *Tetraclinis articulata*, Heidari *et al.* (2022) stated that it is possible to replace expensive imported cocopeat, partly or wholly by either the palm trunk compost (prepared only from the date palm trunk) or the palm tree (composted from all date palm parts) to achieve the greatest stem diameter, bud diameter, bud length and quality index of lily cut flowers with the highest concentration of chlorophyll a, b and total carotenoids.

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تحديد بيئة النمو وكمية مياه الري الأكثر ملائمة لإنتاج بعض نباتات الزينة الورقية

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أجريت تجربتان عاملتان منفصلتان، بتصميم عشوائي كامل وثلاث مكررات داخل إحدى الصوبات البلاستيكية بالمزرعة الإستوائية بكم أمبو، محافظه أسوان خلال موسمي ٢٠٢١ و ٢٠٢٢ لدراسة تأثير الزراعة في مخاليط النمو التالية: الرمل فقط (كمقارنة)، الرمل + الطمي، الرمل + كمبوست مخلفات المزرعة، الرمل + كمبوست عشب نهر النيل (أعدت هذه المخاليط إما بنسبه (١:١) أو (١:٢) بالحجم)، كميات مياه الري: ٢٠٠، ٣٠٠، و ٤٠٠ مل لكل نبات (اصيص بلاستيك قطره ١٦ سم) والتفاعلات بينهما على النمو، التركيب الكيماوي، إنتاج المادة الجافه وكفاءه استخدام المياه لنباتين من نباتات الأصص الورقية، شائعه التداول في مصر هما الدراسينا الزجاجي (*Dracaena marginata*) والشفليرا الأسترالية (*Schefflera actinophylla*). أوضحت النتائج المتحصل عليها أن متوسطات مختلف قياسات النمو الخضري والجذري لكلا النباتين قد زادت معنوياً بالزراعة في مخاليط النمو المستخدمه بهذه الدراسه، مع تفوق معاملة الزراعة في مخلوط الرمل + كمبوست مخلفات المزرعة (١:١)، والتي أعطت أعلى المتوسطات على الإطلاق بكلا الموسمين. أما الزراعة في مخلوط الرمل + الطمي (١:١) وفي مخلوط الرمل + كمبوست عشب النيل (١:١) فقد احتلت المرتبه الثانيه والثالثه على الترتيب، بينما حققت الزراعة في مخلوط الرمل المدعم اما بالطيني أو كمبوست عشب نهر النيل بنسبه (١:٢) بألحجم) أقل نسبه تحسن في النمو. ولقد أدت زيادة كمية مياه الري من ٢٠٠ مل الى ٣٠٠ أو ٤٠٠ مل لكل نبات الى أقصى زيادة معنوية في متوسطات قياسات النمو المختلفه، دون وجود فروق معنويه فيما بين هذين المعدلين في معظم الحالات بكلا الموسمين. لذلك، فإن زياده كميته مياه الري من ٣٠٠ مل الى ٤٠٠ مل/نبات لم تحدث اي تحسن اضافي في النمو. وعليه، فإن الجمع بين الزراعة في بيئة الرمل + كمبوست مخلفات المزرعة (١:١) بالهجم) والري إما بمعدل ٣٠٠ أو ٤٠٠ مل/نبات سجل أعلى المتوسطات لقياسات النمو المختلفه مقارنة بالتوليفات الأخرى في كلا الموسمين. ولقد تم الحصول على اتجاه مشابه فيما يتعلق بتركيزات كلوروفيللي أ، ب، الكاروتينويدات، النسبه المئوية للنيتروجين، الفوسفور والبوتاسيوم بأوراق كلا النباتين بكلا الموسمين. بالمثل، فإن إنتاج المادة الجافه بكلا النباتين بلغ أقصاه بالزراعة في مخلوط الرمل + كمبوست مخلفات المزرعة (١:١) بالهجم)، زيادة كمية مياه الري إلى ٣٠٠ أو ٤٠٠ مل/نبات و معاملات التفاعل بينهما. ومن ثم، فإن أفضل معدل لكفاءة استخدام المياه (WUE) تحقق أيضاً بمعاملات التفاعل سابقه الذكر. من هذه النتائج، يمكن النصح بزراعة نباتات كل من الدراسينا الزجاجي (*Dracaena marginata*) والشفليرا الأسترالية (*Schefflera actinophylla*) في مخلوط الرمل المدعم بكمبوست مخلفات المزرعة بنسب حجمية متساوية لكليهما وريها بمعدل ٣٠٠ مل/نبات، مرة يوم بعد يوم خلال موسم النمو النشط للحصول على أفضل مظهر للنمو وعلى نباتات أصص ورقية رائعة الجمال.