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NATURAL LOCAL MEDIA AND THEIR EFFECT ON WATER REQUIREMENTS OF *Ficus* "HAWAII"

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ABSTRACT

This study was carried out in the nursery of the Ornamental Plant Research Department, Horticulture Research Institute, Giza, Egypt during the period from February to November of the two successive seasons of 2009 and 2010. A factorial experiment, in a randomized complete block design (RCBD), with three replicates, was conducted, to investigate the effects of different watering regimes (irrigation with 300, 450 and 600 cm^3/pot/week) comprising the main plot and potting media (peat moss, water hyacinth compost, rice hulls compost, date palm leaf compost and a mixture of the four components at equal volume parts) representing the sub-plots on *Ficus nitida* "Hawaii" plants grown in 25 cm dia. plastic pots.

Results show that performance of plants grown in the mixed compost and watered with 450 cm^3/pot/week was the best in all characters studied, followed by plants grown in the same medium and watered with either 600 cm^3/pot/week (in the second position) or with 300 cm^3/pot/week (in the third one). Performance of plants grown in rice hulls compost and watered with 450 cm^3/pot/week came in the fourth rank, followed by those grown in peat moss and watered either with 450 or 600 cm^3/pot/week, occupying the fifth position in this concern. In contrast, plants grown in date palm leaf compost and watered with 300 cm^3/pot/week scored the lowest records in almost all parameters studied, preceded by those grown in the same medium and watered either with 450 or 600 cm^3/pot/week.

Keywords: watering regime, potting media, peat moss, water hyacinth compost, rice hulls compost and date palm leaf compost.

INTRODUCTION

Ficus nitida Thunb. cv. "Hawaii", Family Moraceae. Chinese or Malayan banyan tree, Indian laurel, curtain fig or laurel rubber. Origin in India and Malaysia. Hardiness zones: USDA 9-11. Potentially massive evergreen trees with a dense rounded canopy, spreading with age, heavy looking, formal. Width generally slightly greater than height, (InterNet Site 1, 2010). The leaves are very persistent, lustrous, glabrous oval tapering to acuminate tip. Trunk and branches have thin, smooth, grayish white bark with lenticels on small branches, latex producer. Flowers are small, auxiliary and inconspicuous. Fruits are small yellowish green rounded nuts. Landscape use: Dense shade tree, street tree only in sites with wide medians, large courtyards and interior malls, large containers, and topiary. It can be maintained as a slow growing interior container plant for some time. (InterNet Site 1, 2010).

The quantity of water available for irrigation is getting scarce in Egypt, especially as problems arise on the division of Nile water among the nine nations living on its waters. Water assumes great importance for assured

crop production. More efficient irrigation practices are needed in ornamental plant production to reduce the amount of water used for production as well as runoff of fertilizers.

Agricultural wastes or agrowastes, such as water hyacinth, date palm leaves, and rice hulls (or rice husks) represent a problem. The continuous accumulation of these wastes causes a lot of harm to the environment. It is necessary to get rid of these wastes by means of a scientific and economic method. A good approach to solve this problem is in turning these wastes to media suitable for growing a lot of plants. Through this technique we can make use of these wastes and save a big sum of money needed for importing agricultural media from abroad.

Blok *et al.* (2009) gave an overview of the substrates used for horticultural rooting media in Holland in the period from 2001 to 2005. They reported an interest of public and society in a possible substitution of peat. They showed that for *Hedera* and *Schefflera*, the ultimate alternative mix was superior to the commercial standard used. For five species, *Anthurium, Chrysanthemum, Gerbera, Spathiphyllum and Castanospermum*, the alternative mix proved equal to the commercial standard. For eight species, *Azalea, Guzmania,* poinsettia*, Rosa, Saintpaulia, Adiantum, Crassula and Ficus*, results were poorer than on the standard medium. The growers however, felt confident that the alternative mixes could do better if the growing system, often the irrigation frequency, could be adapted to the experimental growing medium. The most popular peat moss alternatives were coir products. Other alternatives used were various barks, rice hulls, perlite, wood fiber, composts, and rockwool granulate. Those alternatives were used in mixtures from 5 to 30%.

Peat moss: Peat moss is an accumulation of partially decayed vegetation matter or histosol (a soil consisting primarily of organic materials, these soils have 40 cm or more of organic soil material in the upper 80 cm). It comprises any of more than 150-300 species of plants that make up the bryophyte genus *Sphagnum*, which grow in dense clumps around ponds, in swamps and bogs. Peat moss can hold 20 times its weight of water. Peat can store nutrients, although it is not fertile itself.

Water hyacinth: *Eichhornia crassipes*, Family *Pontederiaceae* is a floating aquatic plant, of tropical America, having showy bluish-purple flowers and swollen leafstalks. It forms dense masses in rivers, ponds, etc. It is the world's worst waterweed that is now clogging up waterways throughout warm countries in the world. The primary benefit of water hyacinth was in the positive effect, the plant had, on soil texture. It is ideal for composting and can be used for this purpose, InterNet Site 2, 2010.

Rice hulls: (or rice husks) are the hard protecting coverings of grains of rice. Rice hulls are organic material and can be composted. A number of rice-producing countries, (e.g. Thailand), are currently conducting research on industrial uses of rice hulls, (InterNet Site 3, 2010).

Date palm leaflets: Date trees produce large quantities of agricultural waste. For example, each date tree produces about 20 kg of dry leaves yearly (Khiyami *et al.*, 2008). Osman *et al.* (2010) stated that date palm (*Phoenix*

dactylifera) is one of the most important fruit species grown in Egypt. Date palms are distributed in Nile Valley, Oases and desert districts.

This work aimed to find out the individual and the combined impact of different irrigation regimes and some of the local agrowastes on growth, developments and chemical constituents of *Ficus nitida* "Hawaii" plants.

MATERIALS AND METHODS

This study was carried out in the nursery of the Ornamental Plant Research Department, Horticulture Research Institute, Giza, Egypt during the period from February to November of the two seasons of 2009 and 2010.

A factorial experiment, in a randomized complete block design (RCBD), with three replicates, was conducted, to investigate the effects of different watering regimes (irrigation with 300, 450 and 600 cm^3/pot/week) comprising the main plot and potting media (peat moss, water hyacinth compost, rice hulls compost, date palm leaf compost and a mixture of the four components at v:v equal parts) representing the sub-plots. There were 6 plants in each replicate. Each plant was planted individually in a 25 cm plastic pot filled with one of the 5 different potting media as mentioned above.

The above mentioned amounts of water were given once a week in winter. In summer, the same amounts were divided on two times a week on Sunday and Wednesday. The amount of water needed to saturate a single pot (600 cm^3/pot) was calculated by measuring the difference in volumetric moisture content 1 h and approximately 24 h after irrigation.

Composting of agricultural wastes was carried out according to Abd el-Sattar (2002). Plant residues were left to dry in the open for one week in a shaded place. They were then enriched to hasten composting by thoroughly mixing 1 liter of aqueous solution of ammonium sulfate (at 2 g/l) with each 1 kg of plant residue for 2 successive days. In the third day the ammonium sulfate was substituted with an aqueous solution of commercial phosphoric acid 38% (at 0.4 cm/l). In the fourth day water only was added. These procedures were repeated 4 times (reducing solutions or water amount to the half) during which the three kinds of plant residues were stirred to allow aerial composting. About one kilogram of the potting medium was enough for each 25 cm dia. pot.

Thus, the 5 potting media were:

1 - Peat moss (as a control)
2 - Water hyacinth compost
3 - Rice hulls compost
4 - Date palm leaflets compost
5 - A mixture of the 4 components at v:v equal parts

Analysis of these media is shown in table (a).

Table (a). Media analysis

Element	Unit	Peat moss	Rice hull	W. hyacinth	Date palm leaflets
N	%	0.79	0.40	0.50	0.80
P_2O_5	%	0.05	0.60	0.86	0.29
K_2O	%	0.02	1.70	4.81	0.29
Acidity	*p*H	6.28	6.40	7.00	6.85

Data obtained in both seasons were the effects of straw kind on:

1 - Plant height (cm)
2 - Number of leaves/plant
3 - Shoot fresh weight (g)
4 - Shoot dry weight (g)
5 - Root fresh weight (g)
6 - Root dry weight (g)
7 - Root length (cm)

These data were statistically analyzed using SAS 1995 computer program, and means were compared by Duncan's multiple range test according to Snedecor and Cochran (1980). According to this test, means with the same letter are not significantly different.

Additional data obtained in the second season only were the effects on:

9 - Contents of total chlorophyll and carotenoids (mg/g FW*) according to Moran (1982).
10 - Shoot content of total carbohydrates (mg/g DW**) according to A.O.A.C. (1995).
11 - Shoot content of N, P and K % (DW) according to Jackson (1973).

*** = fresh weight, ** = dry weight**

RESULTS

1 - Effect of media type and watering amounts on plant height, (Table 1).

a - Media type: The media type affected plant height significantly in the two seasons of this study. The significantly tallest plants (38.21 and 42.86 cm in the first and second seasons, respectively) were those grown in the mixed compost, followed by those grown in rice hulls compost (34.77 and 38.03 cm in the first and second seasons, respectively). Those grown in water hyacinth compost came in the third position as their mean heights were 28.62 and 31.87 cm in the first and second seasons, respectively. Plants grown in peat moss occupied the 4^{th} position with heights of 17.41 and 22.51 cm in the first and second seasons, respectively, while using palm leaves compost resulted in the significantly shortest plants (12.46 and 16.41 cm in the first and second seasons, respectively).

b - Watering amounts: The watering amounts exerted significant effect in both seasons. The tallest plants (30.72 and 34.41 cm in the first and second seasons, respectively) were a result of giving 450 cm^3 water a week, followed by those irrigated with 600 cm^3 a week (25.79 and 29.96 cm in the first and second seasons, respectively). The shortest plants were those watered with only 300 cm^3 a week (22.37 and 26.63 cm in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: The interaction between media type and watering amounts was significant in the two seasons. Plants irrigated with 450 cm^3 a week and either grown in the mixed media or in the rice hulls medium were significantly the tallest (43.30 and 42.97 cm, respectively in the first season; and 47.53 and 47.37 cm, respectively in the second one), followed by plants grown in the mixed media and either irrigated with 600 cm^3 a week (37.70 and 40.77 cm, respectively) in the first and second seasons; or with 300 cm^3 a week (40.27 cm) in the second season only. Plants in the third position

in this concern were those grown in rice hulls compost and irrigated with 600 cm^3 a week (32.93 and 35.75 cm in the first and second seasons, respectively), in water hyacinth compost and irrigated with 450 cm^3 a week (31.47 and 34.27 cm in the first and second seasons, respectively), in addition to those planted in the mixed compost and irrigated with 300 cm^3 a week (33.63 cm in the first season) or in water hyacinth compost and irrigated with 600 cm^3 a week (33.27 cm in the second season). The fourth rank was occupied by plants grown in rice hulls compost and watered with 300 cm^3 a week (28.40 and 31.17 cm in the first and second seasons, respectively), besides plants grown in water hyacinth compost and irrigated with 600 cm^3 a week (29.53 cm in the first season).

The significantly shortest plants were those grown in the mixed compost and watered with 300 cm^3 a week (11.53 and 13.67 cm in the first and second seasons, respectively), in addition to those grown in peat moss and irrigated with 300 cm^3 a week or those grown in date palm leaf compost and watered with 600 cm^3 a week (13.40 and 11.50 cm, respectively) in the first season only. This lowest group is preceded by plants grown in date palm leaf compost and watered either with 450 cm^3 a week (14.33 and 18.40 cm in the first and second seasons, respectively) or with 600 cm^3 a week (17.17 cm in the second season), in addition to plants grown in peat moss and watered with either 600 cm^3 a week (17.30 cm) or 300 cm^3 a week (20.00 cm) in the first and second seasons, respectively.

Table (1): Effect of media type and watering amounts on plant height (cm)

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	17.30 g	21.53 f	13.40 h	17.41 D	23.03 f	24.50 f	20.00 g	22.51 D
W. hyacinth	29.53 d	31.47 cd	24.87 e	28.62 C	33.27 cd	34.27 c	28.07 e	31.87 C
Rice hull	32.93 c	42.97 a	28.40 d	34.77 B	35.57 c	47.37 a	31.17 d	38.03 B
Palm leaves	11.50 h	14.33 gh	11.53 h	12.46 E	17.17 g	18.40 g	13.67 h	16.41 E
Mixture	37.70 b	43.30 a	33.63 c	38.21 A	40.77 b	47.53 a	40.27 b	42.86 A
Mean	25.79 B	30.72 A	22.37 C		29.96 B	34.41 A	26.63 C	

2 - Effect of media type and watering amounts on number of leaves, (Table 2).

a - Media type: The effect of media type on number of leaves was significant in the two seasons. The highest number of leaves was noticed on plants grown in the mixed compost (30.78 and 31.70 leaves in the first and second seasons, respectively), followed by plants planted in rice hulls compost (25.63 and 26.38 leaves in the first and second seasons, respectively). Plants grown in water hyacinth compost had number of leaves in the third position (21.42 and 23.00 leaves in the first and second seasons, respectively). Plants grown in date palm leaf compost had the least number of leaves (15.93 and 17.57 leaves in the first and second seasons, respectively), preceded by those grown in peat moss

where the corresponding values were 19.30 and 19.66 leaves in the first and second seasons, respectively.

b - Watering amounts: The watering amounts exerted a significant influence on number of leaves. The highest value in this regard belonged to plants watered with 450 cm^3 a week (24.58 and 26.69 leaves in the first and second seasons, respectively), followed by plants irrigated with 600 cm^3 a week (22.32 and 23.41 leaves in the first and second seasons, respectively). The significantly lowest number of leaves was observed on plants watered with 300 cm^3 a week (20.94 and 20.89 leaves in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: The interaction between media type and watering amounts had an insignificant effect on number of leaves.

Table (2): Effect of media type and watering amounts on number of leaves

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	18.57 a	21.07 a	18.27 a	19.30 D	19.70 a	22.20 a	17.07 a	19.66 D
W. hyacinth	21.53 a	24.47 a	18.27 a	21.42 C	22.57 a	25.93 a	20.50 a	23.00 C
Rice hull	25.17 a	27.90 a	23.83 a	25.63 B	26.77 a	30.23 a	22.13 a	26.38 B
Palm leaves	15.47 a	17.47 a	14.87 a	15.93 E	17.07 a	19.30 a	16.33 a	17.57 E
Mixed	30.87 a	32.00 a	29.47 a	30.78 A	30.93 a	35.77 a	28.40 a	31.70 A
Mean	22.32 B	24.58 A	20.94 C		23.41 B	26.69 A	20.89 C	

3 - Effect of media type and watering amounts on shoot fresh weight, (Table 3).

a - Media type: The Effect of media type on shoot fresh weight was found to be significant in both seasons. The heaviest fresh plants (113.03 and 126.04 g in the first and second seasons, respectively) were those grown in the mixed compost, followed by those grown in rice hulls compost (105.14 and 113.02 g in the first and second seasons, respectively). Plants grown in water hyacinth compost had fresh weight in the third position (95.59 and 95.22 g in the first and second seasons, respectively). The lightest fresh plants were a result of using date palm leaf compost (69.79 and 67.84 g in the first and second seasons, respectively), preceded by those grown in peat moss (85.14 and 87.99 g in the first and second seasons, respectively).

b - Watering amounts: The effect of watering amounts on shoot fresh weight was significant in both seasons. Plants had watered with 450 cm^3 a week were significantly the heaviest (100.49 and 105.78 g in the first and second seasons, respectively). The second position was occupied with plants irrigated with 600 cm^3 a week (95.05 and 98.98 g in the first and second seasons, respectively). The significantly lowest value, in this concern, were those watered with 300 cm^3 a week (85.68 and 89.31 g in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: This interaction exerted a significant influence on shoot fresh weight in both seasons. Plants grown in mixed compost and irrigated either with 450 cm^3 a week (120.63 and 133.10 g in the first and second seasons, respectively) or with 600 cm^3 a week (117.80 and 130.23 g in the first and second seasons, respectively) had the heaviest fresh weight. Plants in the second position were those planted in rice hulls compost and watered with 450 cm^3 a week (114.43 and 123.13 g in the first and second seasons, respectively). Plants in the third position were those planted in rice hulls compost and watered with 600 cm^3 a week (102.23 and 114.70 g in the first and second seasons, respectively), in the mixed compost and irrigated with 300 cm^3 a week (100.67 and 114.80 g in the first and second seasons, respectively), in rice hulls and watered with 300 cm3 a week (98.77 g in the first season) or in water hyacinth and watered with either 450 or 600 cm^3 a week (101.17 and 97.47 g, respectively in the first season).

Table (3). Effect of media type and watering amounts on shoot fresh weight (g)

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	84.20 f	93.30 de	77.93 g	85.14 D	87.60 g	97.43 de	78.93 h	87.99 D
W. hyacinth	97.47 cd	101.17 c	88.13 ef	95.59 C	94.40 ef	100.80 d	90.47 fg	95.22 C
Rice hull	102.23 c	114.43 b	98.77 cd	105.14 B	114.70 c	123.13 b	101.23 d	113.02 B
Palm leaves	73.53 g	72.93 g	62.90 h	69.79 E	67.97 j	74.43 i	61.13 k	67.84 E
Mixed	117.80 ab	120.63 a	100.67 c	113.03 A	130.23 a	133.10 a	114.80 c	126.04 A
Mean	95.05 B	100.49 A	85.68 C		98.98 B	105.78 A	89.31 C	

The lightest fresh plants were those grown in date palm leaf compost and watered with 300 cm^3 a week (62.90 and 61.13 g in the first and second seasons, respectively), preceded by those grown in date palm leaf compost and watered with 600 cm^3 a week (73.53 and 67.97 g in the first and second seasons, respectively), in peat moss and watered with 300 cm^3 a week or in date palm leaf compost and watered with 450 cm^3 a week (77.93 and 72.93 g, respectively in the first season).

4 - Effect of media type and watering amounts on shoot dry weight, (Table 4).

a - Media type: The effect of media type was significant in both seasons. The heaviest dry shoots were those grown in the mixed compost (64.41 and 77.19 g in the first and second seasons, respectively), followed by those grown in rice hulls compost (61.71 and 64.66 g in the first and second seasons, respectively) and those grown in water hyacinth compost (47.20 and 50.18 g in the first and second seasons, respectively). The lightest dry shoot belonged to plants grown in date palm leaf compost (22.52 and 24.47 g in the first and second seasons, respectively). However, plants

grown in peat moss had dry shoot weight in the pre-lowest position (33.92 and 41.04 g in the first and second seasons, respectively).

b - Watering amounts: The effect of watering amounts on shoot dry weight was found to be significant in the two seasons. The highest values in this concern (52.13 and 57.56 g in the first and second seasons, respectively) were a result of giving plants water at 450 cm^3 a week. Giving water to plants at 600 cm^3 a week resulted in shoot dry weight in the second position (48.38 and 52.48 g in the first and second seasons, respectively). Plants irrigated with 300 cm^3 a week had the lowest shoot dry weights (37.35 and 44.48 g in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: The significant effect of the interaction between media type and watering amounts on shoot dry weight was confined to the second season only. The heaviest dry shoots belonged to plants grown in mixed compost and watered with 450 cm^3 a week (71.03 and 86.17 g in the first and second seasons, respectively), in addition to plants grown in the same medium and watered with 600 cm^3 a week (86.10 g in the first season), followed in the second position by plants grown in rice hulls compost and irrigated with 450 cm^3 a week in the first season and those grown in mixed compost and watered with 600 cm^3 a week in the second season (67.07 and 79.90 g, respectively). Values in the third category were a result of planting in rice hulls compost and irrigated with either 600 or 450 cm^3 a week (63.07 and 73.27 g, in the first and second seasons, respectively). The lowest records in this regard were a result of planting in date palm leaf compost and giving water at 300 cm^3 a week (15.67 and 20.43 g, in the first and second seasons, respectively), preceded by plants grown in date palm leaf compost and given water at 600 cm^3 a week (23.97 and 25.60 g, in the first and second seasons, respectively), in addition to plants grown in peat moss and watered with 300 cm^3 a week and those grown in date palm leaf compost and given water at 450 cm^3 a week (23.70 and 27.37 g, in the first and second seasons, respectively).

Table (4): Effect of media type and watering amounts on shoot dry weight (g)

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	36.53 a	41.53 a	23.70 a	33.92 D	42.73 i	47.40 gh	33.00 j	41.04 D
W. hyacinth	50.23 a	53.07 a	38.30 a	47.20 C	51.10 fg	53.60 ef	45.83 hi	50.18 C
Rice hull	63.07 a	67.07 a	55.00 a	61.71 B	63.07 d	73.27 c	57.63 e	64.66 B
Palm leaves	23.97 a	27.93 a	15.67 a	22.52 E	25.60 k	27.37 k	20.43 l	24.47 E
Mixed	68.10 a	71.03 a	54.10 a	64.41 A	79.90 b	86.17 a	65.50 d	77.19 A
Mean	48.38 B	52.13 A	37.35 C		52.48 B	57.56 A	44.48 C	

5 - Effect of media type and watering amounts on root fresh weight, (Table 5).

a - Media type: The effect of media type was found to be significant on root fresh weight in both seasons. The highest value in this regard belonged to plants grown in the mixed compost (40.87 and 52.38 g, in the first and

second seasons, respectively), followed by those grown in rice hulls compost (35.93 and 40.18 g, in the first and second seasons, respectively). Root fresh weight of plants grown in water hyacinth compost occupied the third position (30.02 and 32.98 g, in the first and second seasons, respectively) and those grown in peat moss (28.79 g, in the first season). Plants grown in date palm leaf compost had the significantly lowest root fresh weight (25.23 and 19.38 g, in the first and second seasons, respectively).

b - Watering amounts: the watering amounts affected root fresh weight significantly in both seasons. The heaviest fresh roots belonged to plants watered with 450 cm^3 a week (35.28 and 37.89 g, in the first and second seasons, respectively), followed by those irrigated with 600 cm^3 a week (32.51 and 34.85 g, in the first and second seasons, respectively). The lightest fresh roots were obtained from plants watered with 300 cm^3 a week (28.72 and 31.31 g, in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: the interaction between media type and watering amounts exerted a significant influence on root fresh weight in the second season only. Irrespective of this fact, the heaviest fresh roots belonged to plants grown in the mixed compost watered with 450 cm^3 a week (44.47 and 56.30 g, in the first and second seasons, respectively), followed by those grown in the mixed compost watered with 600 cm^3 a week (40.07 and 51.90 g, in the first and second seasons, respectively), in addition to those grown in rice hulls compost watered with 450 cm^3 a week or grown in the mixed compost watered with 300 cm^3 a week (37.53 and 38.07, respectively in the first season). The third position in this concern was occupied by fresh roots grown either in rice hulls compost watered with 600 cm^3 a week or grown in the mixed compost watered with 300 cm^3 a week (36.77 and 48.93 g in the first and second seasons, respectively).

Table (5): Effect of media type and watering amounts on root fresh weight (g)

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	29.30 a	31.67 a	25.40 a	28.79 C	28.07 g	34.10 f	23.37 h	28.51 D
W. hyacinth	31.47 a	32.97 a	25.63 a	30.02 C	34.07 f	34.90 f	29.97 g	32.98 C
Rice hull	36.77 a	37.53 a	33.50 a	35.93 B	40.40 de	42.27 d	37.87 e	40.18 B
Palm leaves	24.93 a	29.77 a	21.00 a	25.23 D	19.83 i	21.87 hi	16.43 j	19.38 E
Mixed	40.07 a	44.47 a	38.07 a	40.87 A	51.90 b	56.30 a	48.93 c	52.38 A
Mean	32.51 B	35.28 A	28.72 C		34.85 B	37.89 A	31.31 C	

The lightest root fresh weight was obtained when plants were grown in date palm leaf compost watered with 300 cm^3 a week (21.00 and 16.43 g in the first and second seasons, respectively), preceded by those grown in date palm leaf compost watered with 600 cm^3 a week (24.93 and 19.83 g in the first and second seasons, respectively), besides those watered with 300 cm^3 a week and grown either in peat moss or in water hyacinth compost (25.40 and 25.63, respectively in the first season).

6 - Effect of media type and watering amounts on root dry weight, (Table 6).

a - Media type: The media type affected root dry weight significantly in the two seasons of this study. The significantly heaviest dry roots (17.49 and 30.23 g in the first and second seasons, respectively) were those grown in the mixed compost, followed by those grown in rice hulls (16.09 and 21.41 g in the first and second seasons, respectively cm). Those grown in water hyacinth compost came in the third position as their mean root dry weights were 12.64 and 18.82 g in the first and second seasons, respectively. Plants grown in peat moss occupied the 4^{th} position with a value of 15.08 g in the second season. Using palm leaves compost resulted in the significantly lightest dry roots (10.79 and 12.26 g in the first and second seasons, respectively), in addition to those grown in peat moss (11.2 g) in the first season.

b - Watering amounts: the watering amounts exerted significant effect in both seasons. The highest values of root dry weight (15.23 and 22.09 g in the first and second seasons, respectively) were a result of giving water at 450 cm^3 a week, followed by those irrigated with 600 cm^3 a week (13.59 and 19.37 g in the first and second seasons, respectively). The lightest dry roots belonged to plants watered with only 300 cm^3 a week (12.12 and 17.23 g in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: The effect of this interaction was significant in the first season only. The highest records in this concern belonged to plants grown in the mixed compost and watered with 450 cm^3 a week (20.53 and 34.43 g in the first and second seasons, respectively), followed by those grown in the mixed compost and watered with 600 cm^3 a week (17.00 and 30.33 g in the first and second seasons, respectively), in addition to those grown in rice hulls compost and watered with either 450 or 600 cm^3 a week (17.47 and 16.47, respectively in the first season).

The third position was occupied by values of plants grown in the mixed compost and watered with 300 cm^3 a week (14.93 and 26.03 g in the first and second seasons, respectively), plants grown in rice hulls and watered with either 300 cm^3 a week in the first season or with 450 cm^3 a week in the second one (14.33 and 24.10, respectively), in addition to those grown in water hyacinth and watered with 450 cm^3 a week (14.40 g) in the first season.

The lowest dry weight of roots belonged to plants grown in date palm leaf compost irrigated with 300 cm^3 a week (9.90 and 10.93 g in the first and second seasons, respectively), preceded by those grown in peat moss and watered with 300 cm^3 a week (10.43 and 13.57 g in the first and second seasons, respectively), those grown in date palm leaf compost irrigated with 600 cm^3 a week (10.37 and 12.53 g in the first and second seasons, respectively) in addition to those grown in date palm leaf compost irrigated with 450 cm^3 a week (13.30 g in the second season).

Table (6). Effect of media type and watering amounts on root dry weight (g)

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	11.57 d-f	11.67 d-f	10.43 fg	11.22 D	14.43 a	17.23 a	13.57 a	15.08 D
W. hyacinth	12.53 d	14.40 c	11.00 e-g	12.64 C	18.50 a	21.37 a	16.60 a	18.82 C
Rice hull	16.47 b	17.47 b	14.33 c	16.09 B	21.13 a	24.10 a	19.00 a	21.41 B
Palm leaves	10.37 fg	12.10 de	9.90 g	10.79 D	12.53 a	13.30 a	10.93 a	12.26 E
Mixed	17.00 b	20.53 a	14.93 c	17.49 A	30.23 a	34.43 a	26.03 a	30.23 A
Mean	13.59 B	15.23 A	12.12 C		19.37 B	22.09 A	17.23 C	

7 - Effect of media type and watering amounts on root length, (Table 7).

a - Media type: The media type affected root length significantly in the two seasons of this study. The longest roots belonged to plants grown in the mixed compost (20.52 and 25.90 cm in the first and second seasons, respectively), followed by plants grown in rice hulls (17.52 and 19.28 cm in the first and second seasons, respectively) in addition to those grown in peat moss or water hyacinth (16.88 and 16.54, respectively cm in the first season). Values in the third position were obtained by plants grown in peat moss or water hyacinth composts (17.57 and 17.53 cm, respectively) in the second season. The lowest records in this regard were a result of growing pants in date palm leaf compost (15.40 and 14.18 cm in the first and second seasons, respectively).

b - Watering amounts: the watering amounts exerted significant effect on root length in both seasons. The longest roots (18.67 and 20.12 cm in the first and second seasons, respectively) were a result of giving water at 450 cm^3 a week, followed by those irrigated with 600 cm^3 a week (17.55 and 18.87 cm in the first and second seasons, respectively). The shortest roots were those watered only at 300 cm^3 a week (15.89 and 17.68 cm in the first and second seasons, respectively).

c - Interaction between media type and watering amounts: the interaction between media type and watering amounts failed to exert a significant on root length. Irrespective of this, the longest roots were those grown in the mixed compost and watered with 600 cm^3 a week (21.23 and 27.43 cm in the first and second seasons, respectively), 450 cm^3 a week (22.03 and 25.43 cm in the first and second seasons, respectively) or 300 cm^3 a week (24.83 cm in the second season). The second position was occupied by plants watered with 450 cm^3 a week and grown either in water hyacinth compost (18.50 and 19.27 cm in the first and second seasons, respectively) or in rice hulls compost (18.67 and 21.77 cm in the first and second seasons, respectively) in addition to those irrigated with 600 cm^3 a week and grown in either peat moss or rice hulls compost (17.13 and 18.00 cm, respectively in the first season) and those grown in peat moss and watered with 450 cm^3 a week or grown in the mixed compost and watered with 300 cm^3 a week (177.77 and 18.30 cm, respectively in the first season). The third rank was occupied by plants grown in date palm leaves compost and watered with 450 cm^3 a week (16.40 cm in the first

season), plants grown in peat moss and watered with either 450 or 600 cm^3 a week (18.80 and 17.30, respectively in the second season), plants grown in water hyacinth compost (16.87 cm in the second season) in addition to those grown in rice hulls compost and watered with either 600 or 300 cm^3 a week (18.23 and 17.83 cm in the second season). The shortest roots belonged to plants grown in date palm leaf compost and watered with 300 cm^3 a week (14.40 and 12.67 cm in the first and second seasons, respectively) preceded by those grown in water hyacinth compost and watered with 300 cm^3 a week or in date palm leaf compost and watered with 600 cm^3 a week (15.13 and 14.53 respectively, in the second season).

Table (7): Effect of media type and watering amounts on root length (cm)

Medium	1st season			Mean	2nd season			Mean
	Watering amount per week (cm^3)				Watering amount per week (cm^3)			
	600	450	300		600	450	300	
Peat moss	17.13 a	17.77 a	15.73 a	16.88 B	17.30 a	18.80 a	16.60 a	17.57 C
W. hyacinth	16.00 a	18.50 a	15.13 a	16.54 B	16.87 a	19.27 a	16.47 a	17.53 C
Rice hull	18.00 a	18.67 a	15.90 a	17.52 B	18.23 a	21.77 a	17.83 a	19.28 B
Palm leaves	15.40 a	16.40 a	14.40 a	15.40 C	14.53 a	15.33 a	12.67 a	14.18 D
Mixed	21.23 a	22.03 a	18.30 a	20.52 A	27.43 a	25.43 a	24.83 a	25.90 A
Mean	17.55 B	18.67 A	15.89 C		18.87 B	20.12 A	17.68 C	

8- Effect of media type and watering amounts on total chlorophyll content, (Table 8-a).

a - Media type: the media type affected the total chlorophyll content significantly. The highest content in this regard was noticed in plants grown in the mixed compost (2.50 mg/g FW), followed by those grown in peat moss or rice hulls compost (1.84 and 1.72 mg/g FW, respectively). The third position was occupied by plants grown in water hyacinth compost (1.49 mg/g FW) while the lowest record was that of plants grown in date palm leaf compost (1.11 mg/g FW).

b - Watering amounts: The effect of watering amounts on total chlorophyll content was found to be not significant. However, the highest content was detected in plants watered with 450 cm^3 a week, followed by those watered with 600 cm^3 a week (1.80 and 1.71 mg/g FW, respectively). The lowest value in this concern belonged to plants watered with 300 cm^3 a week (1.69 mg/g FW).

c - Interaction between media type and watering amounts: The effect of this interaction was not significant. However, The highest contents were a result of growing plants in the mixed compost and giving them water at 600, 450 or 300 cm^3 a week (2.46, 2.57 and 2.45 mg/g FW, respectively). Plants grown in peat moss and watered with either 600 or 450 cm^3 a week, in addition to those grown in rice hulls and watered with 450 cm^3 a week had this parameter in the second position (1.85. 1.99 and 1.79 mg/g FW, respectively).

The third rank in this concern was given to pants grown in peat moss and watered with 300 cm^3 a week (1.69 mg/g FW), in addition to plants grown in rice hulls and watered with either 300 or 600 cm^3 a week (1.65 and 1.73 mg/g FW). The lowest contents were observed in plants grown in date palm leaf compost watered with either 600 or 450 cm^3 a week (1.02 and 1.06 mg/g FW), preceded by those grown in the same medium and watered with 300 cm^3 a week (1.27 mg/g FW).

Table (8): Effect of media type and watering amounts on: a- total chlorophyll content b- carotenoids content (mg/g FW)

Medium	Watering amount per week (cm^3)			Mean	Watering amount per week (cm^3)			Mean
	600	450	300		600	450	300	
Peat moss	1.85 a	1.99 a	1.69 a	1.84 B	1.84 ab	1.98 a	1.77 bc	1.87 A
W. hyacinth	1.49 a	1.59 a	1.39 a	1.49 C	1.16 ef	1.16 ef	1.04 fg	1.12 C
Rice hull	1.73 a	1.79 a	1.65 a	1.72 B	1.46 d	1.63 c	1.29 e	1.46 B
Palm leaves	1.02 a	1.06 a	1.27 a	1.11 D	1.24 e	1.00 g	1.01 g	1.08 C
Mixed	2.46 a	2.57 a	2.45 a	2.50 A	1.74 bc	1.95 a	1.80 b	1.83 A
Mean	1.71 A	1.80 A	1.69 A		1.49 A	1.54 A	1.38 B	

9 - Effect of media type and watering amounts on carotenoids content, (Table 8-b).

a - Media type: media type affected the content of carotenoids significantly. The highest contents in this concern were found in plants grown in either peat moss or the mixed compost (1.87 and 1.83 mg/g FW), followed by those grown in rice hulls compost (1.08 mg/g FW). The lowest contents were a result of growing plants in either water hyacinth or date palm leaf composts (1.12 and 1.08 mg/g FW).

b - Watering amounts: The watering amounts affected this character significantly. Watering plants with 600 or 450 cm^3 a week resulted in the highest contents (1.49 and 1.54 mg/g FW) compared to contents in plants watered with 300 cm^3 a week (1.38 mg/g FW).

c - Interaction between media type and watering amounts: the effect of interaction between media type and watering amounts was significant. The highest contents were a result of growing plants in peat moss and watering them with either 600 or 450 cm^3 a week (1.84 and 1.98 mg/g FW) together with those grown in the mixed compost and watered with 450 cm^3 a week (1.95 mg/g FW). The second position was occupied by plants grown either in peat moss and watered with 300 cm^3 a week (1.77 mg/g FW) or in the mixed compost and watered with 300 or 600 cm^3 a week (1.80 and 1.74 mg/g FW). Plants grown in rice hulls and watered with 450 cm^3 a week had this content in the third position (1.63 mg/g FW).

The lowest values in this regard resulted by growing plants in date palm leaf compost and watered with either 450 or 300 cm^3 a week (1.00 and 1.01 mg/g FW), preceded by those grown in water hyacinth compost and watered with 300 cm^3 a week (1.04 mg/g FW).

10 - Effect of media type and watering amounts on total carbohydrate content, (Table 9-a).

a - Media type: the media type affected total carbohydrate content significantly. The highest content in this concern was found in plants grown in the mixed compost (162.36 mg/g DW), followed by plants grown in rice hulls compost (136.74 mg/g DW) and water hyacinth compost (96.67 mg/g DW) in the second and third positions, respectively. The lowest content belonged to plants grown in date palm leaf compost (53.70 mg/g DW), preceded by those grown in peat moss (67.04 mg/g DW).

b - Watering amounts: the watering amounts exerted significant effect on total carbohydrate content. The highest value (112.45 mg/g DW) was a result of giving water at 450 cm^3 a week, followed by those irrigated with 600 cm^3 a week (104.16 mg/g DW). The lowest content belonged to plants watered only at 300 cm^3 a week (93.29 mg/g DW).

c - Interaction between media type and watering amounts: The interaction between media type and watering amounts exerted a significant influence on total carbohydrate content. Plants grown in the mixed compost and watered with 450, 600 or 300 cm^3 a week had the highest, the second and the third-ranked records (172.70, 163.33 and 151.03 mg/g DW, respectively). The lowest and the pre-lowest values in this regard were obtained by plants grown in date palm leaf compost and watered with either 300 or 600 cm^3 a week (48.30 and 54.33 mg/g DW, respectively).

Table (9): Effect of media type and watering amounts on
a- total carbohydrate content (mg/g DW) b- N%

Medium	Watering amount per week (cm^3)			Mean	Watering amount per week (cm^3)			Mean
	600	450	300		600	450	300	
Peat moss	65.67 j	73.27 i	62.20 jk	67.04 D	3.13 a	3.24 a	3.06 a	3.14 D
W. hyacinth	96.40 g	107.33 f	86.27 h	96.67 C	3.61 a	3.87 a	3.45 a	3.65 C
Rice hull	141.07 d	150.50 c	118.67 e	136.74 B	4.09 a	4.35 a	4.08 a	4.17 B
Palm leaves	54.33 lm	58.47 kl	48.30 m	53.70 E	2.50 a	2.75 a	2.32 a	2.52 E
Mixed	163.33 b	172.70 a	151.03 c	162.36 A	5.13 a	5.42 a	4.70 a	5.08 A
Mean	104.16 B	112.45 A	93.29 C		3.69 B	3.93 A	3.52 C	

11 - Effect of media type and watering amounts on nitrogen%, (Table 9-b).

a - Media type: The effect of media type on N% was significant. The highest N% was achieved by plants grown in the mixed compost, followed by those grown in rice hulls compost (5.08 and 4.17%, respectively). The third and fourth positions were occupied by plants grown in water hyacinth and peat moss compost (3.65 and 3.14%, respectively). The lowest percentage in this concern was a result of growing plants in date palm leaf compost (2.52%).

b - Watering amounts: The watering amounts affected N% significantly. The highest percentage was obtained by plants watered with 450 cm^3 a week (3.93%), followed by those watered with 600 cm^3 a week (3.69%). The lowest record in this regard belonged to plants watered with 300 cm^3 a week (3.52%).

c - Interaction between media type and watering amounts: This interaction failed to affect N% significantly. However, the highest value belonged to plants grown in the mixed compost and watered with 450 cm^3 a week (5.42%), followed in the second and third positions by those grown in the same medium and irrigated with either 600 or 300 cm^3 a week (5.13 and 4.70%, respectively). The lowest record was scored by plants grown in date palm leaf compost and watered either at 600 or 300 cm^3 a week (2.50 and 2.32%, respectively), preceded by plants grown in the same medium and watered with 450 cm^3 a week (2.75%).

12 - Effect of media type and watering amounts on phosphorus%, (Table 10-a).

a - Media type: media type affected P% significantly. The highest percentage was found in plants grown in the mixed compost (0.94%), followed by those grown in peat moss (0.83%) in the second position and those grown in rice hulls (0.78%) in the third one. The lowest record was obtained by plants grown in date palm leaf compost (0.48%) and the record just higher than that was detected in plants grown in water hyacinth compost (0.61%).

b - Watering amounts: The watering amounts affected this parameter significantly. The highest value (0.77%) was a result of giving water at 450 cm^3 a week, followed by those irrigated with 600 cm^3 a week (0.73%). The lowest content belonged to plants watered only at 300 cm^3 a week (0.69%).

c - Interaction between media type and watering amounts: This interaction between media type and watering amounts exerted a significant influence on P%. The highest value was a result of growing plants in the mixed compost and watering them with 450 cm^3 a week (0.98%), followed by those grown in the same medium and watered with either 300 or 600 cm^3 a week (0.91 and 0.93%, respectively). The third position was occupied by plants grown in peat moss and watered with 450 cm^3 a week (0.87%). The lowest record belonged to plants grown in date palm leaf compost and watered with 300 cm^3 a week, preceded by those grown in the same medium and watered with 600 cm^3 a week (0.46 and 0.48%).

Table (10): Effect of media type and watering amounts

a- on P%

Medium	Watering amount per week (cm^3)			Mean
	600	450	300	
Peat moss	0.82 d	0.87 c	0.79 e	0.83 B
W. hyacinth	0.60 h	0.69 g	0.53 i	0.61 D
Rice hull	0.79 e	0.81 de	0.75 f	0.78 C
Palm leaves	0.48 k	0.51 j	0.46 l	0.48 E
Mixed	0.93 b	0.98 a	0.91 b	0.94 A
Mean	0.73 B	0.77 A	0.69 C	

b- K%

Medium	Watering amount per week (cm^3)			Mean
	600	450	300	
Peat moss	6.31 a	6.57 a	6.07 a	6.32 B
W. hyacinth	4.14 a	4.51 a	3.82 a	4.16 D
Rice hull	5.35 a	5.35 a	4.78 a	5.16 C
Palm leaves	2.97 a	3.12 a	2.52 a	2.87 E
Mixed	6.64 a	7.14 a	6.25 a	6.68 A
Mean	5.08 B	5.34 A	4.69 C	

13 - Effect of media type and watering amounts on potassium%, (Table 10-b).

a - Media type: Media type exerted a significant effect on K%. The highest percentage was observed in plants grown in the mixed compost (6.68%), followed by those grown in peat moss (6.32%) in the second rank and those grown in rice hulls (5.16%) in the third one. The lowest record was obtained by plants grown in date palm leaf compost (2.87%) and the record just before the lowest one was obtained by plants grown in water hyacinth compost (4.16%).

b - Watering amounts: The watering amounts affected K% significantly. The highest percentage was obtained by plants watered with 450 cm^3 a week (5.34%), followed by those watered with 600 cm^3 a week (5.08%). The lowest record in this regard belonged to plants watered with 300 cm^3 a week (4.69%).

c - Interaction between media type and watering amounts: This interaction failed to affect K% significantly. However, the highest percentage in this regard was obtained by plants grown in the mixed compost and watered with 450 cm^3 a week (7.14%), followed by those grown in the same medium and watered with 600 cm^3 a week (6.64%). The third position in this concern was occupied by plants grown in peat moss and watered with 450 cm^3 a week (6.57%). The lowest record was scored by plants grown in date palm leaf compost and watered with 300 cm^3 a week (2.52%), preceded by those grown in date palm leaf compost and watered with either 450 or 600 cm^3 a week (3.12 and 2.97%, respectively).

DISCUSSION

The main objective of this study was to determine the suitable amount of watering, 300, 450 or 600 cm3/pot/week, and to investigate the possibility of using a compost made of local farm resources and agrowastes such as water hyacinth, rice hulls and date palm leaflets, in addition to a mixture of the these materials and peat moss; and compare its effect to the imported peat moss on the growth of potted *Ficus microcarpa* var. *nitida* “Hawaii”.

Results show that performance of plants grown in the mixed compost and watered with 450 cm3/pot/week was the best in all characters studied, followed by plants grown in the same medium and watered with either 600 cm3/pot/week (in the second position) or with 300 cm3/pot/week (in the third one). Performance of plants grown in rice hulls compost and watered with 450 cm^3/pot/week came in the fourth rank, followed by those grown in peat moss and watered either with 450 or 600 cm^3/pot/week. Plants grown in date palm leaflet compost and watered with 300 cm^3/pot/week scored the lowest records in almost all parameters studied, preceded by those grown in the same medium and watered either with 450 or 600 cm^3/pot/week.

These results agree to a great extent with the findings of a lot of workers who investigated different kinds of agrowastes compared to peat moss.

1- Peat moss: Chong *et al*. (1991), who grew eight species of ornamental plants in mushroom compost and bark media. They observed better growth in the mushroom compost than bark. Also, Hartz *et al*. (1996) obtained better growth for *Tagetes* in the garden waste compost than in peat moss. On the other hand, Aiello and Graves (1997) obtained a different result when they used bark compost and peat moss 1:1 by volume.

2 - Water hyacinth: A lot of workers reported the benefits of using composted water hyacinth as a potting medium. Abdel-Sabour *et al.* (1999) evaluated the influence of water hyacinth compost application on sunflower. Results showed an increase in the dry matter and leaf content of total chlorophyll, carbohydrates and major elements (NPK). Gajalakshmi and Abbasi (2002) assessed the application of compost obtained from water hyacinth on growth and flowering of *Crossandra undulaefolia* raised on water hyacinth compost as compared to the untreated saplings. They found that the impact of compost was beneficial. Chukwuka and Omotayo (2008 and 2009) stated that the application effects of water hyacinth compost on nutrient-depleted soil resulted in an increase in the soil N, P, K, Ca, Mg, Cu, Zn, Mn, Fe, nitrate and nitrite compounds, pH and organic C of treated soils. Mitra *et al.* (2010) stated that maximum N and K uptake by jute plants were observed when 25% N was replaced by water hyacinth compost.

3 - Rice hulls: Rice hulls or rice husks was a subject of many researches to prove it as a good growing medium after being composted. Accati *et al.* (1996) reported that media prepared using rice hulls and maize cobs (1:1) gave better or similar results to those obtained with peat, in terms of quality and yield of *Salvia splendens* cv. Flame, *Verbena x abeled□cv*. Romance Scarlet Eyes and *Tagetes patula* cv. Bonanza Arancio. Ingelmo *et al.* (1998) reported that 50% of the peat used in nurseries of ornamental plants could be successfully replaced with different mixtures of dry sewage sludge, grape marc, rice hulls and pine bark. This led to a reduction in the cost of substrates. Dutt *et al.* (2002) evaluated the substrates cocopeat, soilrite, compost and rice husk for their effect on the root growth of two chrysanthemum cultivars (Spray Purple and Sonali Tara). They reported that no significant differences were observed in the various measured parameters. Ginwal *et al.* (2002) used two types of potting mixtures for raising *Dalbergia sissoo* seedlings. They reported that a mixture of rice husk, charcoal and compost in the ratio 1:3:1 showed satisfactory results. Meyer and Cunliffe (2004) successfully propagated five ornamental grasses (*Schizachyrium scoparium*, *Sporobolus heterolepis*, *Calamagrostis acutiflora* and *Miscanthus* 'Purpurascens'), and variegated Japanese silvergrass (*Miscanthus sinensis* 'Variegatus') by transplanting plugs or field divisions into media composed of rice hulls to sand. Barreto and Jagtap (2006) stated that cocopeat + perlite + rice husk produced gerbera flowers with the highest net returns. Goyal *et al.* (2006) observed more dry matter of spinach and NPK uptake by addition of compost prepared from sewage sludge with rice husk which acted as a source of different plant nutrients. Marchese *et al.* (2006) indicated that rice hulls is a

potentially substitute for Canadian sphagnum peat in *Verbena x hybrida* plug production. Güler and Büyük (2007) stated that a compost obtained from rice husk alone or mixed with peat or perlite, was better for cucumber in relation to stem diameter, dry shoot weight, leaf chlorophyll and K content of seedling. Peat+perlite medium gave the lowest value in terms of these characteristics. Anda *et al.* (2008) stated that the worldwide production of rice husk, a by-product and agrowaste that causes serious environmental problems, may reach 116 million tons/year. The composted rice husk increased cocoa growth up to 37%. Caballero *et al.* (2009) used cotton gin trash mixed with rice hulls and peat for growing *Gerbera jamesonii* plants. Awang (2010) concluded that replacing 30% of cocopeat with burnt rice hull, perlite and kenaf core fiber did not affect the growth and flowering of *Celosia cristata* plants. KengHeng *et al.* (2010) mentioned that growth, yield, leaf number and cut flower quality of *Anthurium andreanum* plants grown in pea and rice hulls compost were the same as those receiving chemical nutrient solution and controlled release fertilizer in soilless condition.

4 – Palm leaflets

Egypt has about 7 million date palm trees according to InterNet Site 4 (2010). As Khiyami *et al.* (2008) stated that date trees produce large quantity of agrowastes. Each date palm tree produces about 20 kg of dry leaves yearly. It will be economically wise to make use of this huge amounts. Ali (2008) prepared a compost using local date palm leaves and compare it with the imported peatmoss on seed germination, rate of germination and growth of ornamental plants (cosmos, dahlia, tagetes and zinnia). Results showed that plant height, number of leaves per plant and the dry-biomass per plant was better in the date palm leaves compost relative to the peat moss.

The effect of the aforementioned agrowaste composts and their mixtures might be attributed to their effect as a source for ample phytohormones and nutrients as demonstrated by many authors. Sircar and Kunder (1959) and Sircar and Ray (1961) found high levels of growth hormones such as gibberellins in water hyacinth roots. Lareo *et al.* (1982) stated that because inorganic nitrogen and phosphorus are accumulated to a large extent in water hyacinth roots (roots represent 20% of the wet weight of the plants), this quality signifies a possible use for the water hyacinth as compost. Ueno and Yamamuro (2001) reported that relatively high rates of N efficiency were obtained from rice hulls composts, as it exhibited remarkably high N mineralization rates.

Another cause that may explain the beneficial effect of using agrowaste composts lies in their effect as a means of pest control. Sharma *et al.* (1997) stated that carbofuran was the most effective in improving yield of tomato and reducing nematode numbers. This was followed by water hyacinth compost or rice husk compost. Trillas *et al.* (2002) tested composts from rice hulls and olive marc+cotton gin trash+rice hulls on tomatoes and cucumber to evaluate their effectiveness in suppressing *Fusarium* wilt and *Rhizoctonia* damping-off disease, respectively. They found that these composts proved suitable for container media and field soils. Muhammad and Amusa (2003 a) reported that *Pythium* damping-off disease was less severe

in the seedlings of melon (*Colocynthis vulgaris*) raised in soil amended with rice husk and cow dung.

This pest control effect might be interpreted in the light of some works. Muhammad and Amusa (2003 b) stated that compost-inhabiting microbes such as *Trichoderma harzianum*, *Bacillus cereus* and *Bacillus subtilis* were found associated with cow dung, sawdust and rice husk composted soils. When these microbes were paired with the cowpea and maize seedling blight inducing pathogens, they grew on the mycelia of the tested fungal pathogens or reduced their growth. This inhibitory activity might partly be responsible for the efficacy of compost in reducing seedling blight diseases of crops. JennWen (2005) stated that agricultural wastes such as rice hulls benefit crop production by reducing the incidence of plant diseases. In some cases, control is achieved by direct killing of the pathogen propagules. In other cases, disease suppression is the result of a combination of multiple factors, including direct poisoning of the pathogen and indirect effects by improving vigour of plants. Singh *et al.* (2005) studied the effects of rice husk (10 g/kg) on the incidence of *Meloidogyne incognita*. They reported that root knot egg masses were not found in soils treated with rice husk.

B – Watering amount:

Lucia (2009) stated that knowledge of plant performance under reduced irrigation has the potential to reduce drastically the amounts of the applied container irrigation water, but there is still a lack of information about growth and physiological behaviour relative to potted ornamentals grown under limited water availability. Padilla *et al.* (2009) found that roots of seven Mediterranean shrub species, *Anthyllis cytisoides, Atriplex halimus, Ephedra fragilis, Genista umbellata, Lycium intricatum, Retama sphaerocarpa, and Salsola oppositifolia*, responded to alterations in water supply by changing biomass allocation patterns (i.e., higher root:shoot mass ratio in droughted plants). Iersel *et al.* (2010) performed a study to determine how different substrate volumetric water contents affected petunia growth and to quantify the daily water use of the plants. They found that daily water use of the petunias was 12 to 44 ml/plant and was positively correlated with both plant age and daily light integral.

Using the appropriate amount of water is the ideal situation in irrigation. Abou Rawash *et al.* (2004) studied the effect of different irrigation regimes on leaf mineral (N, P, K, Ca, Mg, Zn, Fe and Mn) content of mango cv. Zebda. They stated that irrigation at 80% evapotranspiration, improved sugar content, but leaf mineral content (N, P, K, Ca, Mg, Zn, Fe and Mn) seemed to be unaffected. ShuMing *et al.* (2008) cut off six-year-old *Eucommia ulmoides*(Eucommiaceae), and studied growth of the stump plant under different water conditions. They found that diurnal courses of photosynthetic rate showed double peak in normal or little water conditions and a single peak under greater amount of water supply and rate of photosynthesis increased. Optimum irrigation norms were 0.42 m^3/tree, where number and length of second ramification were the most, and the dry weight of the leaves was greater.

Excessive watering, however, might have some privileges. Shaban *et al.* (2007) reported that the increase in amount of irrigation water led to an

increase in leaf water potential of *Cercis siliquastrum*, *Fraxinus angustifolia*, *Olea europea*, *Platanus orientalis*, *Populus nigra*, *Populus alba*, *Quercus infectoria* and *Salix alba*. ShuYong *et a.* (2007) found that with the increase of soil moisture (from 22.4 to 72.2%), the number of light compensation point declined while light saturation point, the maximum net photosynthetic rate and apparent quantity yield of three-year-old *Euonymus fortunei* var. *radicans* increased. Wassel *et al.* (2007) indicated that shoot length and number of leaves per spring shoot of Balady mandarin trees 6 years old, watered 16, 20, 24 and 30 m^3/tree per year, increased by raising the amount of water applied per tree. Hussein (2008) concluded that applying water at 35 m^3 (instead of 25 m^3)/tree/year enhanced vegetative growth and improved nutrients contents of Manzanillo olive trees. Correa-Tedesco *et al.* (2010) found that vegetative growth of olive was proportional to the amount of irrigation. Kafi *et al.* (2010) subjected two local populations of *Kochia scoparia* (Sabzevar and Borujerd) to four irrigation regimes from 40 to 100%. They found that the highest biomass was obtained from complete irrigation.

On the other hand, other workers tried using less amount of water in irrigation. Shimizu and YanWen (2007) found that water stress significantly reduced the dry weight of two-year-old seedlings of *Betula ermanii* whole plant. Significant reductions of net photosynthesis, transpiration and stomatal conductance were observed under water deficiency treatments, while contents of chlorophylla+b and some essential nutrient elements (N, P, K, Mg and Ca) were not markedly changed. They suggested that the decrease in net photosynthetic rate, induced mainly by stomatal closure, was the major cause of the growth reduction under water stresses. Chylinski *et al.* (2007) grew plants of *Impatiens walleriana* and *Pelargonium hortorum* at three levels of soil water content: 80% (control), 60% (mild stress) and 30% (severe stress). They mentioned that roots of both plants were significantly longer in plants grown at 30% compared to 80% soil water content, while plant height was reduced by drought only in impatiens. The reduction in the a+b chlorophyll concentration in leaves of impatiens was significantly stress dependent while no reaction in geranium was observed.

Arji and Arzani (2008) subjected one-year-old rooted olive cutting of Mary, Zard, Roghani, Bladi and Mission cultivars to various irrigation treatments: control, medium stress and severe stress. They indicated that the degree of water stress had a significant effect on the amount of soluble carbohydrates, chlorophyll a, b and carotenoids. Exposure of plants to drought conditions led to noticeable increases in soluble carbohydrate concentration. The amount of chlorophyll a, b and carotenoids significantly decreased under drought stress conditions. This reduction was related to the degree of drought stress. Blanusa *et al.* (2009) found that under a 25% evapotranspiration "ETp" regime in which *Petunia hybrida* 'Hurrah White' plants received 25% of the "100% ETp" value, plant height was reduced by 33% compared with "100% ETp.", however, they were more efficient at producing biomass in relation to the volume of water applied. Lucia (2009) found that irrigation values close to 50% of evapotranspiration 0 “ET0” would be enough to maintain the ornamental values (plant height and diameter, number of shoots and leaves, leaf area, total fresh and dry weights, dry

matter content) of *Eremophila glabra* and *E. nivea* plants. In this way, a considerable saving in water could be promoted. Warsaw *et al.* (2009) irrigated container-grown woody ornamentals, *Deutzia gracilis* 'Duncan', *Kerria japonica* 'Albiflora', *Thuja plicata* 'Atrovirens', and *Viburnum dentatum* 'Ralph Senior', grown in 10.2 liter containers, according to a percentage of daily water use (DWU). Total irrigation applied was 33, 41, and 44% less than the total water applied by the control treatment of 123 liter per container. They found that plants grown under the three DWU treatments had a final growth index greater than or equal to plants irrigated by the control treatment. Irrigating according to the DWU treatments used reduced irrigation volumes, NO_3-N and PO_3-P losses compared with a control while producing the same size or larger plants.

The interaction between water amounts and type of growing medium was investigated by some authors. Aminah (2002) carried out a factorial experiment on rooted cuttings of *Dyera costulata* (Family Apocynaceae), consisting of 5 potting media and 3 watering frequencies. Results showed that there was no interaction between the potting media and watering frequencies tested. Among the potting media, *D. costulata* plants raised in composted oil palm mesocarp fiber were significantly better in height, diameter and root dry weight compared to those grown in other potting media. In terms of watering frequencies, height was the only variable significantly affected by treatments.

Conclusion

In order to grow *Ficus nitida* Hawaii plants in 25 cm dia. plastic pots under shade, it is recommended to use a mixture of peat moss, water hyacinth, rice hulls and date palm leaflet composts (at equal parts by volume) as a potting medium instead of using larger quantities of the highly expensive peat moss. It is also recommended to give 450 cm^3 of water/pot/week to save water.

Farming community and the various research organizations should be encouraged to develop technology for the preparation of composts using local agrowaste such as water hyacinth, rice hulls and date palm leaves rather than importing the more expensive peat moss. Further studies are required to avoid wasting the progressively diminishing sources of water.

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البيئات الطبيعية المحلية وأثرها على الإحتياجات المائية لنباتات الفيكس هاواى

فيصل محمد عبد العليم سعداوى ، بشرى برتى رزق الله و أمل صلاح الفولى
قسم بحوث نباتات الزينة ، معهد بحوث البساتين ، مركز البحوث الزراعية ، الجيزة ، مصر

تمت هذه الدراسة فى مشتل قسم بحوث الزينة بمعهد بحوث البساتين ، مركز البحوث الزراعية ، الجيزة ، مصر ، فى الفترة من فبراير إلى نوفمبر من موسمى 2009 و 2010 . وقد أجريت تجربة عاملية فى تصميم ذو قطاعات كاملة العشوائية وثلاث مكررات ، لإختبار تأثير نظم رى مختلفة (الرى بـ 300 ، 450 ، 600 سم^3 لكل أصيص فى الأسبوع تمثل القطاع الرئيسى ، وبيئات الزراعة فى الأصص (بيت موس ، مكمورة ورد النيل ، مكمورة سرس الأرز ، مكمورة وريقات نخيل البلح ، ومخلوط من البيئات الأربعة السابقة بنسب متساوية) تمثل القطاعات الثانوية ، على نباتات فيكس نتدا "هاواى" مزروعة فى أصص بلاستيكية ذات قطر 25 سم.

تبين النتائج أن أداء النباتات النامية فى مخلوط البيئات ورويت بمعدل 450 سم^3 ماء للأصيص فى الأسبوع كانت الأفضل من حيث جميع الصفات اموضع الدراسة ، يليها النباتات التى كانت نامية فى نفس البيئة ورويت إما بمعدل 600 سم^3 ماء للأصيص فى الأسبوع (حيث جاءت فى المرتبة الثانية) ، أو بمعدل 300 سم^3 ماء للأصيص فى الأسبوع (حيث جاءت فى المرتبة الثالثة).

جاء ترتيب النباتات التى نمت فى مكمورة سرس الأرز ورويت معدل 450 سم^3 ماء للأصيص فى الأسبوع فى المرتبة الرابعة ، يليها النباتات التى نمت فى البيت موس ورويت إما بمعدل 450 أو 600 سم^3 ماء للأصيص فى الأسبوع.

وجاء ترتيب النباتات التى نمت فى مكمورة وريقات نخيل البلح ورويت معدل 300 سم^3 ماء للأصيص فى الأسبوع فى المرتبة الدنيا فى معظم الصفات موضع الدراسة ، وسبقها فى الترتيب النباتات التى نمت فى نفس البيئة ورويت إما بمعدل 450 أو 600 سم^3 ماء للأصيص فى الأسبوع.

ومن الواجب فى هذا المقام تشجيع المهتمين بالزراعة وكذلك مختلف الهيئات البحثية على تطوير تقنية لإعداد المكورة (الكمبوست) باستعمال المخلفات الزراعية المحلية مثل ورد النيل وسرس الأرز ووريقات نخيل البلح بدلا من إستيراد البيت موس المرتفع الثمن. وهناك حاجة لزيد من الدراسات لتفادى إهدار مصادر الماء الآخذة فى التناقص.

قام بتحكيم البحث

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