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PHYSIOLOGICAL STUDIES ON GERMINATION AND GROWTH OF OCHNA SHRUB. B- EFFECT OF IRRIGATION INTERVALS ON GROWTH AND QUALITY OF *Ochna serrulata* (HOCHST.) SEEDLINGS GROWN IN DIFFERENT MEDIA.

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ABSTRACT

A pot experiment was conducted under saran at the nursery of Al-Zohriya Garden, Hort. Res. Inst., ARC, Giza, Egypt during 2018 and 2019 seasons to study the effect of following growing media: the pure sand (S),S + clay at either (3:1,v/v) or (1:1,v/v) and S + farmyard manure (FYM) compost at either (3:1,v/v) or (1:1,v/v), irrigation intervals (once every 1, 2 and 3 days) and their interactions on growth and quality of Mickey Mouse plant (*Ochna serrulata* Hochst.) transplants of 10-month-old during the rearing period in the nursery.

It was found that amending the sand with either clay or FYM compost at any ratio in these studies significantly improved all vegetative and root growth parameters, with the superiority of the mixture, sand + FYM compost (3:1 v/v), which gave the highest means of plant height, No. leaves/plant, root length and fresh and dry weights of shoots and roots compared to all the other media in both seasons. On the other hand, shortening irrigation period from 3 to either 2 or 1 days significantly hastened growth with the prevalence of 2 days irrigation interval that attained means higher, to some extent, than daily irrigation in most growth characters in the two seasons. So, the best vegetative and root growth criteria of *Ochna* plant were obtained from planting in the mixture of sand + FYM compost (3:1, v/v) with irrigation every 2 days. A similar trend to that of vegetative and root growth results was also occurred concerning chlorophyll a, b, carotenoids and total soluble sugars concentrations in the leaves .

From such gains, it can be proposed to culture the small transplants of Mickey Mouse bush (*Ochna serrulata*) under shade in sand + formyard manure compost mixture (3:1,v/v) and watering them once every two days to speed growth of this slow-growing shrub during the incubation period in the nursery .

***Key words*:** *Mickey Mouse bush (Ochna serrulata), FYM, irrigation interval, vegetative and root growth, chemical constituents.*

1. INTRODUCTION

Mickey Mouse plant, or Bird's Eye bush (*Ochna serrulata* (Hochst.) Walp.), a showy bush of the family Ochnaceae that is native to the coast of Southern Africa. It is a slow-growing semi-evergreen small shrub, up to 2.5 m height with a slender dark brown smooth-barked stem and elliptical glossy green leaves with fine toothed wavy margins. It has beautiful yellow fragrant flowers forming at branch tips in spring, and very attractive fruits that are shiny black and berry-like, suspended below bright-red sepals in a way that resembles the face of Mickey Mouse (Huxley *et al*., 1992). This plant can tolerate wet and heavy soils, and may tolerate dry conditions when planted in the shade. It also tolerates wind and seaside conditions and takes well to regular hedging and pruning, making it the proper option for formal or informal small hedge. It can also be used as a feature plant, or in the mixed border. It looks good and does well growing amongst rocks, as a container plant and has a great potential as a bonsai one. It is propagated by seeds and cuttings (Hattatt, 2001).

Ochna could be used in folk medicine, for treatment of some ailments, such as asthma, dysentery, epilepsy, gastric disorders, lumbago, menstrual complaints, ulcers, as an abortifacient and as an antidote against snake bites (Bandi *et al*., 2012). Up to now, about 111 constituents,

including flavonoids, anthranoids, triterpenes, steroids, fatty acids and some others identified in the oil (the seeds contain about 31 % oil) by Makhafola and Eloff (2012), Voegele (2013) and Fidelis *et al*. (2014).

The growing medium is one of the main factors affecting plant production. Thus, preparing a good medium suitable for the slow-growing plants such as Ochna bush may help in improving their growth and flowering. In this regard, Saadawy *et al.* (2005) found that using broad bean compost medium produced the tallest *Peperomia* plants, the highest leaf and branch number/plant and the heaviest shoot dry weight and root fresh weight. Such medium also increased *Syngonium* roots to maximum value. The tallest plants, the highest No. leaves of *Schefflera* plant as well as the heaviest fresh and dry weights roots of both *Schefflera* and *Syngonium* were achieved by planting them in bagasse compost medium. The highest K % in the three mentioned plants was found in plants grown in broad bean straw medium, whereas bagasse compost medium increased the contents of total chlorophylls, N, P and carbohydrates to highest concentrations in the three studied plants. Similar observations were also obtained by Abdel Fattah *et al.* (2008) on *Schefflera actinophylla*, El-Sayed *et al.* (2013) on *Euonymus japonicus*, El-Quasni *et al.* (2014) on *Magnolia grandiflora*, Sarhan *et al.* (2016) on *Moringa oleifera* and Meshaal *et al.* (2018) on *Russelia equisetiformis*.

In addition, minimizing plant water requirements to the least level without plant injury and physiological disorders are very important, especially under the present climatic changes accompanied with water deficit. In this concern, Abdel- Moneim *et al.* (2018) declared that prolonging irrigation interval from one to two weeks resulted in the highest number of leaves and flowers, flower diameter, flower fresh and dry weights, as well as total chlorophyll, P and K concentrations in *Euphorbia milii* var. longifolia plants. SSimilar results were reported by Henson *et al.* (2006) on *Catharanthus roseus*, *Rudbeckia hirta*, *Senecia cineraria*,*Tagetes erecta*, *T. patula*, *Salvia farinacea* and *Petunia hybrida*, Tahir *et al.* (2007) on canola, Ibrahim *et al.* (2010) on *Helichrysum bracteatum*, El-Mekawy (2013) on *Achillea santolina*, Mohamed *et al.* (2014) on *Curcuma aromatica* and *C. domestica*, El- Leithy *et al.* (2018 b) on rosemary, Akhtar (2019) on *Calendula officinalis* and *Dianthus berbatus*, Ahmad *et al.* (2020) on roselle and Do Bomfim *et al.* (2020) on *Ananas comosus* plants.

The effect of interaction between irrigation regime and medium ingredients on ornamentals was studied as well by Shahin *et al.* (2007) who revealed that watering *Agave americana* cv. Marginata transplants grown in sand + loam (10%) + chicken manure (10 %) mixture and irrigated with 150 ml water/clay pot (15 cm diameter) scored the best vegetative and root growth, highest number and quality of new suckers and greatest concentrations of chlorophyll a, b and carotenoids in the leaves, as well as the contents of total carbohydrates, N, P and K in the leaves and roots. Parallel responses were also discovered by Moore and Broschat (2001) on areca palm, crossandra, pentas and philodendron plants, Shahin *et al.* (2009) on tuberose, Saadawy *et al.* (2011) on *Ficus* "Hawaii", Mazher *et al.* (2012) on *Amaranthus tricolor*, Nofal *et al.* (2014) on *Hymenocallis speciosa* and Said (2016) on *Duranta erecta* var. Variegata.

This trialaimed to determine the most appropriate medium and irrigation interval necessary for good and healthy growth of the slow-growing Mickey Mouse shrub during the rearing period in the nursery.

2. MATERIALS AND METHODS

A pot experiment was carried out under saran at the nursery of Al-Zohriya Garden, Hort. Res. Inst., ARC, Giza, Egypt throughout the two successive seasons of 2018 and 2019 to find out the best growing mixture and irrigation interval needed for promoting growth of *Ochna* bush to be reliable for the quick marketing.

Ten-month-old uniform seedlings of *Ochna serrulata* (Hochst.) shrub were carefully transplanted on 15th April in both seasons in 20 cm diameter plastic pots (one seedling/pot). The pots were filled with one of the following mixtures: pure sand (S) as a control, S + clay (3:1,v/v), S + clay (1:1,v/v), S + FYM compost (3:1, v/v) and S + FYM compost (1:1, v/v) up to 1 cm past the pot rim. Physical and chemical analyses of the sand and clay used in the two seasons were determined and illustrted in Table (a), while those of farm yard manure (FYM) compost are listed in Table (b).

Table (a): Some physical and chemical analyses of the sand and clay used in the two experimental season.

Soil type	Particle size distribution (%)				S.P	E.C. (dS/m)	pH	Cations (meq/l)				Anions (meq/l)		
	Coarse sand	Fine sand	Silt	Clay				Ca^{++}	Mg^{++}	Na^{+}	K^{+}	HCO_3^{-}	Cl^{-}	SO_4^{--}
Sand	84.76	6.30	1.49	7.45	22.5	3.50	7.90	7.50	1.63	33.6	0.50	3.20	22.1	18.02
Clay	7.34	22.25	30.57	39.84	55.33	2.26	8.11	7.82	2.12	15.33	0.82	6.61	8.23	11.25

Table (b): The physical and chemical analyses of the FYM compost in both seasons.

O.M. (%)	O.C. (%)	C/N ratio	pH	E.C. (dS/m)	Macroelements (%)					Microelements (ppm)			
					N	P	K	Ca	Mg	Zn	Fe	Mn	Cu
25.80	23.28	12.58	7.78	3.57	1.85	0.71	2.29	0.25	0.79	20.10	1620.0	330.0	54.0

The seedlings were regularly irrigated once every three days with 300 ml of tap water/pot till 1st May, when they were watered afterwards once every 1, 2 or 3 days till end of the experiment on mid of October. The used five media were combined factorially with the three irrigation intervals to create fifteen interaction treatments.

A factorial experiment in a complete randomized design was conducted in the two seasons, with 3 replicates, each containing 5 plants (Mead *et al.,* 1993). All plants under the various treatments received the usual agricultural practices whenever required. At the end of each season, the data were recorded as follows: plant height (cm), number of leaves/plant, the longest root length (cm), as well as the top growth and roots fresh and dry weights (g). In fresh leaf samples taken from the middle part of the plant, the contents of photosynthetic pigments (chlorophyll a, b and carotenoids, mg/g f. w.) and the percent of total soluble sugars were determined using the methods described by Sumanta *et al.* (2014) and Dubois *et al*. (1956), respectively.

The data were statistically analyzed using the Assistant Software Program (Silva and Azevedo, 2016), followed by Duncan's New Multiple Range t-Test (Steel and Torrie, 1980) to compare the means of the various treatments.

3. RESULTS AND DISCUSSION

3.1. Effect of irrigation interval, media and their interactions on

3.1.1. Vegetative and root growth parameters

It is obvious from data averaged in Tables (1, 2 and 3) that plants raised in pure sand medium and watered once every 3 days were dead giving zero values in all vegetative and root growth characters measured in both seasons showing its low tolerance for long irrigation interval under conditions of this study. However, amending the sand with either clay or farmyard manure compost at any portion significantly improved vegetative and root growth traits with the superiority of sand + FYM compost (3:1, v/v) medium, which gave the tallest plant, highest number of leaves, longest roots and heaviest fresh and dry weights of shoots and roots compared to the other growing media in the two seasons. This may be attributed to the high manure values of the FYM compost, which supplies the plants with the different nutrients needed for quality and healthy growth (Abdel-Fattah *et al.,* 2008). Moreover, the well composted FYM may improve structure and texture of the growing medium, electrical conductivity, pH, organic matter content, cation exchange capacity and fertility (Drechsel and Reck,1998), besides, rising the water holding capacity of the medium, consequently water uptake by plants (Gonzalez and Cooperband, 2003).

On the other side, growing plants under irrigation regime at 2 or 1 days significantly speed up growth with the superiority of 2 days interval treatment, which was better than 1 day interval in most growth characters as compared with 3 day interval in both seasons. Thus, the best vegetative and root growth attributes were gained from planting *Ochna serrulata* seedling in S + FYM compost (3:1 v/v) medium and irrigation once every 2 days, as this combined treatment attained, in general, the utmost high means over all the other combinations in both seasons. This may be due to the impact of FYM in improving structure and texture of the growing mixture, increasing its cation exchange capacity and fertility with enhancing its water holding capacity, consequently water uptake by plants and the proper irrigation interval which may save enough water necessary for promoting

Table (1): Effect of irrigation intervals, growing media and their interaction on plant height, No. leaves/plant and root length of *Ochna serrulata* seedlings during 2018 and 2019 seasons.

Irrigation interval (day) / Media	Plant height (cm)				No. leaves / plant				Root length (cm)			
	3	2	1	Mean	3	2	1	Mean	3	2	1	Mean
	First season: 2018											
Pure sand (S)	0.00i	21.33h	24.30gh	**15.21E**	0.00k	24.67j	31.00i	**18.46D**	0.00g	16.97f	18.27f	**11.74C**
S + clay (3:1,v/v)	31.47de	37.00c	44.67ab	**37.71B**	36.33h	50.33c	58.67b	**48.44B**	23.40e	29.80a-c	27.77cd	**26.99B**
S + clay (1:1,v/v)	32.00de	37.97c	32.73d	**34.23C**	43.67ef	52.33c	46.33de	**47.44B**	24.07e	30.63ab	27.43cd	**27.38B**
S+ FYM compost (3:1,v/v)	33.90d	46.33a	41.70b	**40.64A**	49.67cd	76.00a	52.00c	**59.22A**	28.20b-d	31.83a	28.63b-d	**29.56A**
S+ FYM compost (1:1,v/v)	26.13h	29.00ef	28.07f	**27.73D**	39.67gh	44.33ef	40.67fg	**41.46C**	24.40e	27.93b-d	25.90de	**26.08B**
Mean	**24.70B**	**34.33A**	**34.29A**		**33.87C**	**49.53A**	**45.73B**		**20.01C**	**27.43A**	**25.60B**	
	Second season: 2019											
Pure sand (S)	0.00i	21.40h	26.97g	**16.12D**	0.00h	40.67g	68.00e	**36.22E**	0.00h	18.53g	24.97f	**14.50D**
S + clay (3:1,v/v)	37.73e	41.77cd	44.03cd	**41.18B**	58.33f	77.33c	82.67b	**72.78C**	29.87c-e	31.33b-d	31.37b-d	**30.86BC**
S + clay (1:1,v/v)	40.60de	43.30cd	41.33cd	**41.71B**	61.00f	89.00a	78.33c	**76.11B**	29.90c-e	32.77ab	30.77b-d	**31.14B**
S+ FYM compost (3:1,v/v)	44.40c	58.73a	55.13b	**52.76A**	71.67d	90.67a	81.00bc	**81.11A**	34.83a	34.27a	32.47a-c	**33.86A**
S+ FYM compost (1:1,v/v)	31.10f	33.33f	30.20f	**31.54C**	57.67f	73.33d	72.00d	**67.67D**	27.80e	31.27b-d	29.53de	**29.53C**
Mean	**30.77B**	**39.71A**	**39.53A**		**49.73C**	**74.20B**	**76.40A**		**24.48B**	**29.63A**	**29.82A**	

*Means within column or row having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5 % level.

Table (2): Effect of irrigation intervals, growing media and their interaction on top growth fresh and dry weights of *Ochna serrulata* seedlings during 2018 and 2019 seasons.

Irrigation interval (day) / Media	Top growth f. w.(g)/plant				Top growth d. w.(g)/plant			
	3	2	1	Mean	3	2	1	Mean
	First season: 2018							
Pure sand (S)	0.00h	3.02g	3.50fg	**2.17D**	0.00k	1.15j	1.91i	**1.02D**
S + clay (3:1,v/v)	4.63e	6.98c	7.57bc	**6.40B**	2.34g-i	2.53f-h	4.03cd	**2.97C**
S + clay (1:1,v/v)	4.66e	7.89b	7.04c	**6.53B**	2.84fg	4.20bc	3.61de	**3.55B**
S+ FYM compost (3:1,v/v)	5.12de	9.50a	8.85a	**7.83A**	3.07ef	4.91a	4.71ab	**4.23A**
S+ FYM compost (1:1,v/v)	3.91f	5.76d	5.49d	**5.05C**	2.05hi	3.59de	2.33g-i	**2.65C**
Mean	**3.67B**	**6.63A**	**6.49A**		**2.06B**	**3.28A**	**3.32A**	
	Second season: 2019							
Pure sand (S)	0.00k	6.91j	8.77i	**5.23E**	0.00k	2.21j	3.03i	**1.75E**
S + clay (3:1,v/v)	9.82h	12.03f	15.00c	**12.28C**	4.50g	6.02ef	7.42c	**5.98C**
S + clay (1:1,v/v)	10.95g	15.91b	12.93e	**13.27B**	4.99g	7.59c	7.11cd	**6.56B**
S+ FYM compost (3:1,v/v)	11.47fg	17.20a	14.27d	**14.31A**	6.58de	9.91a	8.20b	**8.23A**
S+ FYM compost (1:1,v/v)	9.45h	11.20g	10.98g	**10.54D**	3.72h	6.06ef	5.64f	**5.14D**
Mean	**8.34B**	**12.65A**	**12.39A**		**3.96B**	**6.36A**	**6.28A**	

* Means within a column or row having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5 % level.

Table (3): Effect of irrigation intervals, growing media and their interaction on roots fresh and dry weights of *Ochna serrulata* seedlings during 2018 and 2019 seasons

Irrigation interval (day) / Media	Roots f. w. (g)/ plant				Roots d. w. (g)/ plant			
	3	2	1	Mean	3	2	1	Mean
	First season: 2018							
Pure sand (S)	0.00h	1.15g	2.45f	**1.20E**	0.00i	0.74h	1.02gh	**0.59C**
S + clay (3:1,v/v)	3.58e	5.26c	4.11de	**4.32C**	1.76fg	3.22a-c	2.44de	**2.37B**
S + clay (1:1,v/v)	3.79e	6.99b	3.96e	**4.91B**	3.26a-c	3.51ab	2.29de	**3.02A**
S+ FYM compost (3:1,v/v)	4.83cd	8.06a	5.13c	**6.01A**	2.64c-e	3.74a	2.90b-d	**3.09A**
S+ FYM compost (1:1,v/v)	2.55f	2.69f	2.73f	**2.66D**	1.29gh	2.79cd	1.98ef	**2.02B**
Mean	**2.95C**	**4.83A**	**3.68B**		**1.73C**	**2.80A**	**2.13B**	
	Second season: 2019							
Pure sand (S)	0.00h	3.57g	4.46f	**2.68E**	0.00g	2.60f	2.69f	**1.76E**
S + clay (3:1,v/v)	5.88e	8.94c	7.73d	**7.52C**	3.10f	5.09cd	5.75c	**4.65C**
S + clay (1:1,v/v)	5.92e	12.14b	7.33d	**8.46B**	3.97e	8.01b	4.59de	**5.52B**
S+ FYM compost (3:1,v/v)	8.73c	18.16a	11.75b	**12.88A**	4.17e	10.27a	7.70b	**7.38A**
S+ FYM compost (1:1,v/v)	4.68f	7.30d	5.83e	**5.94D**	2.80f	4.17e	4.01e	**3.66D**
Mean	**5.04C**	**10.02A**	**7.42B**		**2.81C**	**6.03A**	**4.95B**	

* Means within a column or row having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5 % level.

vital processes in plant tissues and producing more metabolites that stimulate growth (Gonzalez and Cooperband, 2003). These findings, coincide with those obtained by Saadawy *et al.* (2005) on *Schefflera actinophylla*, Henson *et al.* (2006) on *Catharanthus roseus, Rudbeckia hirta, Senecio cineraria, Tagetes erecta* and *Petunia hybrida*, Ibrahim *et al.* (2010) on *Helichrysum bracteatum*, El-Quasni *et al.* (2014) on *Magnolia grandiflora*, Sarhan *et al.* (2016 b) on *Moringa oleifera*. In this connection, Moore and Broschat (2001) revealed that *Pentas lanceolat*, *Crossandra infundibuliformis* and *Philodendron* " Hope" plants grown in Pro-mix GSX medium and sub irrigated daily were largest, while that was true for areca palm plants that were grown in either Metro-mix 500 or 60 % biosolid media and watered overhead daily. Elongating irrigation interval to 3 days gave the least shoot dry weight in the four studied plants regardless of the medium used.

Likewise, Mazher *et al.* (2012) reported that applying 200 g Nile compost/pot and irrigating every 2 days greatly improved growth and flowering of *Amaranthus tricolor* plant than adding 100 g/pot and prolonging water interval up to 4 or 6 days. On *Hymenocallis speciosa*, Nofal *et al.* (2014) advised to use sand/ compost (2:1, v/v) mixture for planting and the moderate level for irrigation every 3 days for best growth and quality. Akhtar (2019) suggested that watering *Calendula officinalis* and *Dianthus barbatus* plants at 4 days interval recorded maximum values of plant height, stem diameter, root length, shoot fresh and dry weights, root dry weight, No. flower buds, No. opened flowers and flower diameter than irrigating daily or every 2 days. Do Bomfim *et al.* (2020) found that, for *Ananas comosus* var. Erectifolius, the irrigation interval at 2 days highly improved the plant height, No. leaves, leaf length, rosette diameter and flowering rate than the irrigation intervals between 4 to 10 days.

3.1.2. Chemical composition of the leaves

An identical response to that of vegetative and root growth parameters was also observed regarding the concentrations of chlorophyll a, b and carotenoids (mg/g f. w.), and total soluble sugars (%) in the leaves (Tables, 4 and 5), where the values of these constituents reached maximum in the leaves of plants grown in sand + FYM compost (3:1, v/v), medium with significant differences relative to the other media in both seasons. Also,, irrigation interval at 2 days gave the highest records in the two seasons, as compared with 3 and 1 day intervals which gave lower scores. So, the greatest means of the abovementioned constituents were achieved by interacting between planting in sand + FYM compost (3:1, v/v) medium and watering at two days interval, as such combination got the utmost high concentrations of pigments and soluble sugars in the leaves over the other combinations in both seasons. This may be due to the synergistic effect of both the proper water interval and the favorable composted medium on supplying *Ochna serrulata* plants with their required water and nutrients necessary for accelerating metabolism processes, which increased the concentrations of the active constituents in plant tissues.

The previous results can be supported by those gained by Saadawy *et al.* (2005) on *Peperomia*, *Schefflera* and *Syngonium*, Abdel-Fattah *et al.* (2008) on *Schefflera actinophylla*, El-Sayed *et al.* (2013) on *Euonymus japonicus* cv. Aureus, Mohamed *et al.* (2014) on *Curcuma aromatica* and *C. domestica*, Abdel-Moneim *et al.* (2018) on *Euphorbia milii* and El-Leithy *et al.* (2018) on rosemary plants. In this concern, Saadawy *et al.* (2011) clarified that growth performance of *Ficus nitida* "Hawaii" plants was the best when the plants were grown in peat moss + water hyacinth compost + rice hulls compost + date palm leaf compost (at equal volume parts) mixture and irrigating with 450 ml of water/ pot/ week, and as such combination treatment increased the concentrations of total chlorophylls, carotenoids, total soluble sugars, N, P and K to highest means compared to other combinations, even when water supply raised to 600 ml/pot /week. On *Amaranthus tricolor* plant, Mazher *et al.* (2012) reported that the highest concentrations of total chlorophyll, carotenoids, total carbohydrates, N, P and K were attained by planting in sand amended with 200 g Nile compost/ pot and irrigating once every 2 days. Similarly, Said (2016) pointed out that combining between planting the variegated duranta transplants in sand fortified with poultry manure compost (2:1, v/v) and irrigating with 300 ml water/ pot, at 2 days interval markedly improved the contents total chlorophyll, carotenoids, total carbohydrates, N, P and K in the leaves compared to the other combined treatments.

From the foregoing data, it is prefer to culture *Ochna serrulata* plants under shade in a mixture of sand + FYM compost (3:1,v/v) and

Table (4): Effect of irrigation intervals, growing media and their interaction on pigments concentrations in *Ochna serrulata* **leaves during 2018 and 2019 seasons.**

Irrigation Interval (day)	Chlorophyll a (mg/g f. w.)				Chlorophyll b (mg/g f. w.)				Carotenoids (mg/g f. w.)			
Media	**3**	**2**	**1**	**Mean**	**3**	**2**	**1**	**Mean**	**3**	**2**	**1**	**Mean**
	First season: 2018											
Pure sand (S)	0.000h	0.353g	0.371g	**0.241D**	0.000i	0.093h	0.111gh	**0.068E**	0.000i	0.200h	0.213h	**0.138D**
S + clay (3:1,v/v)	0.409g	0.891c	1.114b	**0.805B**	0.128fg	0.271d	0.313c	**0.237C**	0.240h	0.455d	0.472cd	**0.389B**
S + clay (1:1,v/v)	0.448fg	1.125b	0.915c	**0.829B**	0.150f	0.402a	0.301c	**0.284B**	0.246gh	0.571b	0.459cd	**0.425B**
S+ FYM compost (3:1,v/v)	0.532ef	1.595a	0.936c	**1.021A**	0.219e	0.413a	0.360b	**0.331A**	0.308fg	0.683a	0.524bc	**0.505A**
S+ FYM compost (1:1,v/v)	0.406g	0.742d	0.548e	**0.565C**	0.123g	0.270d	0.274d	**0.222D**	0.222h	0.414de	0.367ef	**0.334C**
Mean	**0.359C**	**0.941A**	**0.777B**		**0.124C**	**0.290A**	**0.272B**		**0.203C**	**0.465A**	**0.407B**	
	Second season: 2019											
Pure sand (S)	0.000j	0.375i	0.393hi	**0.256E**	0.000l	0.109k	0.126j	**0.078E**	0.000i	0.205h	0.219h	**0.141E**
S + clay (3:1,v/v)	0.437hi	0.907de	0.960d	**0.768C**	0.146i	0.296f	0.319e	**0.254C**	0.259gh	0.462cd	0.511c	**0.410C**
S + clay (1:1,v/v)	0.460h	1.155c	0.936de	**0.850B**	0.165h	0.423b	0.345d	**0.311B**	0.283fg	0.575b	0.486cd	**0.448B**
S+ FYM compost (3:1,v/v)	0.567g	1.710a	1.231b	**1.170A**	0.233g	0.584a	0.380c	**0.399A**	0.322ef	0.724a	0.568b	**0.538A**
S+ FYM compost (1:1,v/v)	0.420hi	0.866e	0.657f	**0.647D**	0.143i	0.285f	0.228g	**0.219D**	0.249gh	0.444d	0.378e	**0.357D**
Mean	**0.377C**	**1.003A**	**0.835B**		**0.137C**	**0.339A**	**0.280B**		**0.223C**	**0.482A**	**0.432B**	

* Means within a column or row having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5 % level.

Table (5): Effect of irrigation intervals, growing media and their interaction on total soluble sugars concentrations in *Ochna serrulata* **leaves during 2018 and 2019 seasons.**

Irrigation interval (day)	Total soluble sugars (%)			
Media	**3**	**2**	**1**	**Mean**
	First season: 2018			
Pure sand (S)	0.000k	1.663j	1.853i	**1.172E**
S + Clay (3:1)	3.020gh	3.207f	3.373e	**3.200C**
S + Clay (1:1)	3.190f	4.257b	3.330e	**3.592B**
S+ FYM compost (3:1)	3.483d	4.590a	3.653c	**3.909A**
S+ FYM compost (1:1)	2.947h	3.163f	3.123fg	**3.078D**
Mean	**2.528C**	**3.376A**	**3.067B**	
	Second season: 2019			
Pure sand (S)	0.000j	2.293i	2.467h	**1.587E**
S + Clay (3:1,v/v)	3.930e	4.053de	4.657b	**4.213C**
S + Clay (1:1,v/v)	4.003e	5.687a	4.180d	**4.623B**
S+ FYM compost (3:1,v/v)	4.793b	5.717a	4.480d	**4.997A**
S+ FYM compost (1:1,v/v)	3.273g	3.617f	3.710f	**3.533D**
Mean	**3.200C**	**4.273A**	**3.899B**	

*Means within a column or row having the same letters are not significantly different according to Duncan's New Multiple Range t-Test at 5 % level.

irrigating them once every 2 days to accelerate growth of this slow- growing shrub during the incubation period in the nursery for quick marketing.

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دراسات فسيولوجية على إنباتت ونمو شجيرة الأوكنا
ب- تأثير فترات الري على نمو وجودة شتلات ميكي ماوس (*Ochna serrulata*)
المنزرعة فى بيئات نمو مختلفة

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ملخص

أجريت تجربة أصص تحت السيران بمشتل حديقة الزهرية ، معهد بحوث البساتين ، مركز البحوث الزراعية، الجيزة ، مصر خلال موسمي 2018 ، 2019 لدراسة تأثير بيئات النمو المختلفة : الرمل فقط (كمقارنة) ، أو مخلوط الرمل + الطين إما بنسبة 3 : 1 أو 1 : 1 حجم اً ، وكذلك مخلوط الرمل + كومبو سِت مخلفات المزرعة بنسبة 3 : 1 أو1 : 1 حجماً مع فترات الري (الري مرة كل 1 ، 2 ، 3 أيام) ، والتفاعلات المشتركة بينهما على نمو وجودة شتلات شجيرة ميكي ماوس (*Ochna serrulata*) عمر عشرة أشهر خلال فترة الرعاية بالمشتل . أوضحت النتائج أن خلط الرمل بالطين أو كومبو سِت مخلفات المزرعة بنسبة 3 : 1 و 1 : 1 أحدث تحسناً معنوياً فى جميع صفات النمو الخضري والجذري ، مع تفوق بيئة النمو المكونة من مخلوط الرمل + كومبوست مخلفات المزرعة (بنسبة 3 : 1 حجماً) ، والتى أعطت أعلى المتوسطات فى أرتفاع النبات، عدد الأوراق/نبات، طول الجذر، والأوزان الطازجة والجافة للنمو الخضرى والجذرى مقارنة بجميع البيئات الأخرى فى كلا الموسمين. على الجانب الآخر، فقد أدى تقصير فترة الري من 3 أيام إلى يوم أو يومين إلى تشجيع وتحسين النمو معنوياً، وسجلت أحسن النتائج لفترة الري كل يومين والتي حققت متوسطات نمو أعلى نسبياً من فترة الري كل 1 يوم (أي يوم بعد يوم) فى معظم قياسات النمو بكلا الموسمين. لذلك، فإن أفضل معدل للنمو الخضري والجذري تم الحصول عليه بالجمع بين الزراعة فى مخلوط الرمل + كومبو سِت مخلفات المزرعة (3: 1 بالحجم) والري مرة كل يومين، حيث حققت هذه التوليفة بصفة عامة أفضل نمو للشتلات. وكان هناك اتجاه مشابه لنتائج النمو الخضري والجذري فيما يتعلق بمحتوى الأوراق من الكلوروفيل أ، ب، الكاروتينويدات والسكريات الذائبة الكلية. **من هذه النتائج،** يمكن التوصية بزراعة الشتلات الصغيرة لنبات ميكي ماوس (*Ochna serrulata*) تحت الظل فى مخلوط نمو من الرمل + كومبو سِت مخلفات المزرعة (بنسبة 3 : 1 حجماً) وريها مرة كل يومين لتسريع نمو شتلات هذا النبات بطئ النمو خلال فترة حضانتها بالمشتل.