Middle East Journal of Agriculture Research, 3(4): 869-875, 2014
ISSN 2077-4605

Effect of some Growing Media on Growth and Chemical Constituents of Magnolia Seedlings. (*Magnolia grandiflora* L.)

[1]EL-Quasni, F. E. M., [1]Mazhar, A. M., [2]S. S. Sakr, [2]M.A. EL-Khateeb, [1]H.M. Abd El - Magied

[1]Ornamental Plants and Woody Trees Dep., National Research Centre, Egypt
[2]Ornamental Horticulture Dep., Faculty of Agriculture, Cairo University, Egypt

ABSTRACT

This study was carried out in the glasshouse of the Experimental Nursery of Ornamental Horticulture Department, Faculty of Agriculture, Cairo University, Giza, during 24 months-after a month from transplanting from 2006 to 2008 . The aim of this study to investigate the effect of some growing media :Peat moss + sand (1:1 v/v)- Peat moss + sand + clay (1:1:1 v/v/v)-Peat moss + sand + perlite (1:1:1 v/v/v)-Peat moss + sand + vermiculite. (1:1:1 v/v/v) and Peat moss + sand + *Ficus elastica* var. *decora* dried leaves. (1:1:1 v/v/v) on growth of (*Magnolia grandiflora* L.). Effect of growing media on *Magnolia grandiflora* L. seedling: Growing the magnolia seedlings in a mixture of peat moss+ sand+ perlite produced the highest plants, the highest values of stem thickness, the largest leaves formed the maximum number of leaves, tallest roots and the heaviest fresh weight of leaves, stems and roots .As well as, increased the accumulation of P in leaves. The mixture of peat moss +sand increased the content of chlorophyll-a,b and caroteniods. The carbohydrates content in the different plant organs was increased by adding vermiculite to the mixtures of peat moss+ sand .Using peat moss+sand+clay increased N% in the leaves and stems of the seedlings.

Key words: *Magnolia grandiflora* L, Peat moss, sand , clay, vermiculite, perlite, dried leaves.

Introduction

Magnolia grandiflora L is an important ornamental tree due to its showy flowers; it will do well in sun or in light shade as well as in acid soil and will tolerate a slightly alkaline soil. The tree grow best when planted in a well-drained, sandy soil which should be improved by the addition of organic matter.

It can be used in public and private gardens, streets as well as in reclaiming marginal land, parking lots and highway medians. The leathery green leaves and beautiful flowers are used in decoration and floral arrangements. The wood is limited in its uses but may be manufactured into furniture, paneling, veneer, creates, and cabinets (Brown and Kirman, 1990).High quality and quantity of magnolia seedlings production can be achieved, partially, by improving cultural practices, especially chemical fertilization. Macro and micro-nutrients have many beneficial effects on plants growth, metabolism and resistance of adverse environmental conditions. (Milne and Milne, 1975).

The production of greenhouse nursery plants involves a number of cultural inputs; the most important factor is the type of growing medium used growing media must be amended to provide the appropriate physical and chemical properties necessary for plant growth. In addition to shallow depth and limited volume of container. Field soils are generally unsatisfactory for the production of plants in containers. Peat moss is formed by the accumulation of plant materials in poorly drained areas. The type of plant material and degree of decomposition largely determine its value for use in a growing medium. Sand, a basic component of soil, ranges in particle size from 0.05mm to 2.0mm in diameter. Sand has a tendency to back tightly together reducing the amount of air available to the root. So you should use sand or mix it with perlite or other material that will increase aeration. The difference between the sand and gravel is purely one of the particle size. (Verdonck *et al.* 1991). Medium and coarse sand particles are those which provide optimum adjustments in media texture. Although sand is generally the least expensive of all inorganic amendments it is also the heaviest. This may result in prohibitive transportation costs. Sand is a valuable amendment for both potting and propagation media. Perlite, crude perlite is a rock, which is formed during volcanic eruptions, because direct contact between lava and water, there is bounded water in this rock. Good old perlite, mainly for use as a soil additive to increase aeration and draining of the soil. Perlite is commonly used with vermiculite (1:1 mix is a very popular medium), Perlite is also relatively inexpensive. (Grilles *et al.* 2001). Perlite is a siliceous mineral of volcanic origin. The grades used in container media are first crushed and then heated until the vaporization of combined water expands it to a light powdery substance. Lightness and uniformity make perlite very useful for increasing aeration and drainage. Perlite has a tendency to float to the top of a container during irrigation. It has also been shown that perlite contains potentially toxic levels of fluorine. Although costs are moderate, perlite is an effective amendment for growing media.

Corresponding Author: Azza A. M. Mazher, Ornamental Plants and Woody Trees Dept., National Research Centre, Egypt
E-mail: azza856@yahoo.com

Vermiculite is a micacious mineral produced by heating to approximately 745°C. The expanded, plate-like particles which are formed have a very high water holding capacity and aid in aeration and drainage. Vermiculite has excellent exchange and buffering capacities as well as the ability to supply potassium and magnesium. Although vermiculite is less durable than sand and perlite, its chemical and physical properties are very desirable for container media. Vermiculite is most frequently used in conjunction with perlite as the two complement each other well. (Olympics, 1992).

The main purpose of this study is to determine the effects of potting media composed of clay, sand, peat moss, vermiculite, perlite and dried leaves on the growth of plants and chemical constituents of *M. grandiflora* L. seedlings in order to increase its quantity and improve quality.

Materials and Methods

This study was carried out in the greenhouse of the Experimental Nursery of Ornamental Horticulture Department, Faculty of Agriculture, Cairo University, Giza, during the period from 2006 to 2008.

The objective of this study was to investigate the response of vegetative growth and chemical constituents of *Magnolia grandiflora* L. seedlings to some growing media. Uniform seedlings of *Magnolia grandiflora* L. were obtained from local market with an average 10 – 12 cm height and 4-5 leaves. On the 9th of January, 2006 uniformal seedlings of *M. grandiflora* L. were transplanted in plastic pots 25 cm filled with one of the following growing media: Peat moss + sand (1:1 v/v)- Peat moss + sand + clay. (1:1:1 v/v/v)-Peat moss + sand + perlite. (1:1:1 v/v/v)-Peat moss + sand + vermiculite (1:1:1 v/v/v) and Peat moss + sand + *Ficus elastica* var. *decora* dried leaves. (1:1:1 v/v/v).After a month from transplanting a mixture of NPK (1:1:1) at 2g/pot was added at monthly intervals using ammonium nitrate (33 % N), potassium sulphate (48 % K_2O) and calcium super phosphate (16 % P_2O_5), seedlings were irrigated regularly.

Data were recorded on vegetative growth after 12 months from transplanting (first year) and then after 24 months from transplanting (second year).Data recorded after 12 months (first year) were: Plant height (cm)- Stem diameter (mm) (5cm from soil surface)-Leaf area (cm²) (planimeter) and number of leaves / plant.

*Data recorded after 24 months (second year) were:*Plant height (cm)- Stem diameter (mm) (5cm from soil surface)- Leaf area (cm²) (planimeter)- Number of leaves / plant-Fresh and dry weights of leaves, stems and roots (g/plant) and root length (cm).

Chemical composition elucidation: Chlorophyll a & b and carotenoids contents (mg/g. F. W.) were determined in leaf samples according Wettstein (1957).Total carbohydrates content in leaves, stems and roots (% D.W.) N were determined according to Herbert *et al*. (1971).Nitrogen content in leaves, stems and roots (% D.W.) were determined by the modified micro-Kjeldahl method as described by Cottenie *et al.* (1982).Phosphorus content in leaves, stems and roots (% D.W.) was estimated using ammonium molybdate method according to Snell and Snell (1949).Potassium content in leaves, stems and roots (% D. W.) was measured in the digested solution by flame photometer according to Chapman and Pratt (1961).

Statistical analysis

The data on vegetative growth were statistically analyzed according to Snedecor and Cochran (1980). Treatments means of all characters were compared by using L.S.D test at 0.05 level of significance.

Results and Discussion

The responses of the height of *Magnolia grandiflora* L. seedlings to the different growing media are shown in Table (1). The obtained data indicated that, in the two years, growing the seedlings in a medium consisting of the mixture from peat moss + sand + perlite resulted in the tallest seedlings; *i.e.* 15.7 and 49.69 cm, respectively, followed by the mixture from peat moss + sand + vermiculite, which produced seedlings with the height of 13.7 and 41.33 cm, for the first and second years, respectively. These results are in accordance with those obtained by El-Sallami (1996) on *Ficus benjamina,* and Vernon and Canada (1985) on *Pinus contonrta* and other ornamental trees.

The data showed significant differences in the first and second years, between the stem thicknesses of seedlings grown in the different growing media. The mixture of peat moss + sand + perlite gave 6.7 mm in the first year and 7.8 mm in the second year. Also, peat moss + sand + vermiculite was similarly favorable for increasing stem diameter. This means that using these mixture produced the highest values of stem thickness of magnolia seedlings. This may be attributed to the availability of the different nutrients in an easy form to be absorbed by the seedlings which reflected on the growth parameters by increasing stem diameter.

Data presented in Table (1) reveal that magnolia seedlings formed the maximum number of leaves/seedling (6.7) and 9.7 when they were grown in the mixture of peat moss + sand + perlite, and the mixtures of peat moss + sand + vermiculite (5.2) and (9.00) and peat moss + sand + dried leaves (4.9) and (7.3) in the first and second years, respectively. These findings are in agreement with those obtained by Nam *et al.*

(1994), who stated that the mixture of peat + perlite + vermiculite (6: 2: 2 v/v/v) was more favorable for growth (leaves number/plant and leaf area) than other media.

Table 1. Effect of growing media on plant height, stem diameter, number of leaves/plant and leaf area of *Magnolia grandiflora* L. seedlings during the first year (2006/2007) and the second year (2007/2008).

Growing media	Plant height (cm)		Stem diameter (mm)		Number of leaves/plant		Leaf area (cm²)	
	1st year	2nd year	1st year	2nd year	1st year	2nd year	1st year	2nd year
Peat + sand	10.0	33.67	4.7	6.6	3.0	6.0	26.61	35.07
Peat + sand + clay	11.5	37.00	5.1	6.6	3.9	6.7	37.11	46.72
Peat + sand + perlite	15.7	49.69	6.7	7.8	6.7	9.7	51.31	73.94
Peat + sand + vermiculite	13.7	41.33	6.2	7.7	5.2	9.0	43.11	65.48
Peat + sand + dried leaves	13.0	39.67	5.6	7.3	4.9	7.7	40.00	56.26
LSD at 5 %	0.7	0.61	0.7	1.0	0.4	0.6	1.06	2.18

The responses of leaf area of magnolia seedlings to the different growing media are shown in Table (1). Magnolia seedlings produced the largest leaves in the first year (51.31 cm²) when plants were grown in the mixture of sand + peat moss + perlite and the mixtures of peat moss + sand + vermiculite (43.11 cm²) .In the second year, the mixture of peat moss + sand + perlite, followed by the mixtures of peat moss + sand + vermiculite which indicate the response of area of leaves to the highest values (73.94 and 65.48 cm², respectively). The mixture of peat moss + sand reduced the leaf area to 35.07 cm², compared with the other growing media. The findings are in agreement with the results obtained by Matysiak and Nowak (l988) on *Ficus benjamina* and Abd El Azeem (2006) on *Ruscus hypoglossum* .The data presented in Table (2) show that fresh and dry weights of magnolia's leaves were greatly affected by the mixtures of growing media. In most cases, the heaviest fresh weight of leaves (21.17 g) was obtained from growing the seedlings in the mixtures consisting of peat moss + sand + perlite. Mixtures of peat moss + sand + vermiculite and peat moss + sand + dried leaves produced also a considerable increase in leaf fresh weight (19.13 and 17.42 g, respectively). On the other hand, growing magnolia seedlings in a medium containing peat moss + sand resulted in the lowest value of fresh weight *i.e.* (14.25 g).

Concerning the effect of growing media on dry weight of leaves, the data in Table (2), clearly indicate that the responses of dry weights of leaves of magnolia seedlings to the growing media showed almost the same trend of fresh weight. Using the mixtures of peat moss + sand + perlite, produced the greatest increase of dry weight (4.31 g) as compared to the other media. Meanwhile, peat moss + sand + vermiculite and peat moss + sand + dried leaves as growing media were favorable for producing a the markable increase dry weight of leaves *i.e.*, (3.59 and 3.29 g, respectively). These results are in agreement with Matysiak and Nowak (1988) on *Ficus benjamina* El- Khateeb *et al* (2006) on *Ficus alii*.As shown in Table (2), there are significant differences in fresh weight of stems when magnolia seedlings were grown in the various mixtures. Peat moss + sand+ perlite was the most favorable medium for increasing fresh weight of stem that produced in (15.10g); which was significantly higher than the other media. Peat moss + sand + vermiculite, peat moss + sand + dried leaves and peat moss + sand + clay showed the same trend of increasing fresh weight of stems, as they produced 13.98, 13.98 and 13.47 g, respectively. On the other hand, growing magnolia seedlings in the mixtures of sand + peat moss reduced the fresh weight of stems to the minimum value (12.63g). Concerning the effect of growing media on dry weight of stems, it is clear that the response of dry weight of stems of magnolia seedlings to the growing media followed the same trend of the fresh weight as shown in Table (2).These results are in agreement with El-Sallami (1996) on *Ficus benjamina*.

Table 2. Effect of growing media on fresh and dry weights of leaves, stems and roots and root length for *Magnolia grandiflora* seedlings after 24 months

Growing media	Fresh weight of leaves	Dry weight of leaves	Fresh weight of stems	Dry weight of stems	F.wt roots	Dry weight of roots	Root length
	(g)	(g)	(g)	(g)	(g)	(g)	(cm)
Peat + sand	14.25	1.93	12.63	2.18	8.21	1.12	14.0
Peat + sand + clay	15.55	2.29	13.47	2.92	8.76	1.32	14.6
Peat + sand + perlite	21.17	4.31	15.10	4.07	14.94	2.14	22.0
Peat+sand + vermiculite	19.13	3.59	13.98	3.77	12.81	1.86	18.0
Peat + sand + dried leaves	17.42	3.29	13.98	3.36	13.31	1.47	17.0
LSD at 5 %	0.93	0.61	0.40	0.49	0.86	0.32	0.9

The effects of growing media on the fresh and dry weights of roots are shown in Table (2). It is obvious from the data, that the fresh weight of roots of magnolia seedlings was markedly increased when seedlings were grown in the mixture of sand + peat moss + perlite, (14.94 g) followed by sand + peat moss + vermiculite and peat moss + sand + dried leaves, giving the values of 12.81 and 12.31 g, respectively.

Using the mixtures of peat moss + sand + clay and sand + peat moss as a growing medium markedly reduced the weight of roots (8.76 and 8.21 g, respectively.)

Concerning the effect of growing media on dry weight of roots, the data in Table (2) indicate that the dry weights of roots to the growing media was markedly increased when plants were grown in the following mixtures peat moss + sand + perlite and peat moss + sand + vermiculite (2.14 and 1.86 g, respectively.)

Generally, the response of roots dry weight of magnolia seedlings to growing media showed almost the same trend of fresh weight as shown in Table (2). These results are in agreement with E1-Khateeb *et al.* (2006) on two cultivars of *Ficus alii*.

Generally, the highest values of fresh and dry weight of leaves, stems and roots were obtained from seedling plants grown in the mixtures of sand + perlite + peat moss followed by sand + peat moss + vermiculite.

As shown in Table (2) growing magnolia seedlings in the mixtures of peat moss + sand + perlite produced the heighest value of root length (22.0 cm) which was significantly higher than the other values. On the other hand, the least favourable media for root elongation were peat moss + sand + clay (14.0 and 14.6 cm, respectively). These results are in agreement with Singh and Nair (2003) on some woody foliage plants, who stated that the length of roots was the maximum with the mixture of soil, sand and compost at ratio of 2 : 1 : 1. Also, Karakir *et al*. (1994) on fig plant.

Effect on chemical composition
Pigments content

Data in Table (3) show the effect of growing media on the contents of chlorophyll a, b and carotenoids in the leaves of magnolia seedling. The results indicate that, the mixtures of peat moss + sand showed the highest content of chlorophyll-a (1.23 mg/g F.W) in the leaves. The highest value of chlorophyll-b in the leaves of magnolia seedling, was also, recorded with the mixtures of peat moss + sand (1.26 mg/g F. W.).Regarding the effect of media on the content of carotenoids, the obtained data, indicate that, the highest values (0.91 and 0.86 mg/g F. W.) in the leaves of magnolia seedlings were recorded with the mixtures of peat moss + sand and peat moss + sand + vermiculite, respectively. Generally, the mixture of peat moss + sand was the most favorable media for increasing the contents of chlorophyll-a, chlorophyll-b and carotenoids. In this regard, Poole and Conover (1984) on some woody foliage plants, and Abou Dahab (1996) on *Brassaia arboricolaand and* El-Khateeb *et al.* (2006) on *Ficus alii.*

Total carbohydrate (% D.W.)

Data in Table (3), shows the effect of growing media on the content of total carbohydrates in the different parts of magnolia seedling. The results indicate that, the highest values of the total carbohydrates content in the leaves (46.06 and 44.69 %) of magnolia seedlings were recorded when seedlings were grown in the mixtures of peat moss + sand + vermiculite and peat moss + sand + dried leaves, respectively.

Whereas the lowest values in the leaves (37.41 and 35.55 %) were recorded when the seedlings grown in peat moss + sand + perlite and peat moss + sand + clay, respectively. The stem content of total carbohydrates reached the highest value when seedlings were grown in peat moss + sand + vermiculite (51.00 %). Whereas, the lowest value (28.29 %) was recorded when seedlings were grown in peat moss + sand + perlite. The highest values of total carbohydrates in the roots of magnolia seedlings, were recorded with the mixture of peat moss + sand + vermiculite (46.93 %), whereas, the content of total carbohydrates in the roots decreased to the minimum value when seedlings were grown in the mixture of peat moss + sand (31.20 %). In this connection, Abou- Dahab (1996) on *Brassaia arboricola,* stated that using a mixture consisted of peat moss + clay + vermiculite or peat moss + vermiculite + sand had a remarkable effect on increasing the total carbohydrates in the stems. El-Sallami (1996) on *Ficus benjamina,* found that media composed of peat moss + clay or vermiculite produced high leaf contents of carbohydrate. Whereas, El-Khateeb *et al.* (2006) on *Ficus alii,* found that the mixtures of clay + peat + perlite, and clay + sand + vermiculite, increased the content of carbohydrates in the leaves, whereas the highest content of carbohydrates in the roots was obtained on media containing vermiculite.

Table 3. Effect of growing media on the contents of chlorophyll-a, b, carotenoids (mg/g F. W.) in the leaves and total carbohydrates (% D. W.) in the different organs of *Magnolia grandiflora* L. seedling after 24 months

Growing media	Chlorophylls content mg/g F. W.			Total carbohydrates content % D. W.		
	Chl. a	Chl. b	Carotenoids	Leaves	Stems	Roots
Peat + sand	1.23	1.26	0.91	38.59	43.30	31.20
Peat + sand + clay	0.95	0.58	0.77	35.55	42.19	43.75
Peat + sand + perlite	1.00	0.58	0.82	37.41	28.29	41.37
Peat +sand + vermiculite	1.02	0.61	0.86	46.06	51.00	46.93
Peat + sand + dried leaves	0.53	0.34	0.42	44.69	31.55	33.17

Minerals content
Nitrogen content (% D.W.)

The response of nitrogen content in the leaves, stems and roots of the magnolia seedling to the different growing media are presented in Tables (4). The results showed that, using peat moss + sand + clay and peat moss + sand + perlite as growing media increased the N % to the highest values (1.94 and 1.45 %, respectively), whereas most of the other growing mixtures showed lower content of nitrogen in the leaves. Similarly, Watfa (2009) on Aleppo pine seedlings and Mazhar *et al*., (2010) on *Jatropha curca* L., stated that using a mixture of sand + clay increased the content of nitrogen. The highest content of N stems was recorded when plants were grown in peat moss + sand + clay, followed by the mixture of peat moss + sand + vermiculite as increased the N % to the highest values (1.34 and 1.34 %, respectively). Also, the content of N in the roots, reached the highest values when seedlings were grown in sand + peat moss + vermiculite followed by the mixture of peat moss + sand + dried leaves i.e. (2.26 and 2.04 %, respectively), however, the other growing media decreased the content of N in the roots. These findings agreed with those obtained by Watfa (2009) on Aleppo pine who stated that the roots of seedlings were grown in the mixture of peat moss + sand + vermiculite contained higher N in roots. Gomaa (2000) on *Ornithogalum thyrsoides* plants, stated that using a mixture of sand + composted leaves increased the content of nitrogen.

Phosphorus content (% D.W.)

Concerning the effect of growing media on P %, as shown in Table (4), it is clear that growing the magnolia seedlings in a mixture of peat moss + sand + perlite or peat moss + sand + clay and peat moss + sand increased P % in the leaves gave the highest values (0.23, 0.22 and 0.22 %, respectively).The mixture of peat moss + sand + dried leaves produced the highest P content in stem (0.25%), followed by the mixtures of peat moss + sand + vermiculite (0.21%) and peat moss + sand gave the highest P % in the stems (0.19 %) compared with sand + peat moss + perlite medium (giving the lowest value 0.17 %). The highest phosphorus content in the roots (0.34 %) was recorded in seedlings grown in peat moss + sand + clay. Whereas, the lowest phosphorus content in the roots (0.19 %) was recorded in seedlings grown in peat moss + sand + dried leaves. Saleh (2000) on *Ficus benjamina* 'Starlight' indicated that peatmoss + sand + clay mixture increased the contents of N and P and K.

Table 4. Effect of growing media on the contents of nitrogen, phosphorus and potassium (% D. W.) in the different organs of *Magnolia grandiflora* L. seedlings. (after 24 months)

Growing media	Leaves	Stems	Roots
	Nitrogen (%D. W.)		
Peat + sand	1.34	0.97	1.77
Peat + sand + clay	1.94	1.34	1.83
Peat + sand + perlite	1.45	1.24	1.88
Peat + sand + vermiculite	1.18	1.34	2.26
Peat + sand + dried leaves	1.34	1.24	2.04
	Phosphorus(% D. W.)		
Peat + sand	0.22	0.19	0.22
Peat + sand + clay	0.22	0.18	0.34
Peat + sand + perlite	0.23	0.17	0.20
Peat + sand + vermiculite	0.19	0.21	0.23
Peat + sand + dried leaves	0.20	0.25	0.19
	Potassium(%D. W.)		
Peat + sand	1.31	0.78	1.05
Peat + sand + clay	1.20	0.71	1.15
Peat + sand + perlite	1.16	0.69	0.82
Peat + sand + vermiculite	1.43	0.63	1.26
Peat + sand + dried leaves	1.12	0.54	0.97

Potassium content (% D.W.)

Data concerning the effect of growing media on K% are shown in Table (4). Results indicate that, growing the seedlings in a mixture of peat moss + sand + vermiculite, peat moss + sand and in peat moss + sand + clay produced 1.43, 1.31 and 1.20 %, respectively. in leaves of magnolia. Whereas, growing the plants in media consisting of peat moss + sand + dried leaves mixture decreased K % content to the minimum value (1.12 %). In this regard, El-Sallami (1996) on *Ficus benjamina*, found that the mixture of peat moss + clay or vermiculite increased the leaf contents of N, P, K and Mg. As shown in Table (4), growing the seedlings in a mixture of peat moss + sand, peat moss + sand + clay and peat moss + sand + perlite increased K content in the stems to the highest values (0.78, 0.71 and 0.69 %). The highest K content in the roots (1.26 %) was recorded in seedlings grown in peat moss + sand + vermiculite followed by peat moss + sand + clay and peat moss + sand *i.e.* (1.15 and 1.05 %, respectively). Saleh (2000) on *Ficus benjamina* 'Star light' indicated that peat moss + sand + clay mixture increased the contents of N and P and K. El-Khateeb *et al*. (2006) on *Ficus alii*, found that growing the plants in a mixture of clay + sand + peat moss or clay + sand + vermiculite increased K-content in the roots. Contin *et al*. (2008) stated that perlite is usually included in a mixture to increase drainage but does not increase the retention of nutrients, in contrast, vermiculite with its plate-like structure holds large quantities of water and positive charged nutrients like potassium, magnesium and calcium.

References

Abd EI-Azeem, A. M., 2006. Studies on the effect of some agriculture treatments on production of *Ruscus hypoglossum* L. plants cut foliage leaves. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt, 124 p.

Abou-Dahab, T. A. M., 1996. Effect of growing media, nitrogen sources and commercial fertilizers on growth and chemical composition of *Brassaia arboricola* cv. "Gold Capella "plants. Ph.D. Thesis, Fac. of Agric., Cairo Univ., Egypt, 153 p.

Brown, C. and K. Kirman, 1990. Trees of Georgia and Adjacent States. Timber Press, INC. Portland. pp. 230-245.

Chapman, H. D. and P. F. Pratt, 1961. Methods of Analysis for Soils, Plant and Water. Div. Agric. Sci. Univ. Calif., USA, pp. 297-309.

Contin, M., M. De Nobili, and C. Cattiveilo, 2008. Mineralizatioin immobilizadon of nitrogen and phosphorous in composted growing media. ISHS Acta Horticulturae, 21(3):678-779

Cottenie, A. M., M. Verloo, L. Kiekens, G. Velghe, and R. Camerlynck, 1982. Chemical Analysis of Plant and Soil. Laboratory of Analytical and Agrochemistry. State Univ. ghent, Belgium, pp.100-129.

El-Khateeb, M. A., E. E. El-Maadawy, and A. A. El-Atter, 2006. Effect of growing media on growth and chemical composition of *Ficus alii* plants .Annals of Agricultural Science Moshtohor, 46(2): 1987-1998.

El-Sallami, I. H., 1996. Response *of Ficus benjamina* L. to different potting media and doses of nutrient solution. Assiut Journal of. Agriculture Science, 27(3): 61-76.

Gomaa, S .A., 2000. Physiological studies on *Polianthes tuberosa* and *Ornithogalum thyrsoides* bulbs. Ph.D. Thesis, Fac. Agric., Kafr El-Sheikh, Tanta Univ., 126 p.

Grilles, S., M. L. Lucas, E. Bardopoulou, S. Sarafopoulos and M. Voulgari, 2001. Perlite soilless culture system: current commercial application and prospect. Acta Hort., 548: 105-113.

Herbert, D. P., P. Phlipps, and R. Styrangl, 1971. Determination of carbohydrates method on microbial. 58: 209-344.

Karakir, N., A. Misirli, G. Seferoglu, and S. Kara, 1994. Research on the rooting of fig cuttings. I. Effect of different media. Ege- Universitesi- Ziraat- Fakultesi- Dergisi. 31, (2-3): 79-84.

Matysiak, B. and J. Nowak, 1988. Acclimatization and the growth of *Ficus benjamina* micro cuttings as affected by carbon dioxide concentration. Journal of Horticulture Science and Biotechnology, 73(2): 185-188.

Mazhar Azza A. M., G. Abd El-Aziz Nahed and E. El-Habba, 2010. Impact of different soil media on growth and chemical constituents of *Jatropha curca* L. seedlings grown under water regime. Journal of American Science, 6 (8): 549- 556

Milne, L. and M. Milne, 1975. Living Plants of the World. Chanticleer Press. New York, pp. 435-491

Nam, C. W., W. B. Kim, D. Yoo, B. H. Hahn, J. K. Kirn, and K. S. Choi, 1994. Agronomic characters of *Cyclamen persicum* affected by the different shadings and pot soils under rain shelter in Alpine area. Rda Journal Agricultural Science. Horticulture, 36(2): 464-470.

Olympics, C. M., 1992. Soilless media under protected cultivation rockwoll, peat, perlite and other substrates. Acta Hort., 321: 251-260.

Poole, R. T. and C. A. Conover, 1984. Growth of foliage plants in ratios of peat and sand while fertilized and irrigated at different levels. Florida Foliage, USA, 5: 3- 5.

Saleh, S. I., 2000. Effect of different planting media on the growth and chemical composition of *Ficus benjamina* "Star Light" plants grown under two locations "outdoor and plastic house" conditions. Egyptian-Journal. Hort, 27(4): 543-568.

Singh, D. R. and S. A. Nair, 2003. Standardization of rooting media for cuttings of certain house plants. J. Orn. Hort. New Series, 6(1): 78-79.

Snedecor, C. W. and W. G. Cochran, 1980. Statistical Methods. 6th ed. lowa State Univ., Press, Ames. lowa, USA., pp. 941-953.

Snell, F. D. and C. T. Snell, 1949. Colorimetric Methods of Analysis. 3rd ed. Van Nostrand, New York, USA, pp. 785-807.

Verdonck, O., V. Leeschauwer and M. De Boodt 1991. The influence of the substrates on plant growth. Acta Hort., 126: 251-258.

Vernon, B. C. and A. N. Canada, 1985. Growing conifer seedlings in woodwaste sewage sludge compost. Research Note, British Columbia Ministry of Forests, No. 98.
Watfa, R. A., 2009. Effect of soil media, nutrition and mycorrihza fungi on growth and chemical composition of carob and aleppo pine seedlings. M.Sc. Thesis, Fac. Agric., Cairo Univ., Egypt, 128 p.
Wettstein D., 1957. Chlorophyll lethol und dres sunbrnikr Skopiscke formivechsei der piastiden. Exptal Cell. Res.,12 : 4.