INTERNATIONAL JOURNAL OF AGRICULTURE & BIOLOGY
ISSN Print: 1560–8530; ISSN Online: 1814–9596
12–146/AWB/2012/14–6–985–988
http://www.fspublishers.org

Full Length Article

Comparison of the Effect of Different Soilless Growing Media on some Growth Characteristics of Benjamin Tree (*Ficus benjamina*)

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ABSTRACT

Ficus benjamina L. is commercially grown as an ornamental plant. Experiments were conducted to study the effect of different soilless growing media (peat, perlite, composted tree bark, composted tea wastes & rice husks) on plant height, stem diameter, the number of lateral shoots, fresh and dry weight of shoots and fresh and dry weight of roots. Results showed that the effect of different soilless growing media on all these characteristics was significant. Growing medium containing composted tea wastes + rice husks in the proportions of 50 and 50% (v/v) was the best medium for enhancing all these characteristics. Minimum increasing in all characteristics was observed in cuttings grown in growing medium containing rice husks + composted tree bark in the proportions of 50 and 50% (v/v). Analysis of variance (ANOVA) of data showed that the effect of different soilless growing media on all characteristics was significant ($p<0.05$). © 2012 Friends Science Publishers

Key Words: *Ficus benjamina*; Cultivation bed; Dapple-grey; Ornamental plants

INTRODUCTION

Benjamin tree (*Ficus benjamina* L.) belongs to the Mulberry family. This ornamental plant is one of about 60 species of *Ficus* (Bailey & Bailey, 1976; Wagner *et al*., 1999). *F. benjamina* is a popular tree and cultivated worldwide for ornamental purposes. The genus *Ficus* is made up of about 1000 species from pan tropical and subtropical origins (Wagner *et al*., 1999). Plants in the genus are all woody, ranging from trees and shrubs to climbers (Neal, 1965).

Species *F. benjamina* is a shows great variations with several cultivars and varieties in cultivation (Riffle, 1998). In temperate areas of the world it is grown as a houseplant. *Ficus* species propagate from seed and many can be propagated from cuttings. Successful greenhouse and nursery production of container-grown plants is largely dependent on the chemical and physical properties of the growing media (Fitzpatrick, 2001; Wilson *et al*., 2003). A number of critical chemical and physical properties need to be evaluated before making a final media decision (Fitzpatrick, 2001; Wilson *et al*., 2003). Media pH is a critical issue because it plays a major role in determining the availability of many nutrients. Optimum pH of a container medium differs with plant species, but generally a range between 5.0 and 6.5 is desirable (Fitzpatrick, 2001; Wilson *et al*., 2003). The challenge with most modern container mixes is that they rely heavily on organic components such as peat and bark. A high carbon to nitrogen ratio can be a concern to a grower, since it may reflect a tendency for the media to experience rapid decomposition and subsequent decrease in volume and aeration. Significant composting, or decomposition in the pot, not only causes concerns for a deterioration in physical properties, but nitrogen that would normally be available for plant growth will be utilized by the microorganisms involved in the composting process (Fitzpatrick, 2001; Wilson *et al*., 2003).

During the last ten years, peat consumption in horticulture is remarkably increased and the level of imports has multiplied by ten. It is therefore interesting to search out and use cheaper domestic components for the substrates to replace peat at least partially. These substrates must be analyzed to verify the physical properties more suitable for the best growth and mineral nutrients of *F. benjamina*. *F. benjamina* can be successfully grown in the soils with proper pH, aeration and drainage. The soil should be rich in organic matter and retain sufficient moisture for proper growth. Also, maximum yield is obtained by the use of suitable portion of carbon, nitrogen, manganese, magnesium, zinc, copper, iron, phosphorous and potassium (Alizadeh Zavieh, 2005). Selection of growing media type and its effect on vegetative and reproductive growth in *F.*

To cite this paper: Abouzari, A., S. Rouhi, A. Eslami and B. Kaviani, 2012. Comparison of the effect of different soilless growing media on some growth characteristics of benjamin tree (*Ficus benjamina*). *Int. J. Agric. Biol.*, 14: 985–988

benjamina are the main mental disturbance for growers. In recent years, there has been increasing environmental and ecological concerns against the use of peat (Zaller, 2007). Several studies demonstrated that peat can be substituted by various compost types without any negative effects on the plants (Hashemimajd *et al*., 2004; Zaller, 2007).

The purpose of this study was to compare the effect of some compost growing media or organic wastes (composted tree bark, composted tea wastes & rice husks) on some plant characteristics including plant height, stem diameter, the number of lateral shoots, fresh and dry weight of shoots and fresh and dry weight of roots of *F. benjamina* and comparison of them with peat and perlite.

MATERIALS AND METHODS

The experiment was carried out in 2010 in Tonekabon agriculture education center located in Salmanshahr city, Mazandaran province in the northern part of Iran. Cuttings of *Ficus benjamina* L. were prepared from a commercial greenhouse. Uniform apical shoots, as explants, was obtained from one-year-old mother plants. At first, the explants were planted in a growing media containing sand and perlite in the proportions of 50 and 50% (v/v) for rooting. Then, rooted cuttings were planted in different soilless growing media. Used soilless growing media were peat, perlite, composted tree bark, composted tea wastes, and rice husks. The acidity of peat was 5.5–6.5, and perlite size was 2–3 mm. Tea wastes, decayed in natural conditions, were obtained from local tea factories. Trees bark was produced from organic compounds during three months in controlled conditions. Rice husks was prepared from a rice factory and used fresh. Rooted cuttings of *F. benjamina* were planted in the plastic pots (20 × 15 cm) filled with proportions of 50:50% (v/v) of composted tree bark + composted tea wastes, rice husks + composted tea wastes, composted tree bark + rice husks, and peat + perlite and perlite + composted tea wastes and arranged in a randomized design. The time of planting the rooted cuttings was the end of April. Rooted cuttings were planted in depth of 5 cm. Pots were watered each 3–4 days. To sprinkle water on plants was carried out in order to enhancing the circumstance moisture. Kristalon complete fertilizer (0.2%) was used each 10 days as spray. Pymetrozine and Benomyl were applied as bactericide and fungicide and killer of the other pests and pathogens.

Data were taken in the middle of September. Of the potted plants, plant height, stem diameter, the number of lateral shoots, fresh and dry weight of shoots and fresh and dry weight of roots were measured. Plant height was determined via a ruler at the end of the experiment by cutting aboveground parts at soil surface. Stem diameter was calculated by a digital caliper from aboveground parts of stems. Also, the number of lateral shoots was counted. For determination of shoots dry weight, the plants were cut from aboveground parts and then dried in Oven at 75°C for 24 h, after taking fresh weight by a digital balance. To obtain the roots dry weight, the roots were dried in an Oven at 75°C for 24 h. Before drying the roots, their fresh weight was taken by a digital balance.

The experiment was carried out in a complete randomized block design (RCBD) with five treatments and four replications (60 pots). Data was subjected to analysis of variance (ANOVA) and the means compared using the Duncan's test at 5% probability level and MSTAT-C software package.

RESULTS

The overall results of the plant height, stem diameter, number of lateral shoots, fresh and dry weight of shoots and fresh and dry weight of roots of *F. benjamina* are summarized in Table I. The highest and lowest plant height (25.83 & 20.90 cm, respectively) was observed in plants cultivated in composted tea wastes + rice husks and composted tree bark + rice husks, respectively (Table I). The effect of peat + perlite (22.40 cm), composted tea wastes + composted tree bark (23.23 cm) and perlite + composted tea wastes (22.57 cm) on the plant height were almost similar (Table I).

Data revealed that differences among different growing media on the plant height were significant ($p<0.05$). Plants grown in composted tea wastes + rice husks showed the most stem diameter (3.119 mm). Stem diameter in plants grown in composted tea wastes + composted tree bark (2.991 mm) was also suitable (Table I). There was no significant difference between other treatments (Table I). Analysis of variance showed that differences among different growing media on the stem diameter were significant ($p<0.05$). The largest and least number of lateral shoots (8.593 & 5.197, respectively) was observed in cuttings cultivated in composted tea wastes + rice husks and composted tree bark + rice husks, respectively (Table I).

The effect of peat + perlite (6.663), composted tea wastes + composted tree bark (6.230) and perlite + composted tea wastes (6.637) on the number of lateral shoots were almost similar (Table I). Analysis of variance showed that the effect of different growing media on the number of lateral shoots were significant ($p<0.05$). Maximum of shoot fresh and dry weight (11.65 & 6.218 g, respectively) was calculated in cuttings cultivated in composted tea wastes + rice husks (Table I). Also, minimum of shoot fresh and dry weight (3.933 & 1.569 g, respectively) was obtained in cuttings cultivated in composted tree bark + rice husks (Table I). Analysis of variance indicated that differences among different growing media on fresh and dry weight of shoots were significant ($p<0.05$). Fresh and dry weight of shoots in plants grown in composted tea wastes + composted tree bark (10.43 & 5.302 g, respectively) was proper. (Table I). Maximum of root fresh and dry weight (7.367 & 2.918 g, respectively) was obtained in cuttings cultivated in composted tea wastes +

rice husks (Table I). Also, minimum of root fresh and dry weight (1.590 & 0.596 g, respectively) was obtained in cuttings cultivated in composted tree bark + rice husks (Table I). Analysis of variance indicated that differences among different growing media on fresh and dry weight of roots were significant ($p<0.05$). Fresh weight of roots in plants grown in composted tea wastes + composted tree bark (4.347 g) was almost suitable (Table I). Fresh weight of roots in plants grown in peat + perlite and perlite + composted tea wastes was similar, completely (Table I). The effect of peat + perlite (1.325 g), composted tea wastes + composted tree bark (1.102 g) and perlite + composted tea wastes (1.475 g) on the dry weight of roots were relatively similar (Table I).

Our results indicated an overall significant positive correlation ($r=0.955$, $p=0.0001$) between the numbers of lateral shoots and shoots dry weight. Weak positive correlation ($r=0.326$, $p=0.05$) was observed between the plant height and stem diameter. Stem diameter had less positive correlation with other characteristics (Table II).

DISCUSSION

Generally, the results of current study showed that a substitution of commercial peat potting substrate with composted tea wastes along with rice husks. Combination of these two compounds with equal proportion is suitable substitution for peat. Many studies showed superiority of composted organic compounds than peat for increasing the quality and quantity features of both agricultural and horticultural plants (Padasht Dehkaei, 1998; Atiyeh *et al*., 2000; Wilson *et al*., 2003; Zaller, 2007). Composted tea wastes + rice husks (caused the highest growth parameters of *F. benjamina* in our studies) had the lowest acidity (pH), highest total nitrogen and highest manganese compared to other treatments (Alizadeh Zavieh, 2005). Composted tree bark + rice husks growing medium (caused the lowest growth parameters of *F. benjamina* in our studies) had the highest acidity compared to other treatments. Minimum total nitrogen and manganese belonged to peat + perlite (Alizadeh Zavieh, 2005). In the current experiment, growth and shoot and root biomass production of potted plants was significantly altered by peat substitution through composted tea wastes along with rice husks (Karimi, 2003; Wilson *et al*., 2003). In this connection, studies of Padasht Dehkaei (1998) on *Tagetes*, Karimi (2003) on *Dieffenbachia* and Wilson *et al*. (2003) on *Salvia*, showed the beneficial effect of composted tree bark, composted tea wastes and rice husks on quality and quantity parameters of these plants. Results of our work indicated a significant positive correlation between the numbers of lateral shoots and shoot and root biomass production of potted *F. benjamina*. These results are in agreement with those obtained by Alizadeh Zavieh (2005) on *F. benjamina*, reported that composted organic compounds in growing media caused an increase in shoot and root biomass production. Studies of D'Angelo *et al*. (1995) on cyclamen showed that the substrates with higher water retention capacity such as mixtures containing bark compost, peat and draining component were the best for vegetative plant growth. Among the draining components, rice husks and pumice, which are much cheaper than peat and perlite, gave the same performances as the last one. The results of these trials are encouraging for the research of alternative substrates: in fact, as regards cyclamen and pot chrysanthemum, the best cultural results were achieved by reducing the quantity of peat in the substrate to 1/3 of the total amount.

Table I: The effect of different growing media on plant height, stem diameter, number of lateral shoots, fresh and dry weight of shoots and fresh and dry weight of roots of *Ficus benjamina* L*

Growing media	Plant height (cm)	Stem diameter (mm)	The number of lateral shoots	Fresh weight of shoots (g)	Dry weight of shoots (g)	Fresh weight of roots (g)	Dry weight of roots (g)
Tree bark + tea wastes	23.2±1.8b	2.9±0.2a	6.2±0.5c	10.4±1.0b	5.3±0.5b	4.3±0.7b	1.1±02b
Rice husks + tea wastes	25.8±2.1a	3.2±0.4a	8.6±0.6a	11.6±1.2a	6.2±0.8a	7.7±1.1a	2.9±0.8a
Rice husks + tree bark	20.9±1.8c	2.3±0.3b	5.2±0.3d	3.9±0.2e	1.5±0.2c	1.6±0.3c	0.6±0.1c
Peat + perlite	22.4±1.9b	2.4±0.7b	6.6±0.9b	9.8±07c	4.6±0.7b	3.8±0.3b	1.3±02b
Tea wastes + perlite	22.5±1.7b	2.3±0.5b	6.6±1.0b	8.3±0.8d	3.7±0.6b	3.8±0.5b	1.5±0.2b

*In each column, means with the similar letters are not significantly different at 5% level of probability using Duncan's test

Table II: Simple correlation of the effect of different growing media on plant height, stem diameter, the number of lateral shoots, fresh and dry weight of shoots and fresh and dry weight of roots of *Ficus benjamina* L

Characteristics	Plant height	Stem diameter	Number of lateral shoot	Fresh weight of shoot	Fresh weight of root	Dry weight of shoots	Dry weigh of roots
Stem diameter	0.326						
Number of lateral shoot	0.751**	0.555*					
Fresh weight of shoot	0.690**	0.451	0.729**				
Fresh weight of root	0.808**	0.448	0.937**	0.876**			
Dry weight of shoots	0.735**	0.618*	0.955**	0.750**	0.910**		
Dry weight of roots	0.761**	0.432	0.883**	0.674**	0.902**	0.858**	1.000

**Correlation is significant at the 0.01 level, *Correlation is significant at the 0.05 level

Studies of Amarjeet and Godara (1995) and Mohamed (1994) on the effect of growing media and fertilizer on growth characteristics of *Polianthes tuberosa* L. showed that composted leaves medium or its mixture with sand increased some growth characteristics. El-Naggar and El-Nasharty (2009) indicated the superiority of using composted leaves medium for increasing of total fresh and dry weight in *Hippeastrum vittatum*, Herb. Similar results obtained by Ali (1998) on *Lawsonia inermis*. Studies of El-Naggar and El-Nasharty (2009) on the effect of growing media (clay, composted leaves & sand + composted leaves) on growth of *Hippeastrum vittatum*, Herb revealed that the different growing media had significant effect on the most vegetative growth characteristics. Applying the complete fertilizer of nitrogen, phosphorus and potassium grown in composted leaves medium or its mixture with sand, gave the maximum effect on some growth characteristics. Studies of Mahgoub *et al*. (2006) on response of Iris bulbs grown in sandy soil to nitrogen and potassium fertilization showed that the plant height, number of leaves as well as fresh and dry weight increased when bulbs were fertilized with suitable levels of nitrogen and potassium in sandy soil medium. These results may be due to the growth and production of plants affected by soil type and may be sandy soil is poor in nutrient content.

In conclusion, type of growing media due to their different fertilizers and other factors are effective on growth characteristics. These results showed that composted tea wastes along with rice husks had better effect on improvement of shoot and root biomass production than other growing media.

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(Received 03 April 2012; Accepted 09 July 2012)