INNSPUB

International Journal of Biosciences | IJB |
ISSN: 2220-6655 (Print), 2222-5234 (Online)
http://www.innspub.net
Vol. 6, No. 3, p. 76-82, 2015

RESEARCH PAPER OPEN ACCESS

Effect of rooting beds, IBA concentrations and bottom heat on rooting of plane tree (*Plantanus orientalis* L.) cuttings

Leila Tagipoor[1], Hasan Mahmodzadeh[2*], Zohre Jabarzadeh[3]

[1]*Department of Horticulture Sciences, Science and Research Branch, Islamic Azad University, Tehran, Iran*

[2]*Agricultural and Natural Resources Research Center, West Azerbaijan, Iran*

[3]*Department of Horticultural Sciences, Urmia Branch, Urmia, Iran*

Key words: *Platanus orientalis*L., Indole Butyric acid, Cuttings, Planting bed, bottom heat.

http://dx.doi.org/10.12692/ijb/6.3.76-82 Article published on February 07, 2015

Abstract

In order to study on the effects of rooting bed, IBA concentrations and bottom heat on rooting and some characteristics of plane tree cuttings, an experiment was conducted as factorial in RCBD (4 rep). The treatments were 3 different rooting bed: sand, perlite, and sand + perlite, (1+1 by volume), with 4 levels of IBA concentrations (0 ppm, 1000 ppm, 2500 ppm, and 5000 ppm) and with or without bottom heat, during the primary to 4 months, survival rate, dry weight of roots, root length, number and dry weight of leaves were measured. The results showed that the highest survival rate (76.47%) and dry weight of leaf (4.38g) obtained in combination treatment sand + perlite bed, without auxin treatment and bottom heat system, the highest dry weight of root (5g) obtained in combination treatment sand bed, 2500ppm IBA and without bottom heat system, the highest number of leaf (9.6 leaf) obtained in combination treatment sand + perlite bed, 2500ppm and bottom heat system.

* **Corresponding Author:** Hasan Mahmodzadeh ✉ mahmoudzadeh_h@yahoo.com

Introduction

Plane tree (*Platanus orientalis* L.) is extensively planted as a street and courtyard tree. Its popularity is due to its many desirable traits, such as fast growth, broad crown, wide adaptability, and resistance to environmental pollution. Its pollen and hair surrounding the nutlets in the globular fruiting heads, however, disperse widely during the spring, which not only pollutes the environment but also results in human ailments such as asthma, pollinosis, coughs, and sore eyes (Subiza *et al*., 1994). *Platanus* species can be propagated by cutting. The reactions against the propagation methods used vary from species to species (Anonymous, 2003; Dirr and Heuser, 2006; Hartman *et al*., 2011). Plane trees are generally propagated through cuttings (Gordienko, 2000). Hardwood cuttings were a best technique for plane tree propagation when practiced in dormant season (Eldeen and Elgimabi, 2009). It was found that there is limited information about the propagation of *Platanus orientalis*L. by cutting (Pandit, 1990; Dirr and Heuser, 2006; Khosrojerdi *et al*., 2006).

Application of auxin, particularly indole–3–butyric acid (IBA), is one of the most common and effective means to enhance rooting of cutting (Blazich, 1988; Dirr and Heuser, 2006; Hartman *et al*., 2011). In some cases, auxin were effective at increasing rooting; while in others, auxin-treated cuttings rooted as well as the untreated controls (Myers and Still, 1979; Panetsos *et al*., 1994; Schmidt, 1998; Nicoloso *et al*., 1999; Santini, 2001; Grolli *et al*., 2005; Dirr and Heuser, 2006; Khosrojerdi *et al*., 2006; Hartman *et al*., 2011; Zencirkiran and Erken, 2012).

Perlite is the best medium for hopbush and rose stem cuttings (Saffari and Saffari, 2012; AlSaqri *et al*. 1996). It is very useful for increasing aeration and drainage within the container because of its uniformity and lightness (Paradiso and Pascale, 2008). Perlite is recognized to have a unique capillary action which makes it a superior growing medium for hydroponic cultures. Fine sands (0.05mm – 0.25mm) do little to improve the physical properties of a growing media and may result in reduced drainage and aeration. Medium and coarse sand particles are those which provide optimum adjustments in media texture (Robbins and Evans, 2004).*On the* other hand perlite + sand was better treatment in increasing percentage of rooting (Shadparvar *et al*., 2012).

Bottom heat can also be used to induce and speed the rooting of hardwood cuttings of deciduous plants. Some plants are extremely difficult to root using other methods. Rhododendrons for instance are very slow if they root at all using other methods, but with bottom heat they root quite fast (Hartmann and kester, 1975).

Material and method

Experiment site description

The study was carried out at Urmia (Iran) greenhouses during 2013 and 2014. The cuttings of *Platanus orientalis*L. were collected from selected stock plants growing at the Kahriz Horticulture research station 45 km Urmia, Iran.

Plant preparation and auxin application

Cuttings were taken from vigorous shoots about 0.8 – 1.5 cm in diameter and 20-30 cm length .The cuttings were randomly divided into groups and applied Indole-3-Butyric acid (IBA) for 2 hours. IBA concentrations were 0, 1000, 2500 and 5000 ppm were used during the applications. Beds including sand, perlite and mixed of perlite and sand (1:1) and with or without bottom heat.

Experimental design and statistics analysis

The experiment was established using randomized plots in a factorial experimental design with four replicates comprised of 20 cutting each. Data analysis using MSTATC software and Duncan's mean comparison tests were performed.

Results and discussion

The results of the analysis of variance showed that the interaction of rooting beds, IBA concentrations and bottom heat showed significant effect at 1% level on percentage survival, Root dry weight, leaf number and Leaf dry weight. did not show significant effects the interaction of rooting beds, IBA concentrations

and bottom heat on root length (Table1).

Influence of rooting bed

According to table 2, different rooting beds have significant effects on rooting properties. Most survival percent obtained in sand + perlite bed (24.166%) and least one was in sand. Longest roots (13.86cm) occurred in sand and shortest obtained in perlite. Most root dry weight obtained in perlite + sand bed (1.907g) and least one occurred in perlite bed. Most leaf numbers were in perlite and least one were in sand +perlite bed. Most leaf dry weight obtained in sand + perlite bed (2.151g) and least one occurred in perlite bed (Table2).

Table 1. Analysis variance of data relation to traits of Plane tree cuttings.

Sources of variations	df	Mean Square				
		Rate of survival cuttings	Root Length	Root dry weight	leaf number	Leaf dry weight
Replication	3	0.03 ns	0.787 ns	0.105 ns	0.354 ns	0.281 ns
Rooting beds type	2	28.108**	10.778**	1.883**	6.111**	1.358**
IBA concentration	3	93.554**	1.155 ns	0.735**	1.653**	0.793*
Interaction AB	6	9.673**	1.772ns	0.427	0.964**	0.579*
Bottom heat	1	104.408**	1.117 ns	4.571**	8.665**	2.6**
Interaction AC	2	73.156**	0.719 ns	0.578**	2.199**	1.949**
Interaction BC	3	1.175**	3.130 ns	0.811**	1.363**	0.957*
Interaction ABC	6	9.373**	2.348 ns	1.822**	3.169**	1.487**
Error	69	0.008	2.096	0.098	0.202	0.252
C.V %		2.69	52.39	14.53	26.20	36.58

ns, * , ** not significant, significant in 5 and 1% respectively.

Influence of IBA concentration

Data obtained under the effects of auxin concentrations showed that treatment with 0 ppm had the highest percentage of survival (44.942) while the other concentration exhibited lower percentage of survival (table 4).The greatest root dry weight (2.236g) was in 1000 ppm IBA. Data obtained from leaf number showed that treatment with the auxin concentration control group and 2500 ppm had the highest number of leaf (3.869, 3.833 leafs respectively). Treatment with 1000 and 5000 ppm exhibited lower leaf number compared to the 0 and 2500 ppm treatment. The greatest leaf dry weight (2.382 g) was in control group (Table 3).

Table 2. Mean Comparison of the effects of rooting beds type on Plane tree cuttings.

Traits					
Rooting beds type	percentage survival	Root length(cm)	Root dry weight(g)	Leaf number	Leaf dry weight(g)
Sand	9.387c	13.86a	1.540b	2.179b	1.465b
perlite +sand	24.166a	12.22b	1.907a	4.668a	2.151a
Perlite	21.68b	5.763c	0.747c	0.654c	1.63b

The mean of treatments with similar letters are not significantly different from each other at 5% level according to Duncan's multi range test.

The decrease of rooting observed by hormone applications did not eliminated by increasing concentrations of hormone. It can be consider that auxins used for promotion of rooting may be toxic. Therefore the next researches should be planned considering this situation (Zencirkiran and Erken, 2012).

Influence of rooting system type

The results showed that the highest survival

percentage, dry weight of root, leaf number and dry weight of leaf in without bottom heat system (24.567%, 1.979g, 3.84 and 2.069g respectively) and lower survival percentage, dry weight of root, leaf number and dry weight of leaf in bottom heat system (Table4).

Table 3. Mean comparison of IBA concentration effects on characteristics of 'Plane tree' cuttings.

IBA concentration	Traits			
	Percentage survival	Root dry weight(g)	Leaf number	Leaf dry weight(g)
0ppm	44.942a	0.718c	3.869a	2.382a
1000ppm	9.09c	2.236a	2.752ab	1.254ab
2500ppm	16.815b	1.750b	3.833a	1.829ab
5000ppm	2.796d	0.889c	1.5b	0.77b

The mean of treatments with similar letters are not significantly different from each other at 5% level according to Duncan's multi range test.

Table 4. Mean comparison of rooting system type on characters of 'Plane tree' cuttings.

System type	Traits			
	Percentage survival	Root dry weight(g)	Leaf number	Leaf dry weight(g)
Without bottom heat	24.567a	2.069a	3.84a	1.979a
With bottom heat	12.254b	0.728b	2.132b	1.140b

The mean of treatments with similar letters are not significantly different from each other at 5% level according to Duncan's multi range test.

Table 5. Mean comparison the interaction of rooting beds and IBA concentrations and bottom heat on Plane tree cuttings.

Treatment	percentage survival	Root dry weight(g)	Leaf number	Leaf dry weight(g)
A1B1C1	38.235d	0.811b	4.153b	2.268b
A1B2C1	5.55e	5a	6b	2.84b
A1B3C1	5e	5.03a	5b	2.26b
A1B4C1	0e	0b	0c	0c
A2B1C1	54.838c	0.545b	3.7b	1.911b
A2B2C1	8.108e	2.14b	4.66b	2.043b
A2B3C1	9.09e	2.62b	4b	1.7b
A2B4C1	7.69e	2.7b	6b	2.225b
A3B1C1	66.66b	0.41b	2.38b	1.379b
A3B2C1	35d	1.728b	2.857b	1.745b
A3B3C1	55.55c	1.209b	4.4b	2.965b
A3B4C1	9.09e	2.635b	3b	2.42b
A1B1C2	26.315d	1.484b	6.6b	4.352a
A1B2C2	0e	0b	0c	0c
A1B3C2	0e	0b	0c	0c
A1B4C2	0e	0b	0c	0c
A2B1C2	76.47a	1.062b	6.384b	4.386a
A2B2C2	5.882e	4.55a	3b	0.9c
A2B3C2	31.25d	1.644b	9.6a	4.05a
A2B4C2	0e	0b	0c	0c
A3B1C2	7.1428e	0b	0c	0c
A3B2C2	0e	0b	0c	0c
A3B3C2	0e	0b	0c	0c
A3B4C2	0e	0b	0c	0c
LSD5%	5.58	0.68	1.87	0.98

Means followed by the same later are not significantly different according to LSD at P≤ 0.05.

Fig. 1. Effect of sand + perlite bed, without auxin treatment and bottom heat system (a), sand bed, 2500ppm IBA and without bottom heat system (b), sand + perlite bed, 2500ppm and bottom heat system (c), sand + perlite bed, 2500ppm and bottom heat system (d), on rooting performance for hardwood cuttings of' Plane tree' 4 months after planting.

Influence of the interaction of rooting beds, IBA concentrations and bottom heat

The results showed that the highest survival rate (76.47%) obtained in combination treatment sand + perlite bed, without auxin treatment and bottom heat system (Table 5, Fig.1.a). Similar results were also obtained by (Cavusoglu and Sulusoglu, 2014). The highest dry weight of root (5g) obtained in combination treatment sand bed, 2500ppm IBA and without bottom heat system (Table 5, Fig.1.b). The highest dry weight of leaf (4.38g) obtained in combination treatment sand + perlite bed, without auxin treatment and bottom heat system (Table 5, Fig.1.c). The highest number of leaf (9.6 leaf) obtained in combination treatment sand + perlite bed, 2500ppm and bottom heat system (Table 5, Fig.1.d).

References

AlSagri F, Alderson PG. 1996. Effect of IBA, cutting type and rooting media on rooting of *Rosa centifolia*. Hortscience **71,** 729-737.

Anonymous. 2003. Seed propagation of Mediterranean trees and shrubs. APAT. Printed in Italy by I.G.E.R. srl- (Roma). 108 p.

Blazich FA. 1988. Chemical and formulations used to promote adventitious rooting. In: Davis, T. D., B. E. Haissig and N. Sankhla (ed). Adventitious root formation in cuttings. Dioscorides Press, (Portland). 132-149 P.

Cavusoglu A, Sulusoglu M. 2014. Effects of indole-3-butyric acid (IBA) and 1-naphthaleneacetic acid (NAA) on rooting of female and male *Laurus*

nobilis L. cuttings. International Journal of Biosciences **4(11),** 206-216. http://dx.doi.org/10.12692/ijb/4.11.206-216

Dirr AM, Heuser JR. 2006. The Reference Manual of Woody Plant Propagation: From Seed to Tissue Culture. Varsity Press, Inc. North Carolina, (USA). 417 p.

Eldeen M, Elgimabi NE. 2009. Improvement of Propagation by Hardwood Cuttings with or without Using Plastic Tunnel in (Quisqualis indica) Advances Biol. Research **3(1-2),** 16-18.

Gordienko NM. 2000. Propagation of Weigela praecox by hardwood cuttings. USSR na Osnove Region. J **10,** 15-19.

Grolli PR, Morini S, Loreti F. 2005. Propagation of *Platanus acerifolia* Willd by Cutting. Journal of Hortscience and Biotechnolojy **80 (6),** 705-710.

Hartman HT, Kester DE, Davies FT, Geneve RL. 2011. Hartmann and Kester's Plant Propagation: Principles and Practices. (8 th Edition). Prentice Hall. NJ, (USA). 928 p.

Hartmann H, kester DE. 1975. Plant propagation principles and particles 3 rd. ed; Prention hall inc new jersey, 662 P.

Khosrojerdi I, Tabari M, Hosseini M, Rahmani A. 2006. Diameter and number of cutting bud impact on sprouting of *Platanus orientalis*. Journal of Agricultural Science **12(6),** 189-194.

Myers JR, Stil SM. 1979. Propagation London plane tree from cuttings. Plant Prop **25,** 8-9.

Nicoloso FT, Lazzari M, Fortunato RP. 1999. Vegetative propagation of *Platanus acerifolia* Ait.(II): effect of zinc, boron and indolebutyric acid on rooting of cuttings. Ciencia Rur **29(3),** 487-492.

Pandit HC. 1990. Standardization of propagation of Chinar by stem cuttings. In Horticulture, 5- 22 P.

Paradiso R, Pascale SD. 2008. Effects of coco fiber addition to perlite on growth and yield of cut gerbera. Acta Hortic **779,** 529-534.

Panetsos KP, Scaltsoyiannes AV, Alizoti PG. 1994. Vegetative Propagation of *Platanus orientalis x P.occidentalis* F1 hybrids by Stem Cuttings. Forest Gent **1(3),** 125-130.

Robbins JA, Evans MR. 2004. Growing media for container production in a greenhouse or nurseries. Part 1: Components and mixes. Agriculture and Natural Resources. Division of Agriculture: University of Arkansas, Fayetteville.

Saffari M, Saffari VR. 2012. Effects of media and indole butyric acid (IBA) concentrations on hopbush (*Dodoneae viscosa* L.) cuttings in green house. Annals of Forest Research **55(1),** 61-68.

Santini A. 2001. The hybrid plane (*Platanus x acerifolia* L.) family Platanaceae. (II platano ibrido (*Platanus x acerifolia* L.) famiglia Platanaceae). Sherwood **71,** 37-41.

Schmidt D. 1998. Softwood propagation of *Platanus x hispanica* 'Columbia'. Combined Proceeding of the International Plant Propagators' Society **48,** 479-480.

Shadparvar V, Mohammadi Torkashvand A, Alinejad Alamshiri H. 2011. Effect of IBA and Soil

mixture on rooting of (Hibiscus rosa- sinensis). European Journal of Experimental Biology **1(4),** 142-146.

Subiza J, Cabrera M, Valdivieso R, Subiza JL, Jerez M, Jimenez JA, Narganes MJ, Subiza E. 1994. Seasonal asthma caused by airborne *Platanus* pollen. Clin Exp Allergy **24(12),** 1123–1129.

Zencirkiran M, Erken K. 2012. The effects of different time collecting cuttings and auxins treatments of the rooting in *Platanus orientalis* L. The Journal of Animal & Plant Sciences 764-767 P.