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PROPAGATION OF *TAXUS BACCATA* 'GREEN DIAMOND' BY CUTTINGS

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ABSTRACT
Buxus sempervirens and its varieties, such as 'Suffruticosa', are popular plants of historic as well as modern gardens. The box tree moth (*Cydalima perspectalis*), one of its most aggressive pests, also appeared in Hungary in 2011. *Taxus baccata* is also a species with a great tradition in historic gardens. This species has outstanding longevity, a good self-renewing capacity and is easy to handle. It can create a dense and solid surface that could serve as a green wall or an excellent background to colourful shrubs and blooming plants. The 'Green Diamond' variety of *Taxus baccata* boasting a spherical habit similar to *Buxus sempervirens* 'Suffruticosa' is a slow-grower with small, dark green leaves and would be suitable to replace 'Suffruticosa'. It tolerates pruning well and has a good renewing capacity. *Taxus baccata* 'Green Diamond' is currently propagated by grafting in Western European ornamental tree nurseries, which is however a costly and slow propagation method. As part of our work, we set the aim to work out the propagation method for *Taxus baccata* 'Green Diamond' by cuttings. As part of our work, we examined the propagation of *Taxus baccata* 'Green Diamond' by cutting in various plant growth mediums with the application of root stimulants in different concentrations.

Keywords: number of cuttings, number of roots, root length, Baltic ground peat, mixed, IBA hormone.

INTRODUCTION

The most frequent *Taxus baccata* varieties present in plant production are the following:
'Aurea' is a slow-growing variety with golden yellow shoots. Its new leaves have yellow edges and turn green again in the second year.
'Fastigiata' is a wide, columnar female variety with thick leaves standing circularly on upright branches.
'Fastigiata Aurea' is of a size similar to the previous variety. New growth is golden yellow then yellow at the edges; it is a slow-growing male variety.
'Green Diamond' is a slow-grower with a spherical habit and small, dark green leaves. It tolerates pruning well and has a good renewing capacity.
'Overeynderi' is a variety with a columnar crown when very young and turning globoid later; a male variety with upright branches.
'Nissen's Corona' is a 1-1.2 m tall cushion-shaped variety, with branches spreading on the ground then standing upright at the tips.
'Barmstedter' is a clone with dark green foliage and strong growth.
'Repandens' is a slow-growing female variety with the side branches fanning out (JÓZSA, 1993). We propagate the basic species by seed sowing. The seeds need to be layered for a year before sowing. These species can be propagated by striking in unheated plant growing facilities from August to September, and in heated greenhouses in the months of January to March (SCHMIDT AND TÓTH, 2006).
The most frequently used plant growth media are the following:
- Sand: The best is the sand dredged from the bottom of large rivers, i.e. washed river sand (SCHMIDT AND TÓTH, 1996).
- Washed and graded pearl pebble: Planting in pearl pebbles is recommended only if we can ensure high humidity by regular overhead sprinkling either automatically or manually.

SCHMIDT (1990) and KOMISZÁR (1991) recommend sand, or the 1:1 mixture of sandy peat and perlite or peat and fine gravel.

- Expanded perlite: Perlite is a rock of volcanic origin, which is expanded at a temperature of over 1000 °C after extraction and grinding. The high temperature perfectly sterilises the medium at the same time. The large grain (at least 2-5 mm in diameter) i.e. horticultural perlite is advised for striking. Being extremely light is a definite advantage (it is easy to replace) and at the same time it is perfectly sterile, airy and has a good water-retaining capacity (SCHMIDT AND TÓTH, 1996).
- Fibrous peat moss: Light brown fibrous peat moss is used for striking (Weisstorf, sphagnum peat). Peat is a slowly renewing resource when measured on a human scale (LÁNG, 2002). It has an outstandingly good water-retaining capacity once soaked, while it remains loose and airy even when saturated with water. It is strongly acidic (pH 3,5-4,5) and therefore excellent for calciphobous plants such as Rhododendrons or Erica species. For "ordinary" ornamental trees and shrubs the pH value of peat is adjusted to 6-6,5 by adding powdered lime or other admixture. Acidity hinders the spread of fungous diseases and the humic acids in the peat stimulate cuttings.

In Western-Europe, tree nurseries almost entirely use peat as rooting medium; pure in exceptional cases but the more frequently mixed with coarse sand. The mixing ratio differs from nursery to nursery as well as from plant to plant but ranges between 1:3 and 3:1. The lime content of sand is generally high enough to set the required pH value, while its weight and density improves the physical properties of the peat. We can safely strike cuttings in this mixture of peat and sand with all the possible humidifying methods. In such a medium cuttings spring rich and abundantly branching roots, and retain the medium when picked.

The heteroauxin beta-indoleacetic acid (IAA) is the most frequently used rooting chemical. In practice, the great disadvantage of this chemical is that it decomposes in light in a short while and if concentration is low, bacteria also decompose it fast. Therefore, nowadays, instead of natural auxin almost entirely its synthetically produced related chemical compounds,

- beta-indolebutyric acid (IBA), and
- alfa-naphthaleneacetic acid (NAA)

are used.

As part of our research, we examined the striking capacity of cuttings, the effect of hormone concentration, the media and cuttings quality on cuttings, callusing and cutting decay. We furthermore examined the effect of hormone concentration, the growth medium and cuttings quality on the number and length of the developed roots.

MATERIAL AND METHOD

We performed the propagation experiment under greenhouse conditions in Kovács Kertészet (Kovács Nursery) in Zalaszentgyörgy. Cuttings were planted in 104-cell nursery propagation trays. We used two types of rooting media: Baltic ground peat in 100% and the mixture of 30% Baltic peat, 30% horticultural perlite and 40% peat that can be easily obtained in the Zala region from Hahót. We treated the cuttings with alcoholic solutions of IBA hormone in three concentrations of 0.625%, 0.75% and 0.9375%, respectively. The cuttings were 6-8 cm long. We took simple and torn cuttings, and we also cut the end of the torn cuttings flat. We performed the treatments with four repetitions. We evaluated the experiment of 9 February 2013 on 24 June 2013. We counted the number of cuttings having taken root by treatment and repetition then. We removed the cuttings that had sprung root from the propagation trays. We cleared away the growth medium from the

roots of the cuttings so that we could properly determine the integrity, size and number of the developed roots. We counted the number of roots and measured their length by a measuring tape.

We divided the rooted cuttings into three categories according to the number of developed roots:

- very few (fewer than 2 pieces);
- few (between 3-5 pieces);
- multiple (more than 5 pieces).

We defined three categories according to root length too:

- short rooted cuttings (maximum 1cm);
- medium long rooted cuttings (between 1-3 cm);
- long rooted cuttings (4-5 cm).

We recorded the experimental data in an excel table. We evaluated the measurements by percentage calculation and variance analysis.

RESULTS

The effect of the growth media on the number of rooted cuttings

Based on the experiment we can state that the cuttings planted in the mixture of 30% Baltic ground peat, 30% horticultural perlite and 40% Hahót peat rooted to a larger extent irrespective of cuttings quality compared to those planted in pure Baltic peat (*Figure 1*).

The effect of hormone concentration on the number of rooted cuttings

The highest number of cuttings took root in the mixed medium with a 0.75% IBA treatment, 79 pieces in total (*Figure 2*).

In the Baltic peat medium, the highest number of cuttings rooted with a 0.625% IBA treatment, altogether 66 pieces. The cuttings treated with a 0.75% and 0.9375% IBA hormone concentration showed a significant result (*Figure 1*) in the mixed medium.

The effect of the rooting media on the number of callused cuttings

In the mixed medium the highest number of cuttings callused with the 0.9375% IBA treatment; 153 pieces in total.

In the Baltic peat medium, the highest number of cuttings callused with the 0.9375% IBA treatment; 143 pieces in total.

The effect of hormone concentration on the number of callused cuttings

Of the cuttings treated with 0.75% and 0.9375% IBA hormone concentrations, respectively, those planted in the mixed medium showed a higher number of callusing (indicative of prospective cuttings).

The effect of the rooting media on the number of developed roots

In the mixed medium and with 0.75% IBA treatment altogether 16 cuttings developed roots belonging to the highest category (more than 5 roots).

In the Baltic peat medium and with a 0.625% IBA treatment altogether 31 cuttings developed roots belonging to the highest category (more than 5 roots).

The effect of hormone concentration on the number of developed roots

The number of cuttings with more than five developed roots is the highest for cuttings treated with 0.625% and 0.75% IBA hormone concentrations (*Table 1*).

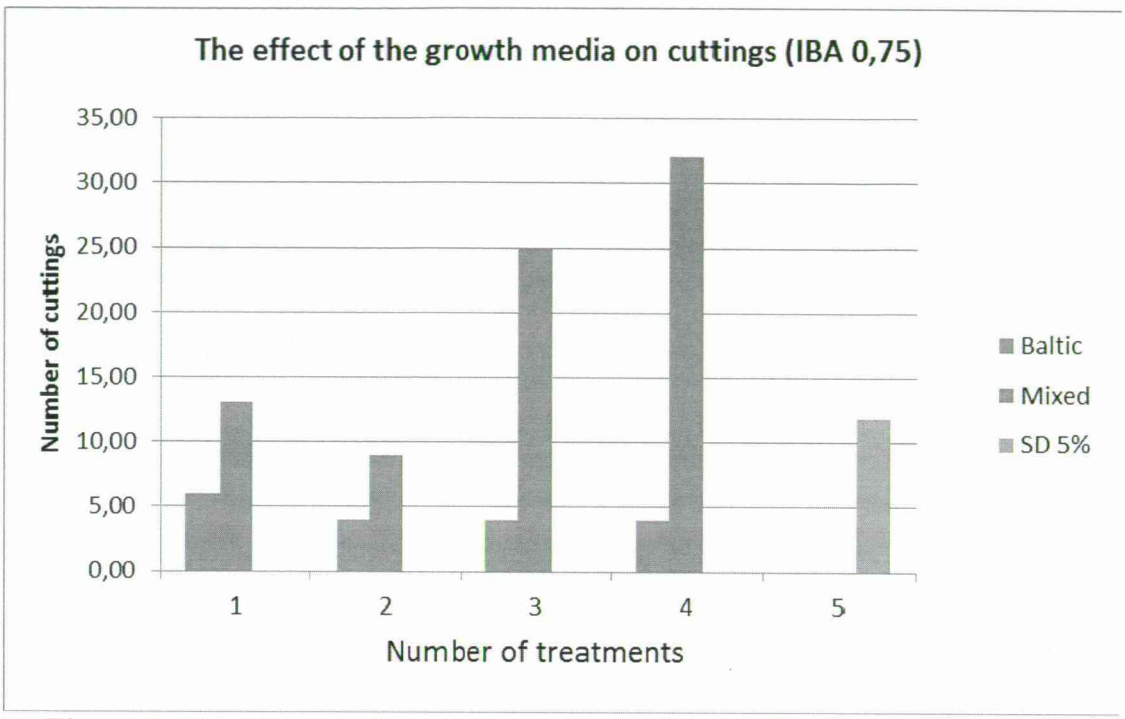

Figure 1. The effect of the growth media on the number of rooted cuttings with 0.75% IBA hormone treatment

Source: ZSUZSA TURI–FARKAS (2014)

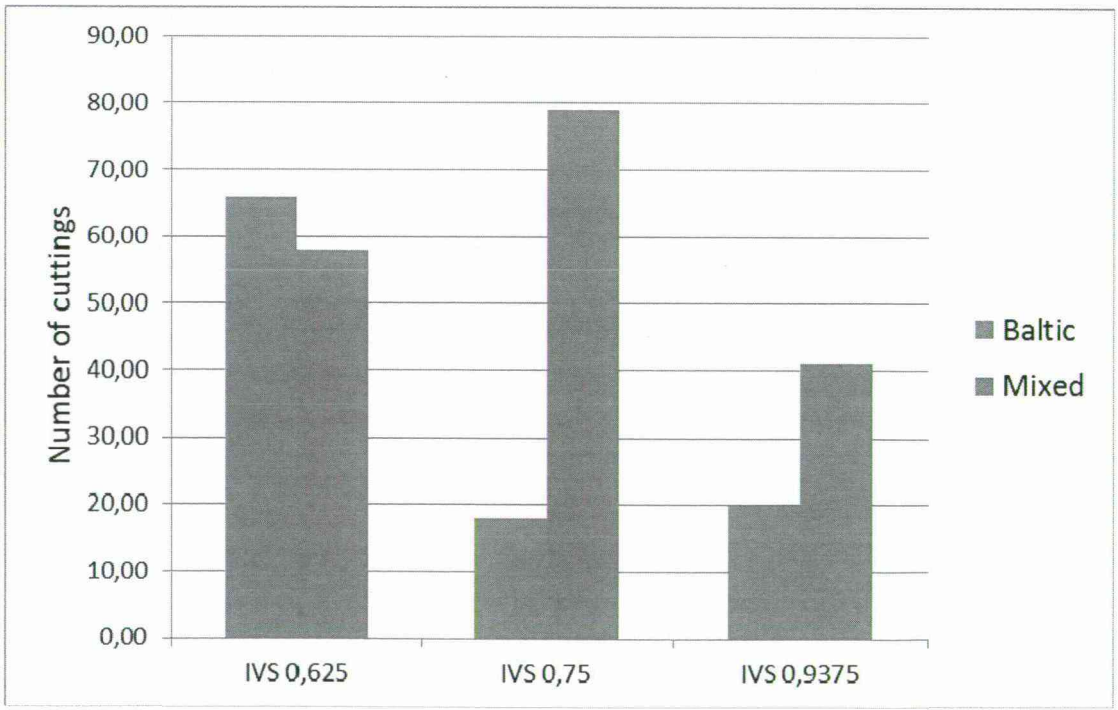

Figure 2. The effect of the medium on striking for different hormone treatments

Source: ZSUZSA TURI–FARKAS (2014)

Table 1. The number and length of the root of rooted cuttings (Mixed medium, IBA 0.625%)

Repetitions	Root length (cm)			Number of roots (pieces)		
	short 1-2 cm	medium-long 2-3 cm	long 3-5 cm	very few 2>	few 3-5	multiple 5<
1	8	4	2	8	4	2
2	12	3	0	12	2	1
3	9	3	3	9	2	4
4	10	4	0	10	3	1

Source: ZSUZSA TURI–FARKAS (2010)

The effect of the rooting media on the size of the developed roots

In the mixed medium and with 0.625% IBA treatment, altogether 5 cuttings developed roots belonging to the longest category (between 3-5 cm).

In the Baltic peat medium and with 0.625% IBA treatment, altogether 27 cuttings developed roots belonging to the longest category (between 3-5 cm).

The effect of hormone concentration on the size of the developed roots

As far as the effect on the length of the roots is concerned, the highest number of roots 3-5 cm in length developed on the cuttings treated with IBA hormone with a 0.625% concentration.

CONCLUSIONS

We can draw the following conclusions from the analysis of the results:

The significant striking and callusing relationships in the case of cuttings treated with IBA hormone in concentrations of 0.75% and 0.9375%, respectively, show a higher number for the cuttings planted in the mixed growth medium (*Figure 3*).

We can state that the cuttings planted in the mixture of 30% Baltic ground peat, 30% horticultural perlite and 40% peat from Hahót struck root and got callused to a higher extent than the ones planted in purely Baltic peat. It was the higher hormone concentration that caused a definite difference.

As far as cuttings quality is concerned, we can definitely state that stronger cuttings did not yield a large enough difference in striking to make us abandon the use of second-class cuttings. It is all the more important a statement since in this case, considering that *Taxus baccata* 'Green Diamond' is a slow-growing variety developing short joints, we can utilise the small amount of raw material suitable for propagation to the largest extent possible.

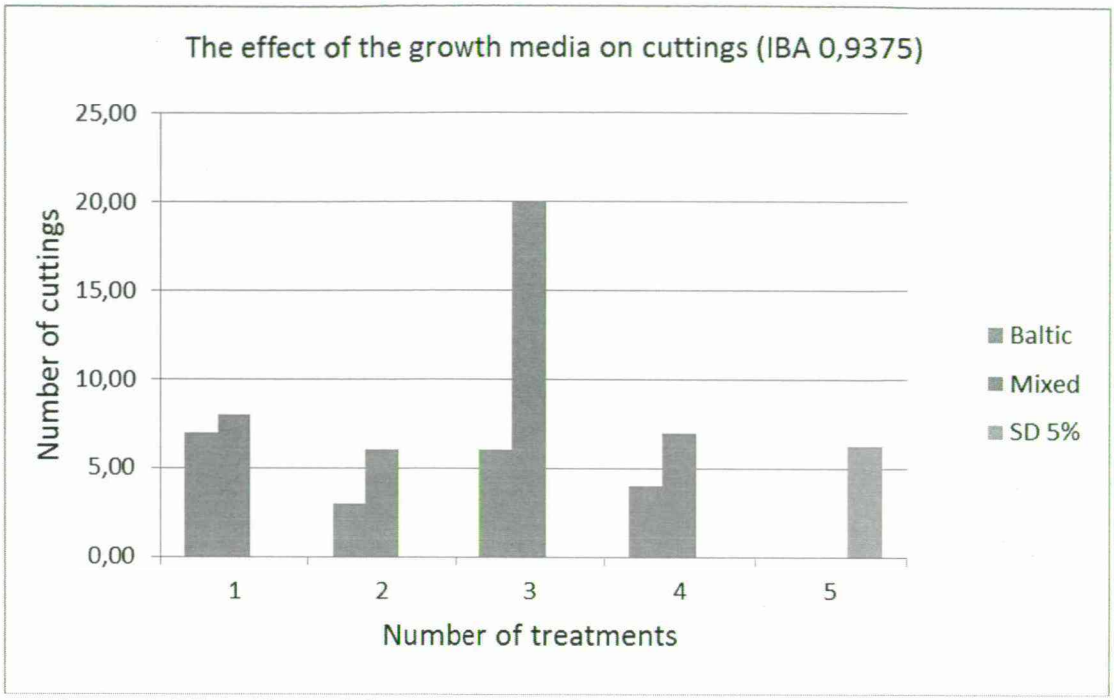

Figure 3. The effect of the growth media on the number of rooted cuttings with 0.9375% IBA hormone treatment
Source: ZSUZSA TURI–FARKAS (2014)

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