THE INFLUENCE OF NAPHTHALENE ACETIC ACID (NAA) IN ROOTING OF THE DIFFERENT VEGETATIVE CUTTINGS OF *THUYA OCCIDENTALIS* "EMERAUD"

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Abstract

Thuya occidentalis "Emeraud" (Thuya ssp), is one of the most used evergreen ornamental plants for decoration of parks and gardens with very slow growth. They form few seeds with relatively low germination. This is the cause of the continuous efforts to find efficient ways of vegetative propagation, which influence the increase of the coefficient of thuya's propagation. The paper presents the influence of the naphthalene acetic acid (NAA) 4000 ppm in the rooting of one year vegetative cuttings of Thuya occidentalis "Emeraud", with and without biennial wood. The experiment was carried out during three consecutive years, 2008-2010, in the flower's greenhouse of the Experimental Centre of the Department of Horticulture at Agricultural University of Tirana. The one year vegetative cuttings were prepared as simple cuttings (cuttings without bark or biennial wood) and cuttings with the scion (cuttings with bark or biennial wood). Vegetative cuttings of thuya were sown in the perlite band. Control for the final rooted seedlings and/or rooting percentage was carried out 60 days after sowing of the vegetative cuttings in the perlite band. There was calculated the rooting percentage of the vegetative cuttings treated and untreated with NAA 4000 ppm. The results show that the average rooting percentage of the simple untreated cuttings was 20%, while the average rooting percentage of the untreated cuttings with a scion was 45%. Total rooting percentage of the untreated cuttings was 32.5%. So, cuttings with a scion (the cuttings with bark and biennial wood), have a higher rooting percentage even when they are not treated with NAA. There were observed significant differences of the results in the case of treating cuttings with the rooting hormone NAA, 4000 ppm. These differences consisted in increasing the rooting ability and the rooting percentage of the cuttings. The average rooting percentage of the simple untreated cuttings with NAA was 51%, while the mean percentage of the cuttings with a scion treated with NAA was 80%. The total rooting percentage of the untreated cuttings was 65.5%. The use of the rooting hormone NAA, 4000 ppm, for the treatment of the one year vegetative cuttings of thuya was followed by the significant increases the rooting percentage in total from 32.5% to 65.5%. The three-year-results showed that the use of the rooting hormone NAA, 4000 ppm, does affect significantly in the increase of the rooting percentage of the vegetative cuttings, up to 30%, as well as in doubling the quantity of the seedling produced for each planting season, which was confirmed by ANOVA.

Key words: hormone, propagation, rooting percentage, *Thuya occidentalis* "Emeraud", vegetative cuttings.

1. Introduction

Thuya (*Thuya ssp*) is an evergreen plant, with a very slow growth, which produces low vigor seeds, so for its propagation are used one year vegetative cuttings [8]. Considering their origin and resistance to cold, thuyas are divided in two groups: *Thuya occidentalis*, which develop a crown at 15 m high and 4-6 m wide, and *Thuya orientalis*, which develop a crown at 8 m high and 3-4 m wide [10; 2]. The clone with limited growth called *Thuya occidentalis* "Emeraud", was selected from *Thuya occidentalis*. This decorative plant develops a dense crown in the form of a pyramid with a height of 4-6 m and width 1.5-2 m [1]. *Thuya Occidentalis* "Emeraud" is one the most used ornamental plants for decoration of parks and gardens [9].

Thuya occidentalis "Emeraud" is widely used to decorate parks and public gardens by exposing it as individual plants, or in groups of 3-4 plants altogether [7]. The propagation of this plant by means of the seeds is slow and difficult because of the low quantity of the seeds and the low germination that they have. This is the reason why this plant is spread by means of

the seedlings taken through the rooting of the vegetative parts taken from the end bottom of the lateral branches [8; 9].

Any living vegetative plant tissue, cambium, epidermis, parenchyma of the bark, etc, can form roots if there are fulfilled appropriate environmental conditions and if there is a certain level of hormonal contents (growth regulators) of the matter [3].

The high hormone concentrations provoke the cambium and pericycle cell division from where the process of root formation starts. Roots originated from vegetative plant's parts under the hormone effect are similar to roots naturally formed [3].

For rooting acceleration can be used growth regulators (synthetic plant hormones) which take part in the group of auxins. In vegetative propagation practices there are used two types of auxins, Indole-3-Butyric Acid (IBA) and Naphthalene Acetic Acid (NAA) [5]. A higher concentration of the rooting hormones is used for woody and lignified parts as well as for those that hardly root, while very high concentrations of the rooting hormone inhibit the rooting process [5].

According to Susaj et alt. (2011) [6], the optimal NAA solution concentration for the treatment of one year vegetative cuttings of *Thuya occidentalis* "Emeraud" is 4000 ppm, and higher concentrations do not affect positively on the rooting percentage.

2. Materials and Methods

The experiment was carried out for three consecutive years, 2008-2010, in the flower's propagation greenhouse on perlite band with basal heating of the Experimental Centre of the Department of Horticulture at the Agricultural University of Tirana. For rooting, one year vegetative cuttings of the decorative plant of *Thuya occidentalis* "Emeraud", were used. The air temperature in the greenhouse was kept of 25-28^{o}C, the basal perlite temperature 17-18^{o}C, and the air humidity 95%.

One year vegetative cuttings with a length of 10-12 cm were used for rooting. They were prepared in two different ways: vegetative simple cuttings (cuttings without bark or biennial wood) and vegetative cuttings with a scion (cuttings with bark or a little biennial wood). Naphthalene Acetic Acid (NAA) 4000 ppm was used for variants 3 and 4 to stimulate rooting. There were used four different variants, respectively:

V_1 – simple cuttings, not treated with NAA

V_2 – cuttings with scions, not treated with NAA

V_3 – simple cuttings, treated with NAA

V_4 – cuttings with scions, treated with NAA

The prepared NAA 4000 ppm solution was poured into a Petri dish, where the bottoms of the vegetative cuttings of variants 3 and 4 were dipped for a few seconds (Figure 1).

Figure 1: Preparation of the vegetative cuttings for rooting

After the treatment, the thuyas vegetative cuttings, with or without scion, were placed for rooting on the perlite band. For each variant there were used 100 vegetative cuttings, planted in distance 10 cm between rows and 5 cm between parts, sowing 200 vegetative cuttings/m^2. The planting of the vegetative cuttings for rooting was carried out at the same period, 20-25 March, for the three consecutive years. Twenty days after sowing, there were observed the formation of root nodules and the callus ring at the end of vegetative cuttings, and forty days later, consisting 60 days after sowing, there were counted rooted seedlings (rooting cuttings), and were evaluated the rooting percentage for each variant.

The influence of NAA concentration on the rooting of different vegetative cuttings of *Thuya occidentalis* "Emeraud" were confirmed by means of the difference of rooting percentage of different variants showed below in tables and statistical analysis (ANOVA test) [4].

3. Results and Discussions

The vegetative parts of thuya were placed for rooting every year at the same period, March 20-25 in the abovementioned distances. Sixty days later, there were accounted the rooted vegetative cuttings of each variant, every year, and, at the end of third year, was estimated the three years mean, as the number of rooted seedlings and as a rooting percentage.

Results showed that there were differences of three years mean of the rooting percentage of the vegetative cuttings of thuya from variant to variant. Rooting ability in both untreated variants with NAA 4000 ppm was considerably low. The mean rooting percentage of the vegetative cuttings with scion was 45%, compared to the simple vegetative cuttings that rooted only in 20% of their total, with a mean in total of 32.5%.

The use of NAA 4000 ppm in V_3 and V_4 was accompanied with a considerable increase in the rooting percentage of both vegetative cuttings, simple or with a scion. The rooting percentage of the vegetative cuttings with a scion was 80% compared to 45% of the rooting percentage of the simple cuttings, with a mean in total of 65.5%. The difference noticed between the variants V_3 and V_4 shows that even in the case of the use of the NAA hormone, the vegetative cuttings with a scion have higher rooting ability (Table 1).

In the cases when there is lack of treatment of the vegetative cuttings with rooting hormones NAA, the parts with a scion should be used. The difference of rooting between variant 1 and 2 was 25% higher for the variant 2. The treatment of the simple vegetative cuttings with NAA 4000 ppm was accompanied by a considerable increase of rooting percentage or rooted seedlings from 20% to 51%, with a difference of 31%, whereas for vegetative cuttings with a scion the increase of rooted seedlings varies from 45% to 80%, with a difference of 35%.

The differences between variants, which were confirmed by statistical ANOVA test showed there exist significant differences. These differences derive from the use of different vegetative cuttings (with or without scion) and form the use of the rooting hormone NAA 4000 ppm, as well.

The use of NAA solution does affect the rooting percentage of one year vegetative cuttings of *Thuya occidentalis* "Emeraud". The statistical index of the variance for variants F-calculated = 241.82.

This value is greater than the value of F-crit = 4.757. At the same time, the value of propability P-value = 1.22E-07 was lower than confidence level α = 0.05 [4] (Table 2).

This means that the use of the NAA hormone, 4000 ppm for the treatment of the vegetative cuttings of the decorative plant *Thuya occidentalis* "Emeraud", positively influences the increase of the rooting ability and the percentage of the rooted seedlings. This propagation practice influences the increase in the number of the seedlings produced and in meeting better the needs of the market with seedlings of this decorative plant with a wide range of uses in parks, public gardens, etc.

Table 1: The rooted seedlings and rooting percentage (%) of the vegetative cutttings of *Thuya occidentalis* "Emeraud", according to variants

Variants	*Total number of*		*Rooting percentage (%)*	*Dried cuttings*	**% of the dried cuttings**
	planted cuttings	Rooted seedlings			
V_1 (simple untreated)	300	60	20	240	80
V_2 (with scion untreated)	300	135	45	165	55
Total (V_1+V_2) without NAA treatment	600	195	**32.5**	405	67.5
V_3 (simple treated with NAA)	300	153	51	147	49
V_4 (with scion treated with NAA)	300	240	80	60	20
Total (V_3+V_4) with NAA treatment	600	393	**65.5**	207	34.5

Table 2: ANOVA for the influence of the use of NAA in rooting percentage of vegetative cuttings of thuya

Variation source	*SS*	*df*	*MS*	*F-calc*	*P-value*	*F- crit*
Rows (variants)	5864.25	3	1954.75	241.82	1.20 E-06	4.757
Error	48.5	6	8.083			
Total	5934.912	11				

4. Conclusions

The use of one year vegetative cuttings of the decorative plant *Thuya occidentalis* "Emeraud" with scion gives better results than using simple vegetative cuttings. The increase of rooting ability was up to 25%.

The use of the Naphthalene Acetic Acid (NAA) 4000 ppm for the treatment of the vegetative cuttings does affect the increase of the rooting ability. This was accompanied by the increase of the rooting percentage up to 31% for simple vegetative cuttings, and 35% for vegetative cuttings with scion.

The best results, with 80% of the vegetative cuttings rooted, were obtained in the variant V_4. This is the reason why we recommend seedling producers of *Thuya occidentalis* "Emeraud" the use of the one year vegetative parts with scion treated with NAA 4000 ppm, rooted in perlite band with basal heating.

Despite the optimal conditions of temperature and humidity, the untreated vegetative cuttings have a low rooting ability and rooting percentage from 20 to 45%. This way of producing seedlings is not efficient and does not meet the requirements of the market for seedlings quantity.

5. References

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