AGRICULTURAL SCIENCE AND TECHNOLOGY, VOL. 12, No 3, pp 260-263, 2020
Published by Faculty of Agriculture, Trakia University, Bulgaria
ISSN 1313-8820 (print)
ISSN 1314-412X (online)
http://www.agriscitech.eu
DOI: 10.15547/ast.2020.03.041

Effects of location, gender and indole butyric acid on rooting of *Laurus nobilis* L. semi-hardwood stem cuttings

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(Manuscript received 15 April 2020; accepted for publication 1 July 2020)

Abstract. *The research was conducted in 2018 in order to investigate the effect of location, tree gender and indole butyric acid (IBA) 4000ppm on rooting of semi-hardwood stem cuttings. Two locations (Al-Samrah and Al-Nabaeen) in Latakia province, Syria, different in latitude and above sea level (500 m and 827 m, respectively) were studied. The results showed significant effect ($p<0.05$) of the location and tree gender on rooting capacity. No rooting was observed in control (without IBA treatment). Location also affected the number of roots/cuttings. No effect of location or tree gender on root length and diameter was established. The highest rooting rates (%) were for cuttings taken from female trees from Al-Samrah location when treated with IBA 4000 ppm (82.2%).*

Keywords: indole butyric acid (IBA), *Laurus nobilis* L., propagation, root diameter, root length

Introduction

Bay laurel (*Laurus nobilis* L.) belongs to Lauraceae family which contains 32 genera and 2000-2500 species. This plant is also known by many names like: sweet bay, bay laurel, Grecian laurel, true bay, etc. (Garg et al., 1992). Laurel could be useful in many ways, i.e.: leaves, or the oil which could be extracted from the leaves, fruits, flowers, bark, wood, seed and roots; this oil is characterized by richness of active compounds (Anon, 2005; Chahal et al., 2017).

Using seeds in propagation of trees in general and bay laurel in particular was reported to be difficult to implement, because seeds take long time for germination due to an epicarp layer which causes dormancy of the seeds, also the period for obtaining transplants is so long (Tilki, 2004), in addition to genetic segregation that leads to offspring differing from the mother plant. On the other hand, vegetative propagation guarantees many advantages: easy, fast and produced high number of individual plants similar to each other and to the mother plant.

Propagation by cuttings is a common method used to propagate tens of plant species like olive (Gerakakis and Özkaya, 2005), ornamental shrubs (Pacholczak et al., 2005), lemon (Batt'ha, 2010), pear (Lebedev, 2019) and many others. For bay laurel studies in this area are scarce. Cavusoglu and Sulusoglu (2014) studied bay laurel propagation by cuttings; they reported differences in rooting ability between male and female cuttings. Average rooting was 17% for female origin cuttings and 9.6% for male origin cuttings when treated with IBA and NAA in concentrations of 2000 and 4000 ppm. The same study mentioned that rooting differed depending on plant material, used hormones and concentration. They also reported weak rooting percentage for semi-hardwood cuttings which was 13.3% in general.

In view of the importance of the laurel tree medically, economically and environmentally, and the need to preserve and protect it from the deterioration resulting from logging and fires, which requires methods to propagate and produce large number of seedlings in a short period of time without the need for large consumption of plant material, this study aimed to investigate the effect of geographical location, tree gender and the indole butyric acid (IBA) on the rooting of laurel naturally spread in Latakia province in Syria in order to obtain a manual that could be used by nurseries for Bay laurel propagation.

Material and methods

Study sites and plant material

Semi-hardwood cuttings were taken from laurel trees (*Laurus nobilis* L.) located in two areas in Latakia province, Syria:

- Al-Samrah location (35.34'35°55 E, 43.03'35°54 S), 500 m asl;
- Al-Nabaaen location (06.99'35°58 E, 16.93'35°54 S), 827 m asl.

The two locations are natural sites for *Laurus nobilis* L. distribution and belong to Kassab area. Three trees which

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were uniform in size, vigor, and disease free were selected from each location. Semi-hardwood stem cuttings with the following characteristics were taken: (length: 12-15 cm), (width: about 0.5 cm), with two leaves. Cuttings were taken in April 2018. Cuttings were rooted in glass house in rooting media consisting of black pumice with fog irrigation and moisture about 80-90%, average air temperature ranged between 25-30°C. The depth of rooting was 3 cm. Indole butyric acid (IBA) 4000 ppm was used. A total of 30 cuttings were taken from each tree (replicate), 15 of them were treated with IBA 4000 ppm. Hormone solution was obtained by dissolving 4 g of IBA in 50 ml of ethanol and the volume was completed to 1000 ml by adding distilled water. Control treatment (15 cuttings) was done in the same way but without adding IBA.

Rooting rate (%), number of roots/cutting (root/cutting), average root length (cm/cutting) and root diameter (cm) were studied in July 2018.

Study design and Statistical analysis

For rooting rates (%) the study was designed as factorial (3-way completely randomized) where: first factor was location (two locations), second factor was tree gender (male - female), and the third factor was hormone application (IBA 4000 ppm - control). Since no rooting was detected in non-treated cuttings (no IBA application), data was analyzed as 2-way completely randomized for the rest of the parameters (root number, length and diameter). Data were subjected to ANOVA and means were separated using Duncan test. Costat software was used for data analysis.

Results

Rooting (%): Figure 1-A showed that location had significant influence on rooting. Rooting percentage of cuttings taken from Al-Samrah location was superior to Al-Nabaeen location (36.67% vs 21.11%). Tree gender affected rooting, Figure 1-B showed that the highest rooting rate was for cuttings taken from female trees (32.78%), while male trees had the lowest rooting rate (25.00%). No rooting was observed in control, while using IBA increased rooting rate up to 57.78% (Figure 1-C).

Factorial analysis showed significant interaction between the studied parameters (Figure 1-D); the highest rooting rate was of cuttings taken from female trees of Al-Samrah location when treated with IBA 4000ppm (AFT - 82.22%) followed by the male trees, treated with IBA from the same direction (64.45%) and the female and male trees, treated with IBA from Al-Nabaeen location (48.89% and 35.56%, respectively. No rooting was observed in the cutting taken from male and female trees without IBA treatment in both locations (controls).

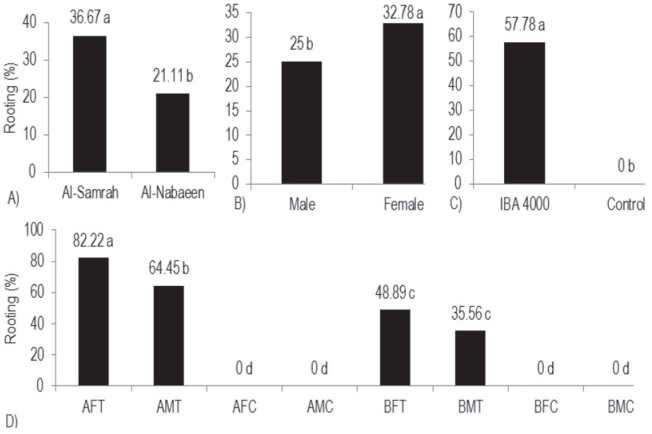

Figure 1. Effect of location (A), tree gender (B), treatment with IBA 4000 ppm (C) and interaction among the three factors (D) on rooting percentage of *Laurus nobilis* L. semi-hardwood cuttings. On figure D: A mentioned to Al-Samrah location, F: Female, T: IBA 4000ppm, B: Al-Nabaeen location, M: male, C: control. Different letters on the columns indicate significant differences ($p \geq 0.05$) using Duncan test.

Number of roots: Figure 2-A showed that Al-Samrah location had the highest average number of roots per cutting (3.6 roots/cutting), while Al-Nabaeen had the lowest (2.29 roots/cutting). No effect of tree gender on number of roots was observed (Figure 2-B). Factorial analysis showed that the highest number of roots/cutting (3.83) was of cuttings taken from female trees in Al-Samrah location when treated with IBA 4000ppm, followed by the male trees in the same location, and female and male trees in Al-Nabaeen location (Figure 2-C).

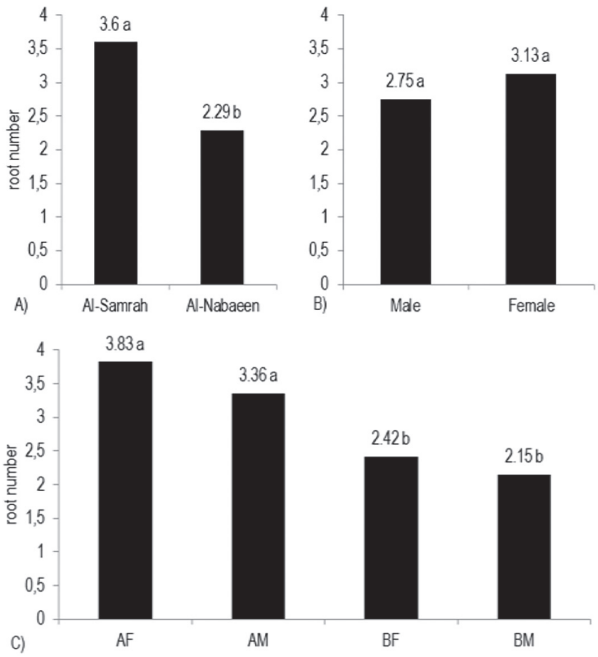

Figure 2. Effect of location (A), tree gender (B) and interaction among the two factors (C) on the number of roots of *Laurus nobilis* L. semi-hardwood cuttings treated with IBA 4000ppm. On figure C: A mentioned to Al-Samrah location, F: Female, B: Al-Nabaeen location, M: male, C: control. Different letters on the columns indicate significant differences ($p \geq 0.05$) using Duncan test.

Root length: None of the studied parameters affected root length individually (Figure 3A,B). Factorial analysis showed no significant interaction between the studied parameters (Table 1). Anyway, the highest root length was of cuttings taken from male trees of Al-Samrah location (5.19±1.50 cm), while the lowest was of cuttings taken from female trees from the same location (3.80±1.39 cm).

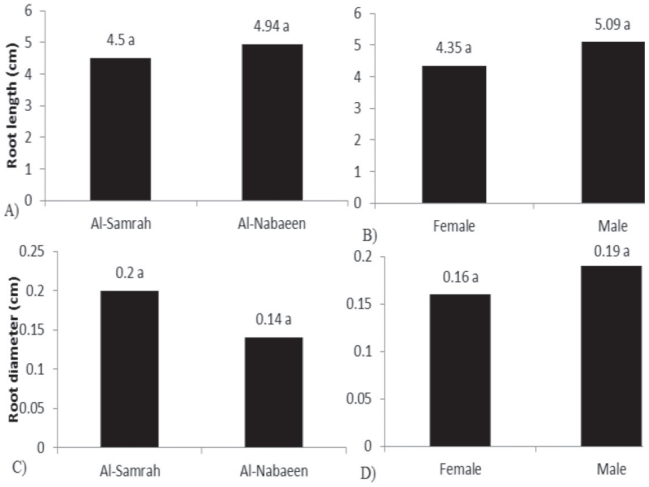

Figure 3. Effect of location (A, C) and tree gender (B, D) on root length and diameter (cm) of *Laurus nobilis* L. semi-hardwood cuttings treated with IBA 4000ppm.

Root diameter: Neither location nor tree gender affected root diameter (Figure 3C,D). By the same way, no significant interaction between location and tree gender was found (Table 1). Any way total average of root diameter was 0.17 cm.

Table 1. Average root length ±SD (cm) and diameter ±SD (cm) of *Laurus nobilis* L. semi-hardwood cuttings taken from male and female trees in two locations in Latakia, Syria (results of factorial analysis)

Location	Gender	Root length, cm	Root diameter, cm
Al-Samrah	Female	3.80±1.39	0.17±0.06
	Male	5.19±1.50	0.23±0.19
Al-Nabaeen	Female	4.90±0.47	0.15±0.01
	Male	4.98±0.48	0.14±0.04
Average		4.72±0.96	0.17±0.08

Discussion

The present study showed the effect of location, tree gender and hormone application on rooting parameters of *Laurus nobilis* L. semi-hardwood stem cuttings. Significant effect of location on rooting rates was found since rooting ability of Al-Samrah (36.67%) was superior to Al-Nabaeen (21.11%) ($p \leq 0.05$). The effect of location on rooting could be related to different reasons. Laurel trees in the two locations could be different in genetic background; Genetic diversity of *Lauris nobilis* was reported to be significant between regions in Lebanon which is not far away from the study area (Said and Hussein, 2014). Genetic diversity could affect the response of the cuttings from the two locations to different rooting treatments; by the same way, different locations mean different environmental conditions which could affect plant physiology and rooting capacity since the two locations are different in latitude (500 and 827 m asl). Cavusoglu and Sulusoglu (2014) reported different rooting rates in response to different locations in Turkey.

The effect of IBA on root formation was clear since no rooting was detected in non-treated cuttings (control); this indicates the difficulty of rooting laurel without hormones. Anyway, IBA-derived auxin was reported to have strong roles in root development, including regulation of root apical meristem size, elongation of root hair, development of lateral roots, and formation of adventitious roots which originated from aerial tissues, such as stems or leaves (Frick and Strader, 2018). Rooting rates of cuttings originated from female trees was higher than male trees which are in accordance of the results of Cavusoglu and Sulusoglu (2014).

Conclusion

Based on the results obtained, it was found that: (i) Al-Samrah location (500 m asl) had higher rooting capacity (36.67%) compared to Al-Nabaeen - 827 m asl (21.11%); also, female trees had significantly more rooting ability (32.78%) than male trees (25%); (ii) if laurel cuttings were not treated with hormones, no roots developed; (iii) the best rooting result (82.22%) from semi-hardwood stem cuttings was obtained in Al-Samrah location from female trees treated with IBA 4000ppm; (iv) these results could be advantageous for nurseries in propagation of laurel trees.

Acknowledgements

Thanks to the staff in Tishreen nursery (Bouka) for their technical assistance. This study was supported by Tishreen University, Latakia, Syria.

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