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# Effects of some auxins on propagation by hardwood cutting of Autumn Olive (*Elaeagnus umbellata* Thunb.)**

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## Abstract

Autumn olive (*Elaeagnus umbellata* Thunb.), belonging to Elaeagnaceae family, naturally spreads over Southern Europe and East Asia. It is a deciduous shrub or small tree growing up to 6 m in height and 9 m in width. Its form is rounded, with dense branches. The species can store the nitrogen in its roots. Thus, it has the ability to live even in the most inefficient soil. It is valued for its ability to prevent erosion and to attract wildlife and has been used in some agroforestry practices. When it is mature, the species has edible fruit with brilliant red or yellow pigmentation, and can be consumed especially as dried fruit. In addition, the greatest benefit of the fruit is the amount of lycopene it has. 100 grams of the fruit contains 7 to 17 times more lycopene than the same amount of tomatoes. Besides being extremely useful, antioxidant-containing fruits can be used in horticulture while leaves and flowers can be used in landscaping. Therefore, it is necessary to reproduce autumn olive for its uses in Turkey. Within the scope of this study, propagation of the species is carried out by hardwood cutting which is one of the vegetative propagation techniques. The objective of the present study is to investigate the effects of different auxins (IBA 1000 ppm, IBA 5000 ppm, NAA 1000 ppm and NAA 5000 ppm) on propagation of autumn olive by hardwood cutting in greenhouse condition with air temperature at 20±2°C, rooting table temperature at 25±2°C and perlite rooting media. The first root formation date, rooting percentage, root length and the number of roots were determined. The results showed that the highest rooting percentage occurred as 70% in NAA 5000 ppm and IBA 5000 ppm treatment. This study will provide a basis for further researches to be conducted using vegetative propagation methods.

***Keywords:*** Autumn olive*, Elaeagnus umbellata*, cutting propagation, auxin

# Güz zeytini (*Elaeagnus umbellata* Thunb.)'nin sert çelikle üretilmesinde bazı oksinlerin etkileri**

## Öz

Elaeagnaceae familyasına ait olan güz zeytini ya da diğer adıyla Japon iğdesi (*Elaeagnus umbellata* Thunb.) Güney Avrupa ve Doğu Asya'da doğal olarak yayılmaktadır. Kışın yaprağını döken, 6 m boya ve 9 m genişliğe kadar büyüyebilen çalı veya küçük ağaç formunda olan bir türdür. Yoğun dalları sayesinde yuvarlak forma sahiptir. Bitki köklerinde azotu depolayabilmektedir. Böylece, en verimsiz toprakta bile yaşama kabiliyetine sahiptir. Erozyonu önleme özelliği olan ve yaban hayvanlarının dikkatini çeken bir türdür. Ayrıca bazı tarımsal ormancılık uygulamalarında kullanılmaktadır. Parlak kırmızı veya sarı renk pigmentli meyveleri olgunlaşınca yenilebilir ve özellikle kurutulmuş meyve olarak tüketilebilir. Ayrıca, meyvenin en büyük faydası sahip olduğu likopen miktarıdır. 100 gram meyvede aynı miktardaki domatesten 7 ila 17 kat daha fazla likopen içerir. Son derece yararlı olmalarının yanı sıra antioksidan içeren meyveleri bahçecilikte, yaprakları ve çiçekleri ise peyzajda kullanılabilir. Bu nedenle, türün Türkiye'deki kullanımları için üretilmesi gerekmektedir. Çalışma kapsamında, vejetatif üretim tekniklerinden biri olan sert çelikle üretim tekniği kullanılmıştır. Çalışmanın amacı, güz zeytini türünün sert çelik ile üretiminde perlit ortamı, 20±2°C hava sıcaklığı ve 25±2°C köklendirme masası alt sıcaklığına sahip sera koşullarında farklı oksin hormonlarının (IBA 1000 ppm, IBA 5000 ppm, NAA 1000 ppm and NAA 5000 ppm) etkisinin araştırılmasıdır. İlk kök oluşum tarihi, köklenme yüzdesi, kök uzunluğu ve kök sayısı değerleri belirlenmiştir. Çalışma sonucunda en yüksek köklenme yüzdesi NAA 5000 ppm ve IBA 5000 ppm uygulamasında olmak üzere % 70 olarak bulunmuştur. Bu çalışma, vejetatif üretim yöntemleri kullanılarak yapılacak daha ileriki araştırmalar için bir altlık olacaktır.

***Anahtar Kelimeler:*** Güz zeytini, *Elaeagnus umbellata*, çelikle üretim, oksin

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## 1. Introduction

In terms of both distribution and diversity, Turkey is a very rich country with respect to secondary forest products. The use of wild plants as medicines by the Anatolian people extends to very ancient times (Akgün et al., 2004; Polat, 2012). The type of plants grown to obtain food is around 3,000. However, the number of wild plants used as food is above 10,000. Although Turkey has such a rich flora, they cannot be utilized sufficiently. Only 200 plants from almost 3000 medicinal and aromatic plants grown in the flora of Turkey have export potential, and about 70-100 of them are exported (Akgün et al., 2004). For the absolute needs of mankind, it is necessary to choose among the wild plants and start growing them (Genç *and Yağbasanlar, 1994).*

*Elaeagnus umbellata* Thunb. (Autumn olive) belonging to Elaeagnaceae family is native to Southern Europe and East Asia. The species has the ability to survive even in the most inefficient soil since it can store the nitrogen in its roots. Thus, it can turn inefficient soil into productive. Although autumn olive fruits are consumed in Asia, they are not consumed in America. When its fruits ripe, they can be renewed and consumed especially as dried fruit. In addition, the greatest benefit of the fruit is the amount of lycopene it has. 100 grams of its fruit contain 7 to 17 times more lycopene than the same amount of tomatoes has. The plant, which also contains antioxidants, can be used in horticulture and landscaping owing to its leaves, flowers, its highly useful fruits (Dirr, 1998; Fordham et al., 2001; Ahmad et al., 2006).

Vegetative propagation allows production of superior genotypes by protecting their genetic structure (Ürgenç, 1982). Cutting propagation method, one of the vegetative propagation methods, is a cheap, fast and simple technique. This method enables a large number of plants to be produced from fewer individuals located in a small area. Also, it does not require special techniques such as in grafting and micro vegetative propagation methods. There is no inconsistency problem with rootstock in cutting propagation method as in the propagation with grafting. The propagation is made by preserving the genetic structure of the rootstock (Hartmann and Kester, 1997).

Hormones have great importance during the process of cutting propagation. It's generally accepted that auxins play a central role in the rooting formation (Davis et al., 1989; De Klerk et al., 1999). They encourage developing newly formed roots throughout starting and growing periods of root formation (Nordström et al., 1991; Bellamine et al., 1998; Nag et al., 2001).

In the scope of the present study, it was tried to determine the effects of different hormones on propagation by cuttings of *Elaeagnus umbellata*. And so, the first callus and the first rooting formations, root length, the number of roots and rooting percentage were determined.

## 2. Material and Method

In the study, cutting propagation method, one of the vegetative propagation methods, was used, and the study was conducted in The Research and Application Greenhouse at Faculty of Forestry, Karadeniz Technical University (KTU). Hardwood cuttings to be used as study material were obtained from the last annual shoots of individual located in KTU Kanuni Campus. Parlak (2007) underlined that when liquid hormone was used, water on the cutting can cause concentration change. Also, usage and preservation of hormones in powder form are more practical and simple. Therefore, 1000 and 5000 ppm dosages in powder form of IBA (Indole-3-Butyric Acid) and NAA (α-Naphthalene Acetic Acid) were selected among the auxin group hormones to induce rooting from plant growth regulators. This study was carried out in technological greenhouse media with the air temperature at 20±2°C, rooting table temperature at 25±2°C. In addition, the humidity level of the greenhouse media was determined as 70%. As rooting media, perlite was used in the rooting process because of its high water retention capacity and ventilation porosity.

The study was set up to be three replications, according to the "randomized complete block design". A total of 150 cuttings were planted to rooting including 1 species x 2 hormones x 2 doses x 1 greenhouse media x 10 cuttings x 3 replications (120 cuttings) and control cuttings (30 cuttings). Cuttings were taken from stock plant in early February. The cuttings were generally prepared to be 10-12 cm long. The bottoms of the prepared cuttings were immersed in powdered hormone and transferred to the rooting media. In order not to adversely affect rooting, the distances were adjusted to be similar in the planting of cuttings. The irrigation was made after the cuttings were transferred to the rooting media. Thus, it was ensured that the cuttings were fully seated in the rooting media. In the measurements made in the cuttings, the first callus and first root formation dates, rooting percentage, root length and the number of root values were determined. The rooting percentage was expressed as a percentage of the total cutting by determining the number of cuttings forming the root. Root length was the length of roots formed in cuttings. And root num-

ber was the number of roots occurred in cuttings. It was decided whether the cuttings should be removed from the rooting medium according to the rooting condition.

The data were analyzed making analysis of variance with SPSS 23 statistical program.

## 3. Results

### 3.1. First callus and root formation

After the cuttings were transferred to the rooting media, the first callus formation was observed in NAA 1000 ppm treatment at the end of 11 days, while the first root formation was determined in IBA 5000 ppm treatment at the end of 20 days. The cuttings were removed from the rooting media after 134 days.

### 3.2. Rooting percentage

Results of rooting percentages for *Elaeagnus umbellata* were given as graphics in Figure 1.

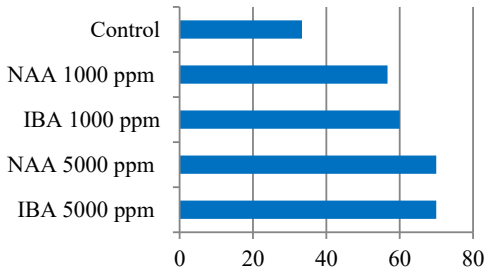


Figure 1. Values of rooting percentages
Şekil 1. Köklenme yüzdesi değerleri

The highest rooting percentage was obtained with 70% in IBA 5000 ppm and NAA 5000 ppm treatments, followed by IBA 1000 ppm (60%) and NAA 1000 ppm (56,67%) treatments. The lowest rooting percentage occurred in Control group was 33,33%.

### 3.3. Root length (RL) and the number of roots (RN)

As a result of hormone application, the mean, standard deviation, maximum and minimum values of root length and the number of roots are shown in Figure 2.

When the values of root length and the number of roots were examined, it was determined that the values of root length were between 8.48 and 9.21 cm, and the average root length was 8.80 cm. The maximum and minimum root length was determined as 18.10 cm and 1.00 cm, respectively. In terms of the number of roots, the values ranged from 6.29 roots to 7.94 roots, and the average was 7.13 roots. The maximum number of roots was 16 while the minimum number of roots was 1. And also, the highest values for root length and the number of roots were found in IBA 5000 ppm treatment while the lowest values were in the NAA 1000 ppm treatment.

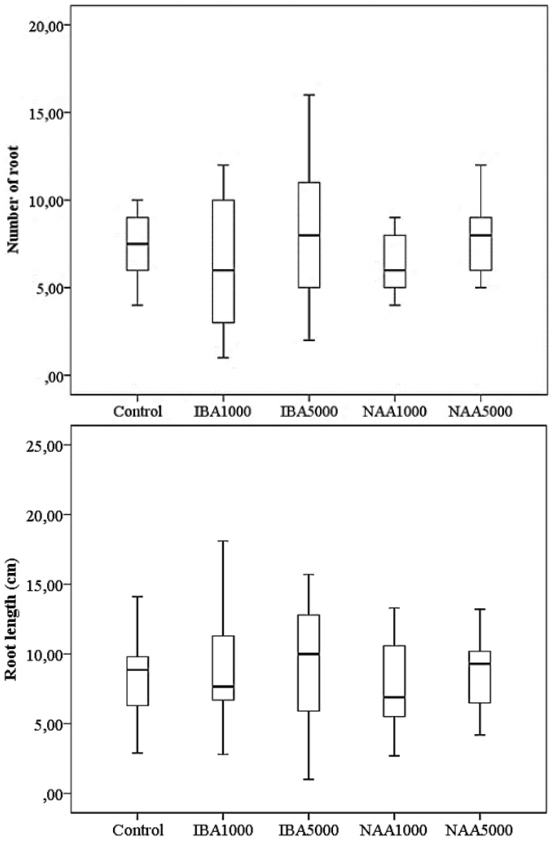


Figure 2. The mean, standard deviation, maximum and minimum values related to the number of roots and root length
Şekil 2. Kök sayısı ve kök uzunluğu değerlerinin ortalaması, standart sapması, maksimum ve minimum değerleri

Variance analysis was performed to determine whether there were statistically significant differences between the hormone applications in terms of the number of roots and root length. The results are shown in Table 1.

Within the scope of this study, analysis of variance was applied to determine whether there is a difference in terms of root length and the number of roots. A statistically significant difference (P>0,05) didn't emerge in terms of results of variance analysis related to root length and the number of roots.

The rooting situation of the removed cuttings of NAA 5000 ppm treatment with the highest rooting percentage was given in Figure 3.

Table 1. Results of variance analysis for RL and RN
Tablo 1. Kök uzunluğu ve kök sayısına ilişkin varyans analizi sonuçları

| Treatments | RL (cm) | RN (root) |
|---|---|---|
| Control | 8,59±3,42 | 7,10±2,08 |
| IBA 1000 ppm | 8,89±3,86 | 6,50±3,62 |
| IBA 5000 ppm | 9,21±4,37 | 7,95±3,71 |
| NAA 1000 ppm | 8,48±5,17 | 6,29±1,80 |
| NAA 5000 ppm | 8,68±2,52 | 7,52±2,48 |
| Average | 8,80±3,89 | 7,13±2,95 |
| F | 0,097 | 1,052 |
| P | 0,983 | 0,386 |

Figure 3. Rooting situation in NAA 5000 ppm treatment
Şekil 3. NAA 5000 ppm işlemindeki köklenme durumu

## 4. Discussion

In the study that is investigating the effects of different auxin on the propagation by cuttings, 70% rooting success, which is the highest rooting percentage, was obtained in IBA 5000 ppm and NAA 5000 ppm treatments in hardwood cuttings of *Elaeagnus umbellata*. Therefore, it can be highlighted that there is no rooting problem for this species. By using IBA 5000 ppm hormone, the longest root length (9,21 cm) and the highest number of roots (7,95 roots) were achieved. It should also be specified that the first callus formation was determined at the end of 11 days in NAA 1000 ppm treatment, the first root formation was observed at the end of 20 days in IBA 5000 ppm treatment.

There have been few studies on the propagation by cuttings for the *Elaeagnus umbellata*, more focused on the production of seeds. The species has dormancy, and there are various researches about germination (Anonymous, 1948; Heit, 1967; Lindquist and Cram, 1967; Hamilton and Carpenter, 1975; Belcher and Karrfalt, 1979; Wolf and Kamondo, 1993; Piotto et al., 2003; Olson and Barbour, 2004).

In a study on cutting propagation for *Elaeagnus umbellata*, the highest rooting percentage was acquired as 94,33% in taken cuttings on 15 May, the longest root length was obtained as 11,07 cm in taken cuttings on 15 July, the highest root number was determined as 10,83 roots in taken cuttings on 15 March (Çelik, 2012). In another study, effects of different greenhouse media (Greenhouse-1 media; air temperature at 20±2°C, rooting table temperature at 20±2°C, Greenhouse-2 media; air temperature at 20±2°C, rooting table temperature at 25±2°C and Greenhouse-3 media; nylon tunnel greenhouse media without temperature adjustment), rooting media (perlite and peat) and hormones (IBA 1000 ppm, IBA 5000 ppm, NAA 1000 ppm and NAA 5000 ppm) were investigated in softwood cuttings of this species. Rooting percentage was determined as 100% in IBA 1000 ppm treatment in perlite rooting media at Greenhouse-3 media (Bayraktar, 2017). When compared to the other studies carried out, the results of this study showed that the date the cuttings are taken and different media conditions are also effective on the rooting.

As a conclusion, although there is no problem in rooting for this species, different treatments can be applied to achieve higher rooting success. In addition, root length and root number values are important for obtaining quality seedlings. Therefore, detailed studies should be carried out that not only the root percentage but also these values are high.

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