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RESEARCH PAPER

Effect of Different Concentrations of IBA and Time of Taking Cutting on Propagation of Black and White Myrtle (*Myrtus communis* L.) Cuttings

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Abstract

This study aimed to evaluate the effect of different time of taking cutting and IBA concentrations on the rooting of *Myrtus communis* L. White and black myrtle types were used as plant materials. The cuttings were obtained from Batı Akdeniz Agricultural Research Institute (BATEM) collection garden. The effects of 0 (control), 500, 1000, 2000, 4000 and 8000 mg L^{-1} doses of IBA applications and time of taking cutting (February, March, April and May) on the rooting were investigated. The highest rooting percentage (76.67%) in black myrtle was obtained from cuttings taken in April and applied 1000 mg L^{-1} IBA, while the lowest rooting (10.00%) was obtained from cuttings applied 500 mg L^{-1} taken in May. White myrtle was rooted at a lower rate than black myrtle. It was determined that the highest rooting percentage (43.33%), shooting percentage (43.33%), rooted-shooted rates (43.33%) and average root number (1.63 pcs) in the white myrtle were 500 mg L^{-1} IBA dose in April. In addition, the study showed that the best rooting of white myrtle was in the cuttings taken in April and applied 500 mg L^{-1} IBA. Based on results, it can be concluded that time of taking cuttings in propagation and different concentration of IBA applications had a different impact on the success of black and white myrtle rooting.

1. Introduction

The myrtle (*Myrtus communis* L.) is one of the important medicinal plants used in traditional medicine in many parts of the World. *Myrtus communis* L. belongs to the family of Myrtaceae. The myrtle plant also known as true myrtle, is a perennial, evergreen shrub or small tree, typical of the Mediterranean region. In Türkiye, it spreads from the lowest altitude up to 600 meters in the Mediterranean, Aegean and Marmara Regions. Myrtle is also known by names such as erduran, erdüren, sazak, zazak, murt, mort. Naturally grown myrtle plant is resistant to both diseases and pests as well as drought and soil stress factors. This feature ensures that myrtle is grown organically (Uzun et al., 2014). The leaves and berries are a source of essential oils that have medicinal, insecticidal and sensory value (Khosh-Khui et al., 1984; Mulas et al., 1996; Milhau et al., 1997). Myrtle fruits are white and black coloured. White myrtles, which are called hambeles, are mostly consumed mainly as fresh fruit in Türkiye. Wild myrtles found in nature are grafted with hambeles or grown as border trees on the edges of the land. The black myrtle fruits are mainly consumed as fresh fruit (edible), dried fruit and fruit tea, and are also used in marmalade and jam production (Baytop, 2007; Alım and Uzun, 2017). The myrtle leaf and fruit are widely used as traditional folk medicine to treat many disorders and diseases. Its fruits, leaves, and seeds have a significant amount of phenolic substances, anthocyanins and antioxidant compounds (Alım et al., 2019).

Generally, myrtles grown wild in nature are grafted with white myrtle. In addition, this type of myrtle is grown as a border tree on the edges of the land. In our country, it is produced in the form of a closed garden in a very limited area. The demand for the myrtle fruits has increased in recent years because of their antioxidant and phenolic compound content. It was determined that especially black myrtle contains more phenolic substances than white fruit. Myrtle fruits naturally grown in Turkey were collected from nature by local people and it was sold at the district bazaars and herbalists in the coastal parts of the Mediterranean region (Şan et al., 2015a; Alım and Uzun, 2017; Alım, 2020).

Myrtle is generally propagated by seeds or woody stem cuttings (Ruffoni et al., 2010). Propagation with cuttings is widely used due to its advantages such as being simple and easy to apply, obtaining many seedlings from a unit area and obtaining high-quality seedlings with the same genetic structure as the rootstock plant. Differences in root ability of cuttings are due to anatomical, physiological, biochemical and environmental factors (Babaie et al., 2014). Cutting is at the moment the easiest and cheapest technique for mass propagation and production of plants more uniform and genetically similar to the genitors (Hartman et al., 2011). As in most fruit trees that are propagated by woody cuttings, physiological stage of the mother plant and the type of growth regulators are very important factors for the success of rooting cutting. In addition, the time of cuttings taken is very important in rooting yield in woody plants, but the optimum time for rooting must be established individually for each species (Howard, 1996; Chojnowska, 2004; Elgimabi, 2008).

For general use, for cuttings propagation of the majority of plant species, treatment with auxins is recommended (Davis and Haissig, 1990). Auxin has an effect on speed and increases the percentage of rooting of the stem cuttings. Plants produce natural auxin in young shoots and leaves, but synthetic auxin should be used for successful rooting to cuttings (Stefanic et al., 2007; Kasim and Rayya, 2009). IBA is a synthetic growth regulator, which belongs to the class of auxins (Hartmann and Kester, 2002). Treatment with rooting stimulators and especially IBA is generally effective in increasing the rooting rate of cuttings and making the root system stronger (Kaşka and Yılmaz, 1990).

The myrtle plant provides raw material for the pharmaceutical, cosmetic, ornamental and food industries (Medda and Mulas, 2021). Myrtle fruits and leaves, which are used as raw materials, are collected from wild plants and natural areas. This situation puts pressure on myrtle grown in the natural area. The increase in demand for myrtle in recent years creates uncontrolled pressure on wild plants. Therefore there is a great need for this plant to be produced as a standard and serial. The rooting ability of myrtle varies considerably, and some growers state that the plant is difficult to root (Mulas et al., 1996; Klein et al., 2000). However, limited studies have been made on the possibilities of producing myrtle plants with cutting, which is easier and more suitable for mass production. So far, studies on the propagation of myrtle species are not enough. The purpose of the present study was to improve the rooting of black and white myrtle cuttings by determination of the best concentration of IBA and time of cutting cultivation under mist propagation.

2. Material and Methods

2.1. Material

The study was carried out in the Batı Akdeniz Agricultural Research Institute Aksu campus rooting greenhouse in 2018. The distance of the research area to the sea is 20 km and the altitude is 46 m. In the province of Antalya, Türkiye where the trial area is located, summers are hot and dry, and winters are warm and rainy. Antalya 4th Regional Directorate of Meteorology has determined the average temperature as 19.65°C, the highest temperature of 32.51°C, the lowest temperature of 9.32°C, the annual average precipitation as 52.67 mm and the average relative humidity as 71.81% in 2018 (Table 1) (Anonymous, 2018).

In this research white (Hambeles) and black (Yakup) myrtle genotype which was not registered taken from the collection garden in the Aksu campus of the Batı Akdeniz Agricultural Research Institute, were used as plant materials (Figure 1). The fruits of hambeles are larger and have fewer seeds compared to the black fruits. Black myrtle fruits contain many (16 pieces fruit^{-1}) and hard seeds. Also, its fruits are more aromatic (Uzun et al., 2016).

2.2. Preparation of cuttings

Cuttings were taken from 5-year-old plants grown in the BATEM collection garden in four periods (February, March, April and May) in 2018. It was prepared from 1-year shoots (woody cuttings), which were about 15 cm long, bearing 3-4 leaves and eyes on the cuttings. Before planting date, all cuttings were soaked in 50% captan solution.

2.3. IBA treatment

In this study, 0 (control), 500, 1000, 2000, 4000 and 8000 mg L^{-1} doses of IBA doses were applied to the cuttings taken at different time of taking cutting. Before the applications, 250 mL 8000 mg L^{-1} IBA stock solution was prepared. For this purpose, 2000 mg L^{-1} of IBA (Sigma-57310) in pure powder form was weighed into a 250 mL measuring cylinder on precision scales and 30 mL of ethyl alcohol (96%) was added to dissolve. After the powder was

Table 1. Some climate data of Antalya 4th Regional Directorate of Meteorology in 2018.

Months	Average temperature (°C)	Highest temperature (°C)	Lowest temperature (°C)	Precipitation (mm)	Average relative humidity (%)
January	10.8	20.9	1.7	93.0	72.2
February	12.8	21.2	3.4	91.0	83.0
March	15.0	25.8	6.8	94.0	78.9
April	18.5	35.2	6.7	2.0	68.7
May	23.2	35.6	11.9	19.0	66.2
June	25.5	38.0	16.3	65.0	72.8
July	28.5	43.3	18.2	18.0	65.8
August	28.0	40.8	17.2	0.0	71.2
September	25.9	40.7	15.2	13.0	65.1
October	20.4	35.5	7.2	24.0	67.3
November	15.7	31.5	7.2	57.0	72.5
December	11.5	21.6	0.0	156.0	78.0
Mean	19.6	32.5	9.3	52.6	71.8

Figure 1. Black and white myrtles.

dissolved, it was completed to 125 ml with 96% ethanol and then to 250 ml with distilled water. For each application 500, 1000, 2000, 4000 and 8000 mg L^{-1} IBA were prepared from the stock solution. In the control application, distilled water was applied. It was applied to IBA cuttings by fast dipping method and 1 cm of the cuttings from the bottom were immersed in IBA solutions for 5 seconds. For each type and time of taking cutting, they were planted 2.5 × 2.0 cm apart in plastic crates (410 × 620 × 255 mm) filled with propagation medium (peat and perlite 1:1 v/v).

The crates were placed on rooting tables irrigated with a fogging system. The fogging system was set to operate for 5 seconds at 10 minute intervals throughout the experiment. In the study, 2 cultivars (white and black myrtles), 4 period (February, March, April, May), 6 doses 0 (control), 500, 1000, 2000, 4000 and 8000 mg L^{-1}, 3 replications and 10 cuttings in each replication, a total of 1440 cuttings were used. The cuttings were cut on the 7th day of February, March, April and May. The rooting percentage (%), the shooting percentage (%), the rooted-shooted rate (%) and the average number of roots (pcs) were determined in the cuttings removed four months after planting. The rooting percentage was found by dividing the number of rooted cuttings to the total number of cuttings. Shooting rate is the number of shooting cuttings by dividing the total number of cuttings. The average root number was found by counting the roots formed in the cuttings.

2.4. Statistical analysis

The research was established according to the Randomized complete block design, with 3 replications. The significance of treatment means was tested by one-way analysis of variance (ANOVA) on the transformed square root of rooting percentages, shooting percentages and rooted-shooted rates. Where significant differences were found ($P<0.05$) treatment means were compared using LSD test (Düzgüneş et. al., 1987).

3. Results and Discussion

Rooting percentage, shooting percentage, rooted-shooted rates and average root number of cuttings were taken in February, March, April and May and IBA was applied at doses (500, 1000, 2000, 4000 and 8000 mg L^{-1}) in black and white myrtles. The results were given in Table 2 and 3. The interaction of time of taking cutting and IBA dosages was determined as important as $P<0.05$ level in terms of rooting rate, shooting rate, rooted-shooted cutting rate and average root number at black and white myrtles.

The highest rooting percentage of black myrtle cuttings in 1000 mg L^{-1} IBA application taken in April were determined as 76.67% (Figure 2). The lowest value was determined in the cuttings taken in May and applied 500 mg L^{-1} (10.00%) IBA application (Figure 2). Rooting percentage decreased in

Table 2. Rooting percentage (%), shooting percentage (%), rooting-shooting rates (%) and average root number (pcs) according to time of taking cutting and IBA doses in black myrtle.

Parameters	IBA doses (mg L^{-1})	Time of taking cutting				
		February	March	April	May	Mean
Rooting percentage (%)	Control	40.00 (5.95) dh*	60.00 (7.68) af	66.67 (8.12) ac	26.67 (5.14) h	48.34
	500	46.67 (6.76) ah	63.33 (7.95) ad	73.33 (8.53) ab	10.00 (2.54) i	48.33
	1000	36.67 (5.95) dh	63.33 (7.79) ae	76.67 (8.75) a	33.33 (5.51) gh	52.50
	2000	40.00 (6.20) ch	73.33 (8.55) ab	36.67 (5.89) eh	36.67 (5.95) dh	46.67
	4000	73.33 (8.54) ab	66.67 (8.12) ac	53.33 (7.27) ag	33.33 (5.70) fh	56.67
	8000	66.67 (8.07) ac	66.67 (8.12) ac	56.67 (7.38) ag	46.67 (6.72) bh	59.17
	Mean	50.56	65.56	60.56	31.11	51.95
Shooting percentage (%)	Control	60.00 (7.67) ac	60.00 (7.69) ac	66.67 (8.12) ab	26.67 (5.14) f	53.34
	500	60.00 (7.69) ac	66.67 (8.15) ab	73.33 (8.53) ab	10.00 (2.54) g	52.50
	1000	60.00 (7.67) ac	66.67 (8.02) ab	66.67 (8.12) ab	33.33 (5.51) ef	56.67
	2000	60.00 (7.59) ad	73.33 (8.55) ab	36.67 (5.89) cf	36.67 (5.95) cf	51.67
	4000	76.67 (8.75) a	70.00 (8.35) ab	56.67 (7.47) bd	33.33 (5.70) df	59.17
	8000	70.00 (8.25) ab	66.67 (8.12) ab	56.67 (7.38) ae	46.67 (6.72) bf	60.00
	Mean	64.45	67.22	59.45	31.11	55.56
Rooted-shooted rates (%)	Control	40.00 (5.95) dg	60.00 (7.68) ae	66.67 (8.12) ab	26.67 (5.14) g	48.34
	500	43.33 (6.51) bg	63.33 (7.95) ac	73.33 (8.53) ab	10.00 (2.54) h	47.50
	1000	33.33 (5.51) fg	63.33 (7.79) ad	66.67 (8.12) ab	33.33 (5.51) fg	49.17
	2000	36.67 (5.95) cg	73.33 (8.55) a	36.67 (5.85) dg	36.67 (5.95) cg	45.84
	4000	73.33 (8.54) ab	66.67 (8.12) ab	53.33 (7.27) af	33.33 (5.70) eg	56.67
	8000	66.67 (8.07) ab	66.67 (8.12) ab	56.67 (7.38) af	46.67 (6.72) ag	59.17
	Mean	48.89	65.56	58.89	31.11	51.11
Average root number (pcs)	Control	1.33 jm	3.80 cg	2.60 fj	0.80 lm	2.13
	500	1.53 ıım	4.53 ad	2.83 ei	0.20 m	2.27
	1000	2.07 hl	4.67 ad	3.30 dh	1.60 im	2.91
	2000	2.27 hl	5.60 ab	1.73 ıl	1.37 im	2.74
	4000	4.20 be	5.17 ac	2.27 hl	1.03 km	3.17
	8000	4.03 cf	5.70 a	2.47 gk	1.50 ıım	3.43
	Mean	2.57	4.91	2.53	1.08	2.77

* IBA dosage × time of taking cutting interaction is indicated with small characters (a) (*P<0.05*). While grouping the percentage values, the square root values written in parentheses were taken as basis.

Table 3. Rooting percentage (%), shooting percentage (%), rooted-shooted rate (%) and average root number (pcs) according to time of taking cutting and IBA doses in white myrtle.

Parameters	IBA doses (mg L^{-1})	Time of taking cutting				
		February	March	April	May	Mean
Rooting percentage (%)	Control	3.33 (1.05) gh*	0.00 (0) h	23.33 (4.80) ad	10.00 (3.59) bg	9.17
	500	3.33 (1.05) gh	16.67 (4.02) af	43.33 (6.57) a	10.00 (2.54) ch	18.33
	1000	6.67 (2.10) dh	8.33 (1.66) eh	10.00 (2.54) ch	3.33 (1.05) gh	7.08
	2000	3.33 (1.05) gh	16.67 (4.02) af	33.33 (5.51) ab	1.82 (0.00) eh	13.33
	4000	6.67 (1.49) fh	12.50 (3.53) bg	20.00 (4.37) ae	13.33 (3.59) bg	13.13
	8000	3.33 (1.05) gh	8.33 (2.35) dh	10.00 (2.54) ch	26.67 (5.14) ac	12.08
	Mean	4.44	10.42	23.33	10.56	12.19
Shooting percentage (%)	Control	13.33 (3.60) ad	0.00 (0.00) e	16.67 (4.04) ad	10.00 (3.60) ad	10.00
	500	3.33 (1.05) de	20.83 (4.40) ac	43.33 (6.57) a	10.00 (2.54) be	19.37
	1000	10.00 (2.54) be	12.50 (2.85) be	13.33 (2.88) be	3.33 (1.05) de	9.79
	2000	3.33 (1.05) de	16.67 (3.22) bd	33.33 (5.52) ab	0.00 (0.00) e	13.33
	4000	10.00 (1.83) ce	12.50 (3.54) ad	20.00 (4.37) ac	13.33 (3.60) ad	13.96
	8000	3.33 (1.05) de	8.33 (2.36) be	10.00 (2.54) be	26.67 (5.14) ab	12.08
	Mean	7.22	11.81	22.78	10.56	13.09
Rooted-shooted rates (%)	Control	3.33 (1.05) ef	0.00 (0.00) f	16.67 (4.04) ae	10.00 (3.60) ae	7.50
	500	3.33 (1.05) ef	16.67 (4.02) ae	43.33 (6.57) a	10.00 (2.54) bf	18.33
	1000	6.67 (2.10) cf	8.33 (1.67) df	10.00 (2.54) bf	3.33 (1.05) ef	7.08
	2000	3.33 (1.05) ef	12.50 (2.85) bf	33.33 (5.52) ab	0.00 (0.00) f	12.29
	4000	10.00 (1.83) df	12.50 (3.54) ae	20.00 (4.37) ad	13.33 (3.60) ae	13.96
	8000	3.33 (1.05) ef	8.33 (2.36) cf	10.00 (2.54) cf	26.67 (5.14) ac	12.08
	Mean	5.00	9.72	22.22	10.56	11.86
Average root number (pcs)	Control	0.03 ef	0.00 f	0.57 cf	0.67 bf	0.32
	500	0.17 df	0.83 bd	1.63 a	0.20 df	0.72
	1000	0.30 df	0.25 df	0.30 df	0.17 df	0.24
	2000	0.07 ef	0.37 df	1.33 ab	0.30 df	0.43
	4000	0.27 df	0.41 df	0.70 be	0.63 cf	0.48
	8000	0.10 ef	0.42 df	0.60 cf	1.17 ac	0.55
	Mean	0.16	0.31	0.86	0.51	0.46

* IBA dosage × time of taking cutting interaction is indicated with small characters (a) (*P<0.05*). While grouping the percentage values, the square root values written in parentheses were taken as basis.

Figure 2. Black myrtle cuttings taken in April and applied 1000 mg L^{-1} IBA.

a

b

Figure 3. Black myrtle cuttings taken in February and applied 4000 mg L^{-1} IBA (a) and white myrtle cuttings taken in April and applied 500 mg L^{-1} IBA (b).

cuttings taken in later periods. The lowest value in both of them was in the cuttings taken in May (31.11%). When evaluated in terms of creep rate, the highest was in the 4000 mg L^{-1} (76.67%) application taken in February, the lowest was in the cuttings taken in May and 500 mg L^{-1} (10.00%) IBA application (Figure 3a). The highest shooting percentage was in February (64.45%), March (67.22%) and April (59.45%) in black myrtle. The lowest shooting rate was taken in May (31.11%). The rate of rooted-shooded rate cutting was highest in 2000 mg L^{-1} (73.33%), 4000 mg L^{-1} (66.67%) in March. The lowest rooted-shooted rate was determined in the cuttings applied (10.00%) 500 mg L^{-1} IBA taken in May. Rooted-shooted rates were found to be significant in the time of taking cuttings. The rate of rooted-shooted cutting decreased as the time of taking cutting progressed, and it was obtained at least in May (31.11%). The highest rooted-shooted cutting rate was in the cuttings taken in March (65.56%) in black myrtle. We have also measured root number of the cutting during in rooting experiment. The data showed significant differences in root number of the cutting which ranged from 0.2 to 5.7 pcs (Table 2). The average root number of black myrtle increased in parallel with the increase in IBA dose in cuttings taken in February and March. In our study, the highest average number of roots was obtained from the cuttings taken in March and applied 8000 mg L^{-1} (5.70 pcs) IBA. The lowest average root number was 500 mg L^{-1} in May (0.20 pcs). As the time of taking cutting progressed, the average root number of the cuttings decreased. It was determined that the highest average root number was in March (4.91 pcs) and the lowest was in the cuttings taken in May (1.08 pcs).

In terms of rooting rate, white myrtle was found to be lower than black myrtle. It was determined that the highest rooting rate (43.33%), shooting rate (43.33%), rooting-shooting rate (43.33%) and average root number (1.63 pcs) in the white myrtle

were 500 mg L^{-1} IBA dose in April (Figure 3b). In this myrtle type, there were no rooting or shooting in the control cuttings taken in March and the 2000 mg L^{-1} IBA application taken in May. The lowest average root shooted rate results were in control (0.00%) in February, 2000 mg L^{-1} IBA (0.00%) in May.

Application of IBA concentration and date of cutting collection can affect and promote root formation of hardwood cuttings in some genotypes by influencing the endogenous auxin and carbohydrate contents of the tissues. Furthermore, a correlation among polarity, root differentiation, and auxin movement can be made (Hartman, 1985; Hartmann and Kester, 2002). It was reported that the sampling time had a clear effect on the rooting percentage of the myrtle cuttings and the weld of the cuttings was negligible. In the study conducted by the researchers, while approximately 70% of the cuttings taken during the winter months (December-February) were rooted, 20% of the cuttings taken in May-August showed rooting (Klein et. al., 2000). Additionally, Abd El Hameed (2018), in his study on *Myrtus communis*, recommended the application of 4000 mg L^{-1} IBA dose to terminal cuttings taken in March and September. The lowest values were obtained from base cuttings without IBA applied in June and December. Our results confirmed the findings that time of taking cutting and IBA applications were important factors affecting plant propagation. Additionally, Pignatti and Crobeddu (2005) reported that applied 0.80% NAA in powder formulation to *Myrtus communis* cuttings. Holcomb and Michalas (1992) reported that 58.30-88.90% of the cuttings of *Myrtus communis* taken from mature plants and 86.10-91.70% of the cuttings taken from young plants were rooted. Researchers stated that *Myrtus communis* is suitable for mass production with young material. In addition, peat:perlite mixture was found to be superior to peat alone in promoting myrtle rooting. It is known that both genotype and growth regulators significantly affect rooting in myrtle. Şan et al. (2015b) reported that in myrtus in vitro study, higher rooting was obtained than our results. In the study, the explants were rooted in ½MS containing indole-3-butyric acid (IBA), naphthalene acetic acid (NAA) and activated charcoal (AC). IBA applications induced more rooting than NAA. The medium supplemented with 1.0 mg L^{-1} IBA + 2.0 g L^{-1} AC resulted in the highest rooting ratio (80%). Addition of AC into the medium resulted in slight increase in the rooting ratio, significant increase in shoot length, and reduced darkening in the rooting area. Acclimatization was successful for 86% of the rooted plants. Hatzilazarou et al. (2001) investigated that rooting capability of two M. communis clones, with large and small leaves. Shoots transferred to WPM medium supplemented with various concentrations (0, 0.5, 1.0 or 2.0 µM) of IBA, IAA or NAA in rooting assays. According to this study, the best rooting was achieved with the application of 0.5 µM IBA (96% rooting) and 1.0 µM IAA (100% rooting) for large leaves and small leaves, respectively.

Similar results to our results were found in studies conducted on different species. Palanisamy and Pramod (1997) stated that in *Pongamia pinnata*, rooting was best in March cuttings and IBA induced 100% rooting. Tewfik (2002) showed that 6000 mg L^{-1} IBA concentration has the highest rooting percentage in Nemaguard peach. It has been reported that the cutting time and IBA doses are important in the success of rooting. Meanwhile, Thirunavoukkarasu and Brahmam (1999) reported that auxin treatments stimulated sprouting of *Enterolobium cyclocarpum* cutting in but only cuttings prepared in January, March responded for rooting. On the other hand, Ercisli et al. (2002), in their study on kiwi fruits, the highest rooting percentage, maximum root length and number were obtained with 6000 mg L^{-1} IBA application. In addition, cuttings taken in February were rooted better than in January. Houle and Babeux (1998), stated that IBA significantly increased percentage of rooting and root length of *Pinus ocarpa* and increased enhanced the number of roots /cuttings and average roots length. A similar effect has also been observed by Ingle (2008) in Stevia. According to the results, on rooting of Stevia that increasing the concentration of IBA from 50 to 500 mg L^{-1}, caused an increase in rooting percentage, root number, root length and fresh weight of root. In addition, De Souza and De Lima (2005) obtained the best rooting percentages for *Prunus* cuttings at 2000 mg L^{-1} IBA concentration. Siddiqui and Hussain (2007) examined the effect of IBA applications (between 0-5000 mg L^{-1}) on the rooting of *Ficus Hawaii*. The researchers showed that the maximum root length and number, maximum shoot and leaf number per cutting were obtained at 4000 mg L^{-1} IBA concentration.

4.Conclusion

When both myrtle types were evaluated together, the rooting rate, shooting rate, rooted-shooted cutting ratio and average root number changed between time of taking cutting and IBA applications. Rooting ability of black myrtle was higher than white myrtle. Rooting properties of black myrtle decreased as time of taking cutting was delayed. The best time of taking cutting for white myrtle was April. As a result, IBA applications of 4000 and 8000 mg L^{-1} in February, 2000, 4000 and 8000 mg L^{-1} in March, 500, 1000 ve control in April can be recommended for black myrtle propagation by cuttings. In addition, propagation was suitable with black (control) cuttings taken in April and not applied IBA. In the production of myrtle with white, 500 mg L^{-1} IBA can be applied to the cuttings taken in April. In further studies, it is aimed to investigate

different applications to increase the propagation rate of myrtle**.**

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