



Application Effects of Humidity and Different Hormone Doses on the Rooting of *Prunus cerasifera* Pissardii Nigra Softwood Top Cuttings

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ABSTRACT

In this study in early July softwood top cuttings were taken from the ornamental plum (*Prunus cerasifera* Pissardii Nigra) tree growing in the campus of Konya Selçuk University. Effects of 90 % - 100 % air relative humidity in the misting system, a different IBA (Indole-3-Butyric Acid) hormone dose (control, 1000, 2000, 3000, 4000 and 5000 ppm) and a perlite rooting environment on the rooting capability and root formation were sought on these cuttings. When the rooting rate of the *Prunus cerasifera* Pissardii Nigra tree in the study was considered it was noticed that the highest rooting rate of 71.43 % was reached in the control group and the lowest rate of 23.81 % was reached with a 2000 ppm hormone dose application. The highest rooting number of 23.46 unit/cutting was obtained with a 4000 ppm hormone dose level. The lowest rooting number was obtained from control groups although there wasn't any roots. The longest root with 4.08 cm length was obtained with a 3000 ppm dose level. The shortest root was obtained from the control group having any roots. The highest rooting surface length of 2.92 cm was obtained with a 5000 ppm level and the lowest rooting surface was obtained from the control group having any roots.

1. Introduction

Prunus cerasifera 'Nigra', sometimes referred to as *P. cerasifera* 'Pissardii Nigra' is a deciduous tree with a rounded habit. The leaves are a deep purple when young, maturing to a dark green. The inflorescence is in the form of solitary, bowl shaped pink flowers which appear before the leaves. These are followed in autumn by edible, dark red and spherical fruit. The species *Prunus cerasifera* is native to parts of Europe and Asia. *Prunus cerasifera* 'Nigra' is useful to the landscape architect as a low maintenance, spring flowering fruiting tree. It also forms an interesting purple hedge or screen. This species can be propagated via generative and vegetative methods (Anonymous 2013). Vegetative propagation technique is one way of multiplying and improving clones for cultivation and research. It is mostly practiced for horticultural crops for the production of good materials within a short period (Nanda *et al.*, 1968). Vegetative propagation by rooting leafy cuttings in a

mist system is widely used for the propagation of ornamental plants. This technique is considered to be easy, inexpensive and appropriate for mass plant production (Fontanazza, 1993; Wiesman and Lavee, 1995).

The experiments reported in this paper were carried out in order to characterize further the rooting response of *Prunus cerasifera* Pissardii Nigra cuttings to the effects of six IBA concentrations and 90-100 % relative humidity level.

2. Materials and Method

In this research, the softwood top cuttings of *Prunus cerasifera* Pissardii Nigra plants grown in the Selçuk University Campus Area located in the province of Konya constituted the herbal material of the study. 90 – 100 % humidity level, perlite media (0.0 - 5.0 mm) and Indole-3-Butyric Acid (IBA) in different doses [0 (control), 1000, 2000, 3000, 4000 ppm and 5000 ppm] were utilized.

The study was carried out between July 14, 2012 and August 14, 2012 in the "Misting Unit" located below a

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plastic cover in a greenhouse in the campus area of the Faculty of Agriculture at Selcuk University. Softwood top cuttings were taken from the tips of the annual shoots. They had some leaves or one or two leaves. Their length was between 16.96 cm and 18.83 cm. Their diameter was between 2.10 mm and 2.75 mm. They were cut 1cm or 2 cm below the lowest eye in a sloped shape. As a result of aforementioned actions one softwood top cutting was obtained from each shoot (Kalyoncu, 1996). After the used softwood red ornamental plum cuttings were exposed to rooting in the misting system between July 14, 2012 and August 14, 2012, the following examinations were made: rooting rate (%), root number (unit/cutting), root length (cm), rooting surface length (cm), root branching (yes/no), callosity status (yes/no), cutting width (mm), cutting length (cm). The mentioned characteristics were examined for 7 cuttings in each repetition and at the end of the examination 21 cuttings were totally examined. Cuttings experiencing rooting were closely monitored during the application period and mossing status, temperature and humidity levels of the cuttings were controlled. Statistical analysis were made on the data obtained from the experiment. A computer package program, "MINITAB", were used for these data. Differences between the environment were controlled with the Duncan test (Düzgüneş et al.1987).

3. Results and Discussion

Characters attributed to some of the examined characteristics were found statistically significant and averages of the characters and Duncan test are shown in the Table 1.

3.1. Rooting Rate

Relations between hormone applications in terms of rooting rate were found statistically insignificant and the insignificance was also noticed when Table 1 was examined. The highest rate of the hormone application averages was 71.43 which was obtained from a 5000 ppm dose application. It was determined that softwood top cuttings of a cherry tree (*Prunus avium* L.) which were cut in early June were experienced different rooting rates at the air relative humidity level of 85 – 90 % and 95 – 100 % and in the different IBA concentrations and in the perlite environment. Rooting rate revealed a significant increase with the hormone applications. The highest rooting rate was obtained from a 1500 ppm dose application (83.3 %) with 85 – 90 % humidity level (Kalyoncu et al. 2008a). In the study made by Babaoğlu and Kalyoncu (2010a) in the misting system they investigated the effects of two different air relative humidity levels, a darkly IBA hormone dose and a perlite rooting environment on the rooting capability and root formation of the softwood top cuttings of a seedling parent apple tree which were cut in early June. At the end of the research the highest rooting rate of 59.52 % was obtained at the relative humidity level of 95-100 % with the 8000 ppm dose and the other highest rooting rate of

62.50 % was obtained in the control group at the relative humidity level of 85-90 %. Babaoğlu and Kalyoncu (2010b) made a study on the effects of the two air relative humidity environments, darkly IBA concentrations and perlite rooting environment on the rooting of the softwood top cuttings cut from cloned semi-dwarf MM106 apple rootstock in early June. They obtained the highest rooting rate of 95 % at the humidity level of 95-100 % with a 500 ppm IBA dose application. Various researchers made rooting studies on the softwood cuttings of various species and obtained high levels of rooting with the humidity level and hormone dose applications (Arslan et al. 1993; Kalyoncu, 1996; Kalyoncu and Özer, 2000; Özer and Kalyoncu, 2007; Kalyoncu et al. 2009; Ersoy et al. 2010; Babaoğlu and Kalyoncu, 2011).

3.2. Root Number

Relations between the hormone doses in terms of root number were found statistically significant ($P<0.01$). The highest root number of 23.46 (unit/cutting) between the hormone dose applications was obtained with a 5000 ppm dose application (Table 1). An increase in the root number was observed in the applications in paralel to the incremental dose application. In other words, the root number increased with the dose increment.

Kalyoncu et al. (2008b) investigated the effects of (85-90 % and 95-100 %) air relative humidity environment, IBA concentration applications (0, 500, 1500, 2500 ppm and 3500 ppm) and perlite rooting environment on the softwood top cuttings, cut from a cornelian cherry tree (*Cornus mas* L.) in early June. In the study they concluded that the cuttings rooted approximately at a rate of 100 %. They also determined that the root number increased significantly in the hormone dose applications in comparison to the control group. They obtained the highest root number of 56.133 unit/cutting at the humidity level of 85-90 % with a 3500 ppm hormone dose application. In an another study, Babaoğlu and Kalyoncu (2011) also investigated the effects of two different humidity conditions, six different hormone doses and perlite rooting environment on the rooting capability and root formation of the softwood top cuttings from M9 cloned dwarf apple rootstock. In the study they obtained the highest cutting root number of 16.05 unit/cutting at the humidity level of 95-100 % with a 4000 ppm dose application.

3.3. The longest root

When the Table 1 is considered, relations between the averages of hormone dose applications were found statistically significant ($P<0.01$). The longest root of 4.08 cm was obtained with a 5000 ppm dose level and the shortest root of 0.53 cm was obtained in the control group. It was observed that the longest root continued to extend with the increase of hormone dose. Babaoğlu and Kalyoncu (2011) investigated in an another study the effects of two different air relative humidity conditions,

various IBA hormone doses and perlite rooting environment on the rooting capability and root formation of the softwood top cuttings from M9 cloned dwarf apple rootstock. They stated that the longest cutting root of 3.80cm

was obtained at the 95-100 % humidity level with a 8000 ppm IBA dose application and the shortest cutting root of 1.14 cm was obtained at the humidity level of 85-90 % with a 6000 ppm dose application.

Table 1

Effects of the humidity level of 90-100 % and various hormone dose applications on the softwood top cuttings from a *Prunus cerasifera* Pissardii Nigra tree

Humidity (%)	Plant Type	Cutting characteristics	IBA Hormone Doses (ppm)					
			Control (0)	1000	2000	3000	4000	5000
90 - 100	<i>Prunus cerasifera</i> Pissardii Nigra	Rooting (%)	23.81	28.57	57.74	61.90	61.90	71.43
		Root number (unit/cutting)	1.61 ^d	2.32 ^{cd}	3.5b ^{cd}	14.33 ^{bc}	14.39 ^b	23.46 ^a
		The longest root (cm)	0.53 ^c	1.92 ^b	1.84 ^b	2.12 ^b	2.77 ^{ab}	4.08 ^a
		Rooting surface length (cm)	0.50 ^d	0.63 ^{cd}	1.67 ^c	1.70 ^{bc}	2.92 ^{ab}	3.15 ^a
		Root branchingn(Yes/No)	no	no	1/5	1/12	1/13	5/13
		Callosity status of the cutting (yes/no)	2/15	no	no	no	no	no
		Cutting diameter (mm)	2.57 ^{ab}	2.32 ^{abc}	2.10 ^c	2.35 ^{bc}	2.47 ^{abc}	2.75 ^a
		Cutting length (cm)	17.52 ^b	18.83 ^a	17.40 ^b	17.54 ^b	17.46 ^b	16.96 ^b

A, B, C :the differences between the averages having different letters in the same line are statistically significant (P<0.05)

a, b, c : the differences between the averages having different letters in the same line are statistically significant (P<0.01)

3.4. Rooting Surface Length

When Table 1 is considered in terms of rooting surface length, relations between the hormone dose applications were found statistically significant (P<0.01). When the rooting surface length was examined in terms of applications, the longest rooting surface of 3.15 cm was obtained with a 5000 ppm hormone dose application but the shortest rooting surface of 0.50 cm was obtained in the control group. It was observed an increase in the rooting surface length of the cuttings in paralel to the incremental applicaitons of the hormone doses. Babaoğlu and Kalyoncu (2010b) investigated the effects of two different air relative humidity environments, various IBA concentrations and perlite rooting environment on the rooting of the softwood top cuttings, cut from MM106 cloned apple rootstock in early June. They found out that the longest cutting root surface of 2.75 cm at the humidity level of 95-100 % was observed with a 3500 ppm dose application and also found out that the longest cutting root surface of 2.90 cm at the humidity level of 85-90 % was obtained with a 1500 ppm dose application. Özer and Kalyoncu (2007) investigated the rooting surface length at the rooting of softwood top cuttings from a gilaburu tree and they obtained the highest result of 14.0cm at the humidity level of 85-90 % with a 2500 ppm IBA dose application. Kalyoncu and Özer (2000) made an another study on the gilaburu and they stated that there were significant differences between the applications. They obtained the highest value of 12.342 cm at the humidity level of 95-100 % with 3500 ppm IBA application.

3.5. Root Branching

When Table 1 is reviewed in terms of cutting root branching, it is determined that there isn't root branching in the control group and a 1000 ppm dose application and the root branching is variable in the other applications and the highest root branching of 5/13 cuttings were experienced with a 5000 ppm dose application. Kalyoncu et al. (2008a) investigated the rooting possibilities of the softwood top cuttings, taken from cherry trees (*Prunus avium* L.) in early June, at the two different air relative humidity levels with various IBA concentrations and perlite environment. The highest value of 2.208 unit/cutting in terms of cutting root branching was obtained with a 1500 ppm application. Kalyoncu et al. (2008b) investigated the effects of two different humidity levels, IBA concentrations and the perlite rooting environment on the rooting of the softwood top cuttings, cut from cornelian cherry trees in early June. They didn't find out any cutting root branching. Kalyoncu et al. (2009) investigated effects of the air humidity level of 85-90 % and IBA doses on the softwood top cuttings, cut from two black mulberry types (Type 1 and Type 2) and a white mulberry type (Type 3) in early June. They obtained the highest root branching of 16.20 unit/cutting in the Type 3 (white mulberry tree) with a 3000 ppm dose application.

3.6. Callosity status of a cutting

When Table 1 is considered in terms of the cutting callosity, it was noticed that 2/15 cutting callosity was obtained in the control group with the applications and there wasn't any other cutting callosity. Initial roots usually develop from a callus. Because of that reason, it is believed that the callus formation is a must for rooting.

A callus and root are developed at the same time. Development of a callus and root require the similar internal and external conditions. A callus formation and root formation are two different events that don't depend on each other (Eriş, 2003). A callus formation is useful for the plants having slower rooting rates. Protective layer formed by a callus prevents a cutting from the bottom rotting. In addition to this, a callus layer sometimes enables that the cutting absorbs water (Knight and Witt, 1926).

3.7. Cutting Diameter

When the cuttings were examined in terms of the cutting diameter, the difference between the hormone dose applications was found statistically significant ($P < 0.01$). The highest cutting diameter of 2.75mm in terms of the hormone dose application average was observed with a 5000 ppm dose application and the lowest cutting diameter of 2.10 mm was observed with a 2000 ppm dose application (Table 1).

3.8. Cutting Length

Relations between the dose applications in terms of the cutting length were found statistically significant ($P < 0.01$). The highest cutting length of 18.83 cm was obtained with a 1000 ppm dose application. The lowest cutting length of 16.96 cm was obtained with a 5000 ppm dose application (Table 1). The other studies were also revealed the similar results (Kalyoncu, 1996; Kalyoncu and Özer, 2000; Özer and Kalyoncu, 2007).

Rooting rate, root number, root length, rooting surface length and root branching of softwood cuttings from *Prunus cerasifera* Pissardii Nigra trees changed in terms of IBA doses in the study. It was determined that the average values of all the examined characteristics' and IBA doses applications' effected the root number, quality, length and surface length increases. Different rooting rates were obtained at the relative humidity of 90-100 % with various IBA dose applications. The highest rooting rate of 71.43 % was obtained with a 5000 ppm dose application. To sum up, it was determined in the study that humidity levels and hormone doses applications effected the cutting propagation of *Prunus cerasifera* Pissardii Nigra tree and these humidity levels and hormone dose applications are recommended.

4. References

- Anonymous (2013). <http://davisla.worshipress.com/2011/03/18/plant-of-the-week-prunus-cerasifera-nigra/>
- Arslan N, Gürbüz B ve Yılmaz G (1993). Adaçayı (*Salvia officinalis* L.)'nda Tohum Tutma Oranı ve Çelik Alma Zamanı ile Indol Butirik Asit (IBA) Gövde Çeliklerinin Köklenmesine Etkileri Üzerine Araştırmalar. *Turkish Journal of Agriculture and Forestry* 19:83- 87.
- Babaoğlu D ve Kalyoncu İH (2010a). Çöğür Elma Anacının Yeşil Çelikle Çoğaltılması Üzerine Değişik Nem ve Indol Butirik Asit (IBA) Uygulamalarının Etkileri. *Bursa Tarım Kongresi* (7-9 Ekim 2010), Bursa.
- Babaoğlu D ve Kalyoncu İH (2010b). MM106 Klonal Elma Anacının Yeşil Çelikle Çoğaltılması Üzerine Değişik Nem ve Indol Butirik Asit (IBA) Uygulamalarının *Bursa Tarım Kongresi* (7-9 Ekim 2010), Bursa.
- Babaoğlu D ve Kalyoncu İH (2011). M9 Elma Anacının Yeşil Çelikle Çoğaltılması Üzerine Değişik Nem ve Indol Butirik Asit (IBA) Uygulamalarının Etkileri. *Selçuklu Tarım ve Gıda Bilimleri Dergisi* 25(1).
- Düzgüneş O, Kesici T, Kavuncu O ve Gürbüz F (1987). *Araştırma ve Deneme Metodları* (İstatistik Metodları II). Ankara Üniversitesi Ziraat Fak. Yay. :1021. Ders Kitabı. 295.
- Eriş A (2003). *Bahçe Bitkileri Fizyolojisi*. Uludağ Üniv. Ziraat Fak. Ders Notları, No 11, 152s. Bursa.
- Ersoy N, Kalyoncu İH, Aydın M, Yılmaz M (2010). Effects of Some Humidity and IBA Hormone Dose Applications on Rooting of M9 Apple Clonal Rootstock Hardwood Top Cuttings. *African Journal of Biotechnology* 9(17): 2510-2514.
- Fontanazza G (1993). *Olivicoltura Intensiva Meccanizzata*. Edagricole, Bologna, Italy, 312 p.
- Kalyoncu İH, Ersoy N, Yılmaz M, Aydın M (2009). Effects of Humidity Level and IBA Dose Application on the Softwood Top Cuttings of White Mulberry (*Morus alba* L.) and Black Mulberry (*Morus nigra* L.) Types. *African Journal of Biotechnology* 8(16): 3724-3760.
- Kalyoncu İH ve Özer E (2000). Gilaburu'nun (*Viburnum opulus* L.) yeşil yan çeliklerle köklendirilmesi ve fidan elde edilmesi. II. *Ulusal Fidancılık Sempozyumu* (25-29 Eylül 2000). 1.1-10, Bademli-Ödemiş, İzmir.
- Kalyoncu İH (1996). Konya Yöresi Kızılcık (*Cornus mas* L.) Tiplerinin Bazı Özellikleri ve Farklı Nem Ortamlarındaki Köklenme Durumu Üzerine Bir Araştırma. Doktora Tezi. *Selçuk Üniversitesi Fen Bilimleri Enstitüsü, Tarımsal Yapılar ve Sulama Anabilim Dalı*.
- Kalyoncu İH, Ersoy N ve Kurt H (2008a). Kiraz (*Prunus avium* L.) Yeşil Uç Çeliklerinin Köklenmesi Üzerine Farklı IBA Dozları ve Nem Seviyelerinin Etkileri. *Selçuk Üniversitesi Ziraat Fakültesi Dergisi* 22(46):68-72.
- Kalyoncu İH, Ersoy N. ve Yılmaz M (2008b). Kızılcık (*Cornus mas* L.) Yeşil Uç Çeliklerinin Köklenmesi Üzerine Farklı IBA Dozları ve Nem Seviyelerinin Etkileri. *Selçuk Üniversitesi Ziraat Fakültesi Dergisi* 22(46): 62-67.

Knight RC and Witt AW (1928). The Propagation of Fruit Tree Stocks by Stem Cuttings. II. Trials With Hard-and Soft-Wood Cuttings. *Journal of Pomology and Horticultural Science* 6(1): 47-60.

Nanda KK, Purohit AN, Bala A, Anand VK (1968). Seasonal rooting response of stem cuttings of some forest tree species to auxins. *Indian Forester* 94(2): 154-162.

Özer E ve Kalyoncu İH (2007). Gilaburu (*Viburnum opulus* L.)'nun yeşil çelikle çoğaltma imkanlarının araştırılması. *Selçuk Üniversitesi Ziraat Fakültesi Dergisi* 21(43): 46-52.

Wiesman Z and Lavee S (1995). Relationship of carbohydrate sources and indole-3-butyric acid in olive cuttings. *Functional Plant Biology* 22(5): 811-816.