

Researches on Organic Black Myrtle Growing

H. Ibrahim UZUN^{1*} Uygun AKSOY² Sadiye GOZLEKCI¹

¹**Akdeniz University, Faculty of Agriculture, Horticulture Department, Antalya / TURKEY**

²**Ege University, Faculty of Agriculture, Horticulture Department, İzmir / TURKEY**

*Corresponding author (Sorumlu yazar) e-mail: uzun@akdeniz.edu.tr

Received (Geliş tarihi): 20.04.2017 Accepted (Kabul tarihi): 30.01.2018

ABSTRACT: Myrtle (*Myrtus communis* L.), is a characteristic plant of Mediterranean climate. The myrtle plant, known as 'Hambeles', which has a white and large fruit had been cultivated in the region for many years. The black myrtle plant on the other hand, grows wild in forest characterized by smaller fruit sizes. Up to now, there has not been any registered black myrtle variety in our country. The results of the observations made in Antalya province showed the presence of some black myrtle ecotypes with large fruits. The aim of this study was to examine the characteristics of black myrtle types; fruit yield and shoot growth performance of this plant grown in two different ecologies of Antalya province. The myrtle plant has been cultivated in two different ecological areas, such as high and low lands. The cultured types were budded on the wild plants under high land conditions by using the patch budding method, whereas under low land conditions, the plants were grown by using own-rooted cuttings. The number of shoots emerged from the patches ranged from 3.9 to 7.0. The shoot length increased up to 208 cm in second growing season, but decreased to 104 cm in the third year. Fruit yield has increased markedly from the third year and reached up to 10.6 kg / plant.

Keywords: *Myrtus communis* L., organic, black myrtle, yield, shoot growth.

Organik Siyah Mersin Yetiştiriciliği Üzerine Araştırmalar

ÖZ: Mersin bitkisi (*Myrtus communis* L.), Akdeniz ikliminin karakteristik bir meyvesidir. İri ve beyaz renkli meyveye sahip olan ve 'Hambeles' adıyla bilinen mersinlerin uzun yıllardır yetiştiriciliği bölgede yapılmaktadır. Siyah renkli mersinler ise doğada yabani olarak yetişmekte ve daha küçük meyvelidir. Siyah mersinde şimdye kadar ülkemizde tescil edilmiş bir çeşit yoktur. Antalya yöresinde yapılan gözlemler sonucu nispeten iri meyveli tipler tespit edilmiştir. Bu çalışmanın amacı, farklı iki ekolojide yetiştirilen siyah mersin tiplerinin, meyve verimi ve sürgün gelişimiyle ilgili özellikleri incelemektir. Mersinler yayla ve sahil olmak üzere farklı iki ekolojide yetiştirilmiştir. Bitkiler yayla koşullarında yabani bitkiler üzerine kültür tiplerinin yama aşu yöntemiyle aşılmasıyla tesis edilmiştir. Sahil koşullarında ise bitkiler çelikten yetiştirilmiştir. Yama aşılardan çıkan sürgün sayısı 3.9-7.0 arasında değişmiştir. Bu sürgünler ikinci yıl 208 cm kadar boy yapmışlardır. Üçüncü yılki sürgün uzunluğu ise en fazla 104 cm olmuştur. Meyve verimi üçüncü yıldan itibaren belirgin bir şekilde artmış ve 10.6 kg/bitki ye kadar yükselmiştir.

Anahtar sözcükler: *Myrtus communis* L., organik, siyah mersin, verim, sürgün gelişimi.

INTRODUCTION

Myrtle (*Myrtus communis* L.) is an evergreen plant in the *Myrtaceae* family and contains about 100 genera and 3000 species. It grows in a wide geographical area from the Mediterranean basin to the northwest Himalayas (Surmaghi *et al.*, 2014).

In Turkey, the myrtle plant is cultivated in several parts of the coastal area, but the highest production areas are located in the Mediterranean region and are used for different purposes. The majority of the black and white colored fruits found in the nature belong to the wild myrtle plants. However, the

myrtle plant growing for fruit purposes named as 'Hambeles' type is mostly characterized by large and white colored fruit, this plant type is often obtained by means of grafting it on the wild myrtle plants growing at the edge of the fields. However, in this region, a few regular myrtle orchards could also be found. The black myrtle fruits are generally collected from the nature and consist of big fruits as well. Until now there has not been any work on the grafting of the big black-fruited myrtles on the wild myrtle type and shoot growth studies in Turkey. The myrtle plants have many benefits, in Turkey essential oils are often extracted from the leaves. There are very few works regarding the horticultural practices on myrtles plants in Turkey, but there are several works regarding the essential oil components research from fruits and leaves of myrtle plants. The vegetative propagation of myrtle plants are often carried out by methods such as grafting and cutting. There are a few literatures on the vegetative propagation of myrtles plants in Turkey (Uzun *et al.*, 2014). Similarly, there are also very few studies on the establishment of black and white myrtle plant orchards as well as fruit yield relationship in Turkey. The majority of the myrtle plants selection researches are often obtained from the natural population. Under these natural conditions, the myrtle plants are exposed to harsh environmental conditions and for that reason, the plant growth and yield are often low as compared to selected domesticated types. A work carried out by Mulas and Cani (1999) regarding the myrtle shoot growth and development found the shoot length in the ranged of 2.8-19.2 cm. The myrtle plants often selected from the natural populations are usually used for the establishment of regular orchards. The planting distances of the black myrtle plants in the regular orchards were reported by Mulas *et al.* (2002b) to be 1x3.25 m. After three years of planting two varieties of myrtle plants in the regular orchards, they found that, the Barbara variety produced 0.8 kg fruit yield whereas, Daniela variety recorded 1.0 kg they also found the shoot length of the Barbara variety to be 11.4 cm whereas Daniela variety to be 11.6 cm.

There are several criteria in the selection of the myrtle plants from the natural population, but in selection process, one has to take into consideration the fruit yield Mulas *et al.* (2002a). They did not provide any numerical value for fruit yield, but they categorized the fruit yield selection criteria of the myrtle plants into three groups as Low, Medium and High. As explained above, there are many gaps in the myrtle plant propagation methods and fruit yield researches. The purpose of this study was therefore, to examine the shoot growth and fruit yield performance after grafting of the black myrtle plant.

MATERIALS AND METHODS

The myrtle orchards were established in two different locations in the coastal and high hilly areas in Antalya province. The first location was the Yumaklar village under Aksu district in the hilly part of Antalya province. The graftings were carried out by using two genotypes namely, Yakup and Işlangıç black myrtles, which were grafted onto the wild types in nature by using patch grafting method in May 2011. The two orchards established in the Yumaklar village was carried out in two locations namely, Hayatözü with altitude of 354 m and Aktarla, 510 m high in Yumaklar village. The research was carried out by using three genotypes namely, Yakup and Işlangıç and Yumaklar black myrtles, which were propagated plant by using cuttings. The establishment of the orchard in the coastal area was carried out in the research plots in the Agricultural Faculty of Akdeniz University in the altitude of 50m in the year of 2010 by using planting distances of 3x3 m. Based on the results of the soil analysis, 3 ton/da fermented goat manure were applied to the soil. In all the three orchards established in both high hilly and the coastal part, no pest and disease problems were observed and for that matter, any pesticide and insecticide were not used. Additionally, in this study any chemical fertilizer didn't applied. The orchards established in the two different locations were organic in nature.

Grafting development: In the second year after grafting, the minimum and maximum shoot lengths were measured for monitoring shoot development performance. The shoot length measurements of the emerged grafted myrtle plants started in the third year after grafting and was measured from month to month (i.e. from May to December) until the experiment was terminated.

In the Yumaklar village myrtle plant orchards, which are wild in nature and established in nature, 10 plants were randomly chosen and grafted.

In the second location (coastal side), the orchard was established in a randomized block design with 3 replicates and every replicates has three tree.

Fruit yield: In the costal side, the orchard was established by using cuttings in 2010, Yumaklar village orchards on the other hand, were established on the hilly part of Antalya and by using patch grafting method. The fruits were harvested only from the coastal side because of the earlier plantation (in 2010) of the trees, but

harvest was not carried out in the Yumaklar village because the trees were grafted in 2011.

It was determined that the data not normally distributed according to the results of the Kolmogorov Smirnov test. In order to make the parametric hypothesis tests the Rank transformation was performed for the data not Gaussian distributed. Then the analysis of variance was applied for comparing group averages and Duncan Test was performed for multiple comparisons (Narinc and Aygun, 2017).

RESULTS AND DISCUSSION

The results of the black myrtle types grafted on the wild myrtle shrubs in two locations of Yumaklar village, showing the numbers and shoot growth after two years of grafting were presented in Table 1 and Table 2. Additionally, because the myrtle types established in the plots (Akdeniz University research plots) were planted earlier on, the fruit yield could be monitored until three years. The yield values of the three years of myrtle types examined in the coastal area are provided in Table 3.

Table 1. The shoot growth of the grafted Yakup and Işlangıç black myrtle types in two locations in Yumaklar village in 2012.
Çizelge 1. Yumaklar köyünde iki lokasyonda aşılanmış Yakup ve Işlangıç siyah mersin tiplerindeki sürgün büyümesi (2012).

Locations Lokasyon	Yakup			Işlangıç		
	Shoot number (number / grafting)	Maximum shoot length (cm)	Minimum shoot length (cm)	Shoot number (number / grafting)	Maximum shoot length (cm)	Minimum shoot length (cm)
	Sürgün sayısı (adet/aşılanan)	Mak. sürgün Uzunluğu (cm)	Min. sürgün Uzunluğu (cm)	Sürgün sayısı (adet/aşılanan)	Mak. sürgün Uzunluğu (cm)	Min. sürgün Uzunluğu (cm)
Aktarla	7.0	179.1	98.9	4.6	94.7	39.9
Hayatözü	5.3	208.0	78.4	3.9	153.9	90.7

Table 2. The total shoot length of the grafted Yakup and Işlangıç black myrtle types in Hayatöz location of Yumaklar village, third year after grafting in 2013, according to the months.

Çizelge 2. Yumaklar köyünde Hayatözü lokasyonunda aşılanmış Yakup ve Işlangıç siyah mersin tiplerinde aşılama sorası 3. yıldaki toplam sürgün uzunluğunun aylara göre gelişimi (2013).

Months Aylar	Shoot length / Sürgün uzunluğu (cm)			
	Yakup		Işlangıç	
	Minimum	Maximum	Minimum	Maximum
May / Mayıs	15.6	28.5	15.6	21.4
June / Haziran	25.2	36.1	21.0	35.4
July / Temmuz	31.3	48.8	30.7	77.0
August / Ağustos	33.5	57.2	33.5	92.6
September / Eylül	33.5	62.2	34.7	94.1
October / Ekim	33.6	66.9	34.9	102.2
November / Kasım	33.5	66.5	35.1	102.6
December / Aralık	33.5	66.9	35.1	104.6

Grafting Development

The values of the grafting development of the black myrtle orchard established in the high hilly area of Yumaklar village are provided below.

Generally, the most successfully grafting method on myrtle plant is patch grafting usually carry out in the month of May, because, during this month, the plant it is mostly active and it is easier to separate the bark from both the scion and the rootstock. The myrtle plant scions even with the same sizes of rectangular patches have a different number of dormant buds, and produce new shoots after grafting (Uzun *et al.*, 2014). In this study, it was found that, the least number of shoots of the grafted Işlangıç genotype was 3.9 numbers per grafted plants in the Hayatözü location, whilest the highest shoot number of Yakup genotype was 7.0 numbers per grafted plants in Aktarla location (Table 1). There can be variations in the development in terms of plant length of the first shoots after grafting based on the plant vigor. Generally, in the first year of the shoot development, the plant usually develops single branch, sometimes there could also lateral shoots. For all the developed shoots, the average lengths of the shoots were not measured, instead, the minimum and maximum shoot lengths were measured, which can be useful for monitoring shoot development performance. For that reason, in this study, second year after grafting, the minimum shoot length of Işlangıç genotype was 39.9 cm in Aktarla location. The reason for these low shoot lengths recorded by the 'Işlangıç' genotype in Aktarla location, could be due to low soil fertility and steep slope nature of the land, whereas the maximum shoot length obtained by Yakup genotype was 208.0 cm in Hayatözü location. The differences between the maximum and the minimum shoot lengths of the myrtle plants in the same location of Hayatözü were about 3 times fold.

The results of the emerged shoots length from the grafted myrtle plants in the third year after grafting, was observed to increase progressively from month to month as shown in Table 2. As observed in this study, active shoot growth started

in April, but the shoot length measurement was carried out in the month of May. The differences in the plant shoot length between the maximum and the minimum was low in the first months, but increased (2-3 times fold) progressively during the later months of shoot development. The least plant shoot lengths recorded by both genotypes in the May was 15.6 cm, whereas the highest shoot lengths were 21.4 and 28.5 cm in 'Işlangıç' and Yakup genotypes, respectively. The total shoot length in the December, which was the same as the harvest month recorded by the Yakup genotype was 33.5 and 66.9 cm for minimum and maximum, respectively. In the Işlangıç genotype it was 35.1 and 104.6 cm for minimum and maximum shoot length, respectively. The level of plant shoot growth in the third year after grafting decreased as compared to the growth during the second year. The reason for this decrease in the short length could be attributed to the rise or growth of the lateral shoot during the later period of plant development. There are very limited researches on the grafting and shoot development studies on the black myrtle plant in the World. In a related work carried out by Mulas *et al.* (2002b) in the spring season on the shoot length development of black myrtle plant, they found shoot length to between 11.4-11.6 cm depending on cultivars under consideration. The results of our study showed little high values with regards to the shoot development studies carried out by Mulas *et al.* (2002b). The reason could be due to ecological and genotypic differences carried in these two separate studies.

Fruit Yield

The fruit yield of all the three myrtle genotype plants established in the coastal part (Akdeniz University Agricultural Faculty Research plots), were obtained two years post-planting (Table 3). There was no statistical difference in fruit yield of all the three genotypes evaluated. The fruit yield in 2011 of all the two-year-old- genotypes were approximately 1 kg, the yield was found to increase sharply (7,670-10,600 g/plant) in the three-year-old plants in 2012, where as in 2013 it was found to be 7,666-9,226 g/plant (fourth year).

Table 3. Fruit yield of black myrtle plants obtained based on the years (coastal side) (g/plant).

Çizelge 3. Siyah Mersin bitkilerinin yıllara göre verimi (sahil kesimi) (g/bitki).

Year / Yıl	Mean±SE	P value	
2011	940.56 ± 418.59 ^{b*}	0.000	
2012	9444.44 ± 418.59 ^a		
2013	8242.22 ± 418.59 ^a		
Genotypes / Genotipler			
İşlangıç	5468.33 ± 418.59	0.084	
Yakup	6288.89 ± 418.59		
Yumaklar	6870.00 ± 418.59		
Interaction / İnteraksiyon			
2011	İşlangıç	905.00 ± 725.02 ^d	0.000
	Yakup	1133.33 ± 725.02 ^d	
	Yumaklar	783.33 ± 725.02 ^d	
2012	İşlangıç	7666.67 ± 725.02 ^c	
	Yakup	10066.67 ± 725.02 ^{ab}	
	Yumaklar	10600.00 ± 725.02 ^a	
2013	İşlangıç	7833.33 ± 725.02 ^{bc}	
	Yakup	7666.67 ± 725.02 ^c	
	Yumaklar	9226.67 ± 725.02 ^{abc}	

*Significant differences among the means were determined by Duncan's multiple range test and means with the same letter do not differ significantly at $P \leq 0.05$.

*Duncan testi ile tespit edilen ve aynı harfle gösterilen ortalamalar arasında önemli fark ($P \leq 0,05$) yoktur.

The values obtained from closely-spaced black myrtle orchards in Italy by Mulas *et al.* (2002b) in the third year was 0.8 and 1.0 kg/plant, which was lower than the results obtained in this study. The differences observed in the fruit yields in the genotypes in these two separate studies could be due to differences in the genotypic structure, or the environmental conditions under which the

REFERENCES

- Narinc, D., and A. Aygun. 2017. A Non Parametric Data Transformation Technique for Quantitative Genetic Analyses: The Rank Transformation. International Conference on Advances in Natural and Applied Sciences, AIP Conference Proceedings, 1833, DOI: 10.1063/1.4981708.
- Mulas M., and M. R. Cani. 1999. Germplasm evaluation of spontaneous myrtle (*Myrtus communis* L.) for cultivar selection and crop development. J. Herbs Spices and Medical Plants 6 (3): 31-49.

genotypes were grown in Italy favors good plant growth and development as compared to the Antalya climatic condition Table 2.

CONCLUSION AND RECOMMENDATION

From the results of this study, we observed that the black myrtle plant grafted on to wild myrtle shrubs and the propagation by cutting method produced the successful results. The plant cuttings used to establish the orchard in this study, were obtained by using the cutting propagation method. The grafting method used in this study was successful, whereas the results of the shoot development were satisfactory. Furthermore, the vegetative propagated plants yielded early fruit set and at the same time provide large number of fruits per plant. We recommend that, further research on myrtle propagation should be carried out. In addition, in order to improve myrtle fruit cultivation, it is recommended that, the research on the regular myrtle orchards, should be established with the incorporation of practices such as irrigation, fertilization, and cultural practices in order close the research gaps.

ACKNOWLEDGEMENT

Part of this research was supported by Republic of Turkey Ministry of Food, Agriculture and Livestock with Project number TAGEM/10-ARGE-02.

- Mulas, M., A. H. D. Francesconi, and B. Perinu. 2002a. Myrtle (*Myrtus communis* L.) as a New Aromatic Crop: Cultivar Selection, Journal of Herbs Spices & Medicinal Plants 9 (2-3): 127-131.
- Mulas, M., A. H. D. Francesconi, B. Perinu, and A. Fadda. 2002b. 'Barbara' and 'Daniela': Two cultivars for Myrtle Berries production. Acta Horticulturae 576: 169-175.
- Surmaghi, M. H. S., G. Amin, A. Shakibafar, and B. Azadi. 2014. Unexpected volatile compounds of *Myrtus communis* L. fruit rind growing in Iran. Int. J. Biol. And Pharm. Research 5 (5): 428-431.
- Uzun, H. İ., U. Aksoy, and Ş. Gözlekci. 2014. Endüstriyel amaçlı organik siyah mersin yetiştiriciliğinin geliştirilmesi. TAGEM-10/ARGE-02 nolu proje sonuç raporu.