

Protected cultivation of sweet cherry in container in coastal region of Antalya

Antalya'nın sahil bölgesinde örtü altında saksı içerisinde kiraz yetiştiriciliği

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ABSTRACT

Sweet cherry production is important for Turkish growers and it is mostly common in temperate zone of Turkey. Recently, sweet cherry was started to grown in the coastal areas of Turkey due to its high income of earliness. The most important problem in the southern region is low chilling period. Thus, the cultivars that require low chilling period are preferred. The aim of this research was to induce earliness in sweet cherry cultivars such as 0900 Ziraat, Early Burlat and Regina grown in containers in the plastic greenhouse under the Antalya ecological conditions. With the purpose of increase fruit set, Starks Gold and Merton Premier cherries were selected as pollen parents. The research was conducted in a plastic greenhouse in the Research and Experimental Station of Akdeniz University in between 2012 and 2013. The plants were placed in 30 L black plastic containers filled with peat- manure mixture (60%-40%). From the second year, the plants were stored at 5 °C for 30 days in the storage house in order to meet the chilling requirements before transferring the plastic greenhouse. The plants were transferred into the greenhouse, and were kept in there until harvest was completed. Soon after, the plants were transferred to the outside. During the vegetation period, some phenological and pomological parameters were determined. Among the sweet cherry cultivars, while Regina was the best in terms of the fruit set and yield per plant, 0900 Ziraat had the highest acidity. According to the results, sweet cherry production in the plastic greenhouse was not found feasible in the coastal region of Antalya.

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ÖZ

Kiraz yetiştiriciliği Türk üreticiler için önemlidir ve çoğunlukla Türkiye'nin ılıman iklim bölgelerinde yetiştirilir. Erken yetiştiriciliğin getirisinin iyi olmasından dolayı son yıllarda Türkiye'nin sahil kısımlarında da yetiştirilmeye başlanmıştır. Güney bölgelerindeki en önemli sorun soğuklama ihtiyacını karşılayamamadır. Bundan dolayı soğuklama ihtiyacı düşük çeşitler tercih edilmektedir. Araştırmanın amacı, Antalya ekolojik koşullarında plastik serada, saksı içerisinde 0900 Ziraat, Early Burlat ve Regina kiraz çeşitlerini erkenci olarak yetiştirmektir. Meyve tutumunu artırmak için Starks Gold ve Merton Premier kiraz çeşitleri tozlayıcı olarak kullanılmıştır. Araştırma 2012-2013 yılları arasında Akdeniz Üniversitesi Araştırma ve Uygulama Arazisindeki plastik serada yürütülmüştür. Bitkiler torf-çiftlik gübresi karışımı (% 60-% 40) içeren 30 l'lik siyah plastik saksılara dikilmiştir. İkinci yıldan itibaren bitkiler plastik sera içerisine konulmadan önce 5 °C'de 30 gün süreyle soğuk hava deposunda bekletilerek soğuklama ihtiyaçları karşılanmıştır. Bitkiler seraya taşınmış ve hasat tamamlanincaya kadar sera içerisinde bekletilmiştir. Daha sonra, bitkiler dışarıya alınmıştır. Bitkilerde bazı fenolojik ve pomolojik özellikler incelenmiştir. Kiraz çeşitleri arasında, meyve tutumu ve bitki başına verimde Regina çeşidi en iyi sonucu verirken, asitlik en fazla 0900 Ziraat çeşidinde saptanmıştır. Elde edilen sonuçlar, Antalya'nın sahil bölgesinde sera içerisinde kiraz yetiştiriciliğinin karlı olmayabileceğini göstermiştir.

1. Introduction

Growing stone fruits in Mediterranean coastline is important because of early grown characteristic. Cultivars that are grown in Mediterranean coastline in Turkey and have a low chilling requirement, ripen earlier than in the other parts of Turkey and

in the other Mediterranean countries like Italy and Spain. The earliest stone fruit cultivars can be even earlier when they are grown in the greenhouse. In addition, Fruits are sold at higher prices when they come to the market before the harvest period.

In case of the winter dormancy requirement is not met for cherries, there can be a problem on pollination. In the mild winters, cultivars that have low chilling requirement blooms earlier than cultivars that have high chilling requirement, thus, fertilization can not be made between these cultivars (Öz 1988; Roversi and Ughini 1996).

Küden et al. (1997) determined chilling requirement of Stella, Noirde Guben, Bing, Van and Vista cultivars using both standard and chill unit methods in the study of cherry cultivation in subtropical zones. At the end of the study, it was determined that all cultivars required chilling between 600-1200 hours. Among these cultivars, while chilling requirement of Stella was 600-650 hours and 218-310 chill units (cu), Noirde Guben, Van and Bing cultivars required 1000-1200 hours and 252-310 chill units. Moreover, it was indicated that these cultivars can be grown in subtropical zones using chemical treatment that stops dormancy.

Küden et al. (2001) grew nectarine, apricot, plum, cherry and almond in the greenhouse in Adana. At the end of the experiment, it was observed that growing stone fruits in the greenhouse made a positive impact on earliness, yield and fruit quality.

Küden and Küden (2004) stated that Cristobolina, Temprano de Sot, Precoce de Bernard, Sunburst, Lapins, Chelan and Nafrina cherry cultivars that have low chilling requirement, can be grown in subtropical conditions. Within the scope of the experiment, researchers determined the chilling periods in 1999-2003 in Adana using both standard and chill unit methods. These values were 583 h and 357 cu in the winter in 1999-2000, 660 h and 411 cu in 2000-2001, 534 h and 423 cu in 2001-2002, and 751 h and 546 cu in 2002-2003.

With the purpose of developing flowering and fruit ripening, Godini et al. (2008) made an experiment about the effect of H₂CN₂ on two cherry cultivars (Burlat and Ferrovia) in Apulia region in the southeast of Italy, where had 964 h chilling period in 2002, 592 h in 2003 and 834 h in 2004. H₂CN₂ was applied in 4 different doses (0.0%, 2.0%, 3.5% and 5.0%) in 3 different times. The best results in 2002 were obtained from all treatments. Flowers bloomed 11-13 days earlier on Burlat cultivar, and 7-9 days earlier on Ferrovia cultivar. While Burlat cultivar ripened 7-8 days earlier, Ferrovia cultivar ripened 6-8 days earlier. Both flowering and ripening decreased for both cultivars in 2002-2003 because the winter was unusually warm. In 2004, early treatments gave good results. In conclusion, 2% or 3.5% H₂CN₂ treatment was suggested in 50 and 85 days before flowering.

In this experiment, it was aimed that providing earliness in the greenhouse to some cherry cultivars that are grown in mild climates, by growing in the container in Antalya conditions and meeting the chilling requirement by some treatments.

2. Materials and Methods

The plants were planted in container in December in 2010 and research was conducted in plastic greenhouse in 2012 and 2013 years in Research and Application Field of Agriculture Faculty of Akdeniz University. The greenhouse has 51 m length, 18 m width and 6 m height and it is composed of 3 tunnels. Furthermore the greenhouse is in 36° 54' 028" N, 030° 38'-810' E and 38 m above sea level.

In this research, 0900 Ziraat, Early Burlat and Regina young sweet cherry trees were used on MaXMa14 rootstock. Starks

Gold and Merton Premier cherries were used as pollen parents. At the beginning of flowering, two bumble bee hives were placed in the greenhouse with the purpose of providing pollination.

Drip irrigation was used as an irrigation system and one spaghetti (having 2 l h⁻¹ water discharge volume) was placed in per container.

Fruit seedlings were planted in 30 liter containers and 60% peat + 40% organic manure (sheep manure) was used as growing media. During planting taproot was cut at the bottom level in order to prevent taproot development, furthermore, other roots were pruned normally. Seedlings were planted as grafting point was 15 cm above the growing media.

Seedlings were pruned as open a vase style. During planting seedlings were topped from 60 cm and shoots, which were located in the first 30 cm, were removed. 3-4 scaffold branches with 5-10 cm distances between each other which were evenly spread in 360° were left with summer and winter pruning in order to form an open vase style canopy. As a result of branch selection, proper open vase style was formed as middle of the canopy stayed open. Afterwards, summer pruning were done until bearing in the middle of June with choosing lateral branches on scaffold branches and the angle of scaffold branches was set in 45-60°. Following that, winter pruning were done in early January every year.

In order to preserve plants from hot weathers in summer, seedlings were placed in the shade area covered with a net, which transmits %40 light. In the second and later years, cold treatments (30 days/720 hours at 5 °C) were done. Treatments were done after 15th January every year. Plants were moved to cold storage, which had 80-85% humidity and 5 °C temperature for 30 days holding treatment. In the middle of February, sweet cherry cultivars and pollen parents were placed inside of the plastic greenhouse with 4x3 m density. In the blooming time, with the purpose of increase pollination, bumblebee hives were placed as 2 hives inside of the greenhouse. After fruit harvest in order to preserve plants from hot weathers in summer, plants which were inside of the greenhouse, were moved to 40% shade area. In that area, plants were held until the treatments for the next year, and in next 2 years of the experiment, same treatments were done as in the first year.

Fertilization schedule was prepared according to soil and leaf analysis results and 30 g NPK (15:15:15) was given to each container with fertigation method in early March, April, May and June. Additionally, Fe-EDTA was sprayed to leaves with a knapsack sprayer to prevent chlorosis in plants.

Phenological observations were done on plants like budburst date, blooming time, fruit set percentages, harvest time, yield per plant and leaf abscission time. Furthermore, pomological analyses were done like fruit weight, fruit width, fruit length, seed weight, fruit flesh/seed weight rate, fruit flesh firmness, total soluble solid, titrable acidity (TA).

The research was designed as randomly blocks. The experiment was conducted with 3 replications and 2 plants were used in each replication. SAS software was used for statistical analyses of data and comparison of means was done with Duncan's multiple range test.

3. Results

In the experiment, budbreak of the cultivars occurred a few days earlier in 2012 than in 2013, furthermore, the earliest

budbreak was determined in 6 March 2012 on Early Burlat cultivar. Flowers bloomed 2-4 days earlier in 2012 than in 2013, and the earliest blooming was observed on Early Burlat cultivar in 19 March 2012. Flowering occurred in both 2012 and 2013, moreover, flowering period took around one week. Fruit set occurred 2.43% on 0900 Ziraat cultivar and 12.92% on Regina cultivar in 2012. However, fruit set was occurred only on Regina cultivar with 7.14% in 2013. The harvest of fruits was done in 14 May 2012, and in 20 May 2013. Yield per plant was determined higher on Regina cultivar than 0900 Ziraat, and the highest yield per plant was obtained in 2012 from Regina cultivar with 118.92 g. Defoliation time was 10-11 January 2012, and in 26-29 December 2013 (Table 1).

Fruit weight, fruit width, fruit length, seed weight, total soluble solid (TSS) and TA of 0900 Ziraat cultivar was slightly higher than Regina cultivar. Only fruit firmness was higher on Regina cultivar. While fruit weight of Regina cultivar was averagely 5.26 g in 2012, it was 7.46 g in 2013. This situation occurred with shortening of fruit width and lengthening of fruit length. While TSS level of Regina cultivar increased from 15.50% in 2012 to 18.00% in 2013, TA level increased from 1.04 g 100 ml⁻¹ to 1.06 g 100 ml⁻¹ (Table 2).

4. Discussion and Conclusions

In this experiment, bud break on cherries occurred on 6-14 March. This time was indicated 30 March by Parlak and Bolat (2001) and 8 April by Özbiçerler (2006), in Pozanti-Adana. Even though İmrak (2010), indicated that cherries blossomed in March similarly to results of this experiment, Özbiçerler (2006), and İmrak (2010), stated that cherries blossomed in April in Pozanti-Adana. Plants were harvested on 14 May in the first year and 20 May in the second year. Önen (2008), stated that 0900 Ziraat cultivar was harvested on 26 June in Adana, moreover, Küden et al. (2001), stated that Early Burlat cultivar was harvested on between 18 May and 6 June in Pozanti-Adana. The difference between results of previous researches and our experiment can be due to the ecology and treatment methods. This situation reveals the effect of ecology on bud break, flowering, and harvest time.

Blooming of the trees every year demonstrated that chilling requirement of cherries can be met with holding 30 days in 5 °C. Flowers turned into the fruits only in Regina cultivar in both years, however, flowers turned into the fruits in a small amount in 0900 Ziraat cultivar, and they did not turn into the fruit in Early Burlat cultivar. This situation can be explained by the adaptability of the cultivars, and also, flower shedding occurred on cultivars by getting stressed due to growing in small plant containers. Because, pollinator cultivars blossomed at the same time in both years. Furthermore, the yield per tree was low, thus, this situation does not support the idea of Roversi and Ughini (1996) that cherry cultivation can be done in the subtropical regions with high economic return. However, the results can be misleading because of the study was carried out with young plants and in the containers. Getting results in a long term is better for the clear conclusion.

Fruit weight, fruit width and fruit length showed differences by years, cultivars and treatments. Küden and Kaşka (1995) determined 7.3 g fruit weight in Akşehir Napolyon cultivar, 7.37 g in Malatya Dalbastı cultivar and 7.43 g in 0900 Ziraat cultivar. Önen (2008) determined 6.70-8.88 g fruit weight, 0.1-23.3 mm fruit width and 19.5-22.6 mm fruit length. Ugurluay (2009) indicated that fruit weight of 0900 Ziraat varied between 8.51 and 9.14 g. Ugurluay (2009) determined the seed weight between 0.47-0.54 g in similar to our experiment.

The highest fruit flesh firmness (5.43 kg cm⁻²) and TSS (18.00%) were determined in Regina cultivar, and the highest TA (1.06 g 100 ml⁻¹) was determined in 0900 Ziraat and Regina cultivars. Küden and Kaşka (1995) determined 17.0-19.6% TSS on cherries, Ugurluay (2009) determined 4.34-4.50 kg cm⁻² fruit flesh firmness and 0.29-0.30 g 100 ml⁻¹ TA in 0900 Ziraat cultivar, Önen and Küden (2010) determined 10.0-12.1% TSS and 0.54-0.64 g 100 ml⁻¹ TA in 0900 Ziraat cultivar.

As a result, it can be said that cherry cultivation in containers in greenhouse in Antalya can be too hard even though the chilling requirement is met.

Table 1. Phenological observations on cherry cultivars during the experiment.

Years	Cultivars	Bud break times	Flowering times [#]	Fruit set rate (%)	Harvest time	Yield per plant (g)	Defoliation time
2012	0900 Ziraat	March 11	March 22	2.43 c*	May 14	50.47 b	January 10
	Early burlat	March 6	March 19	0.00 d		0.00 c	January 11
	Regina	March 9	March 22	12.92 a	May 14	118.92 a	January 10
2013	0900 Ziraat	March 12	March 24	0.00 d		0.00 c	December 29
	Early burlat	March 12	March 27	0.00 d		0.00 c	December 26
	Regina	March 14	March 28	7.14 b	May 20	39.79 b	December 26

*: Mean separation within columns and main effects by Duncan's multiple range test, $P \leq 0.05$.

[#]: Pollinators Starks Gold and Merton Premier varieties blossomed with cherry cultivars at the same time in both years.

Table 2. Pomological analysis on cherry cultivars during the experiment.

Years	Cultivars	Fruit weight (g)	Fruit width (mm)	Fruit length (mm)	Seed weight (g)	Fruit firmness (kg cm ⁻²)	TSS (%)	TA (g 100 ml ⁻¹)
2012	0900 Ziraat	7.56 a*	24.98 a	24.59 a	0.56 a	5.10 a	15.60 b	1.06 a
	Early burlat	0.00 c	0.00 c	0.00 c	0.00 c	0.00 b	0.00 c	0.00 b
	Regina	5.26 b	22.28 ab	21.41 b	0.42 b	5.43 a	15.50 b	1.04 a
2013	0900 Ziraat	0.00 c	0.00 c	0.00 c	0.00 c	0.00 b	0.00 c	0.00 b
	Early burlat	0.00 c	0.00 c	0.00 c	0.00 c	0.00 b	0.00 c	0.00 b
	Regina	7.46 a	21.34 b	25.26 a	0.56 a	5.30 a	18.00 a	1.06 b

*: Mean separation within columns and main effects by Duncan's multiple range test, $P \leq 0.05$.

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