Research Article/Araştırma Makalesi

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MEDITERRANEAN AGRICULTURAL SCIENCES (2018) 31(1): 1-4
DOI: 10.29136/mediterranean.363618

Investigations on yield and quality characteristics of some early table apricot (*Prunus armeniaca L.*) cultivars in Manavgat (Antalya) ecological conditions

Bazı sofralık erkenci kayısı (*Prunus armeniaca L.*) çeşitlerinin Manavgat/Antalya ekolojik şartlarındaki verim ve kalite özellikleri üzerinde araştırmalar

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ARTICLE INFO

Received 03 October 2016
Received in revised form 06 June 2017
Accepted 07 July 2017

***Keywords*:**

Apricot
Yield
Blooming
Earliness
Fruit quality

ABSTRACT

This research was carried out in Manavgat-Antalya to determine the phenological and pomological characteristics of 'Beliana', 'Feriana', 'Ninfa' and 'Precoce de Tyrinthe' apricot (*Prunus armeniaca L.*) cultivars in 2013 and 2014 years. Flowering period, harvesting date, fruit weight, seed weight, acidity, total soluble solids (TSS%) and yield tree^{-1} were determined 'Ninfa' apricot fruits were harvested on 7 May 2013 and 8 May 2014. 'Ninfa' was considered to be superior with respect to earliness in both trial years. In terms of fruit yield, 'Ninfa' was found to be the most productive with 98.50 kg tree^{-1} in 2013 and 108 kg tree^{-1} in 2014. The largest fruit were observed in 'Precoce de Tyrinthe' apricot cultivar in two experimental years. 'Ninfa', regarding earliness and 'Precoce de Tyrinthe', with regard to fruit quality, were found to be the most promising cultivars for the Manavgat area. This study has determined the kinds of the most profitable apricot for early growing for farmers by testing values of yield, earliness and quality in low altitude areas.

MAKALE BİLGİSİ

Alınış tarihi 03 Ekim 2016
Düzeltilme tarihi 06 Haziran 2017
Kabul tarihi 07 Temmuz 2017

***Anahtar Kelimeler*:**

Kayısı
Verim
Çiçeklenme
Erkencilik
Meyve Kalitesi

ÖZ

Bu çalışma 2013-2014 yılları arasında Manavgat/Antalya koşullarında 'Beliana', 'Feriana', 'Ninfa' ve 'Precoce de Tyrinthe' kayısı (*Prunus armeniaca L.*) çeşitlerinin fenolojik ve pomolojik özelliklerinin belirlenmesi amacıyla yürütülmüştür. Çiçeklenme dönemleri, derim zamanları, meyve ağırlığı, çekirdek ağırlığı, asitlik, toplam suda çözünebilir kuru madde miktarı (% Sçkm) ve ağaç başına verim değerleri saptanmıştır. 'Ninfa' kayısısı meyvelerini 2013'de 7 Mayıs, 2014'de 8 Mayıs tarihlerinde olgunlaştırmıştır. 'Ninfa' her iki deneme yılında da erkencilik bakımından diğer çeşitlere göre daha üstün bulunmuştur. Verim bakımından 'Ninfa' 2013 yılında (98.50 kg ağaç$^{-1}$) ve 2014 yılında ise (108 kg ağaç$^{-1}$) ile en verimli çeşit olmuştur. Her iki deneme yılında da en iri meyveler Precoce de Tyrinthe çeşidinden elde edilmiştir. 'Ninfa' erkencilik bakımından; 'Precoce de Tyrinthe' ise meyve kalitesi bakımından Manavgat yöresi için ümitvar olarak saptanmıştır. Bu çalışma ile verim, erkencilik ve kalite bakımından düşük rakımlı alanlarda, erkenci kayısı üretiminde, üreticiler için en kazançlı olan çeşitlerin tespiti yapılmıştır.

1. Introduction

The total amount of apricot production in the world is more than 4 000 000 tons, and 811 609 tons of this amount are supplied by Turkey. Turkey is the largest producer of apricots in the world (FAOSTAD 2015). The Mediterranean and Aegean coastal regions of Turkey enable cultivation of temperate fruits ecologically. In these regions, in comparison with the other countries in subtropical climate zones, earliness and accordingly also early harvest in a considerable extent like 15 to 20 day period can be provided (Polat 1986; Ayanoglu et al. 1995). Low returns from dried apricots has led to an increase in the production of fresh table apricots (Anonymous 1987).

In Turkey, the earliest apricots harvest from the Mut, Antalya and Iskenderun regions (Kaska et al. 1982). In recent years, the demand for the apricot cultivation in coastal regions has continued to increase with the development of varieties focusing on low chilling types growing elsewhere in the Mediterranean region (Ayanoglu and Saglamer 1986). In the growing conditions of the Alata region, the cultivars 'Precoce

de Colomer', 'San Castrese', 'Boccucia', 'Sakit 2', 'Cigli' and 'Fracasso' varieties were found to be the most promising cultivars regarding to their earliness, yield potential and fruit quality (Ayanoglu et al. 1995). In Turkey despite the fact that dried apricot cultivation had developed extensively, especially in Malatya, table apricot cultivation had been neglected. However, because of the appropriate table apricot types found in the Mediterranean coast-line regions, Turkey will be able to become involved in early table apricot cultivation (Baktir et al. 1992; Paydas et al. 1992). Fruit weight and fruit quality are negatively affected when chilling requirement is insufficient in apricots (Ruiz et al. 2006). Hence any development of cultivars must ensure that chilling requirements within a growing region are adequate. Cukadar et al. (2007), studied four local apricot cultivars ('Egri Cigit', 'Tatli Cigit', 'Pelverde Erigi' and 'Guz Erigi') and seven apricot seedlings ('154', '155', '158', '164', '171', '172' and '174'). They found that 'Egri Cigit' was highly suitable for both dried and fresh production, whereas the cultivar 'Guz Erigi' and selection 174 were only suitable for fresh production.

In temperate regions, late spring frost damage can limit apricot production (Rodrigo and Julion 2006). In making use of this warm ecological potential, it is essential to increase the range of high quality early varieties (Onal et al. 1995). Asma et al. (2007), studied 7387 hybrids, from parental combinations in the field between 2002 and 2007, including for early and late ripening characteristics. They found 11 commercially suitable apricot genotypes where two were early ripening, two medium season ripening, four late ripening and three for dried uses.

Most of the apricot cultivation in the Mediterranean region is made in the high altitude regions, meanwhile very little of this cultivation is made in the coastal regions. Manavgat is located to the south of Turkey and on the Mediterranean coast. The north side of Manavgat is surrounded by mountains. These mountains prevent the cold air from the north. Therefore Manavgat has the average ecological conditions for growing early apricot in Turkey. This study, aimed to identify suitable, high yielding, high quality, early table apricot varieties suited to the Manavgat area which has a big advantage in terms of earliness of table apricot production.

2. Materials and Methods

The experiment was carried out between 2013 and 2014 in Manavgat-Antalya, on 9 year-old Beliana, Feriana, Ninfa and Precoce de Tyrinthe apricot trees budded on apricot seedlings. These early season apricot varieties are grown large area in planting and early apricot growing gains especially the advantage of high revenue and low cost of pest control for the growers in Turkey. Soil texture is sandy loam, medium in organic matter, with neutral pH, no soluble salt problem and sufficient total nitrogen and exchangeable phosphorus. Trees were trained to a vase shape and spaced 5 m apart (400 trees ha^{-1}). The altitude of the orchard in which the research was carried out is about 50 m. Meteorological data are 1069.8 mm rain average per year, 18.5 ^{o}C average per month, 8.4 h photoperiod time average per month (between 1954-2013 years) for Antalya region (Anonymous 2015).

In the trial there were 8 trees from each apricot cultivar. A total of 32 trees were used in the experiment. For each apricot cultivar, the date of first bloom, full bloom, end of bloom was recorded and the date of harvest maturity was determined by visual observations of colour change (from green to yellow and red). Measurements were taken of fruit weight, seed weight, firmness, total soluble solids (TSS), and titratable acidity. TSS concentration was determined using a hand refractometer. Titratable acidity (malic acid) was calculated by titrating fruit juice with 0.1 N NaOH. Firmness was determined with 1 to 5 scale (1: Very soft; 2: Soft, 3: Medium, 4: Hard, 5: Very Hard). Yield per tree was found by weighing all the fruits picked up from each of the trial trees.

A randomized experiment was designed with 8 trees from each cultivar, and 2 trees were treated as 1 replicate. Ninety randomly selected fruits with 3 replications were sampled from each apricot cultivar for fruit quality testing when the fruit colour changed from green to yellowish. Data were analysed with Tukey's test using Costat software (Duzgunes 1963).

3. Results and Discussion

3.1. Phenological observations

In two trial years, 'Ninfa' bloomed the earliest (4 March), and followed by 'Beliana' (6 March) and 'Feriana' (7 March). The latest flowering cultivar was 'Precoce de Tyrinthe' (8 March) (Table 1) but it was found as the second mature cultivar after 'Ninfa'. This is due to genetic reasons. These results corresponds with that obtained by Bircan et al. (2007), who reported similar results for 23 apricot cultivars at Mersin, Turkey. Time of maturity of the apricot cultivars ranged from 11 May to 23 May (Table 1). Ninfa and Precoce de Tyrinthe ripened earliest, 11-18 May. Varieties and ecological conditions were very effective on maturation date. These findings are in accord with those of other studies done in Mediterranean coastal ecological regions of Turkey (Paydas et al. 1995; Kaska and Yilmaz 2001).

Table 1. Phenological observation results related to the apricot (*Prunus armeniaca L.*) varieties in the trial (average of years 2013-2014).

Cultivars	First blooming	Full blooming	End of blooming	Harvest date
Beliana	6 March	17 March	24 March	21 May
Feriana	7 March	19 March	24 March	23 May
Ninfa	4 March	15 March	22 March	11 May
Precoce de Tyrinthe	8 March	19 March	25 March	18 May

Karlidag and Bolat (2007), studied with 'Hacihaliloglu', 'Soganci' and 'Hasanbey' apricot varieties in Malatya ecological conditions. They found that the ripening time changed from 8 July to 19 August according to the varieties. In this study, time of maturity ranged from 11 to 23 May.

3.2.Yield (kg tree^{-1})

The highest yields (98.5 and 108 kg $tree^{-1}$) were found in the 'Ninfa' variety in both years, followed by 'Precoce de Tyrinthe' (87.18 and 94.5 kg $tree^{-1}$), 'Beliana' (74.02 and 85.23 kg $tree^{-1}$) and 'Feriana' (60.97 and 64.33 kg $tree^{-1}$) and the product quantities obtained from varieties were statistically significant ($p \leq 0.05$). The yields in the second year of the experiment were higher than in the first year for each cultivar (Table 2). The results were confirmed by previous work (Yildiz et al. 2001). Additionally, research findings of Seferoglu and Gulsen (2003), who studied with 10 apricot varieties, in the ecological conditions of Aydin are in line our findings.

Table 2. Yield per tree of the apricot varieties in the trial (kg tree^{-1}) (2013-2014).

Variety	2013	2014
Beliana	74.02 c	85.23 c
Feriana	60.97 d	64.33 d
Ninfa	98.50 a	108.00 a
Precoce de Tyrinthe	87.18 b	94.50 b
LSD (5%)	5.08	3.05

[a-c]Means with different letters within a column are differ significantly by the Tukey test at 5% (P<0.05).

3.3. Fruit quality characteristics

In the present study, for fruit general average weight, 'Precoce de Tyrinthe' with 55.01 g and 'Ninfa' with 45.48 g were superior than the others. These data agree with the results of Paydas et al. 1995. The smallest fruits were obtained with 34.26 g from 'Beliana' and with 31.84 g from 'Feriana' (Table 3). In a study carried out in Adana, 26 apricot cultivars were evaluated for quality characteristics with some, such as diameter soluble solid content and fruit weight having better quality characteristics than the others (Kafkas et al. 2007). Our findings are in accordance with the results of adaptation studies carried out Mediterranean Region (Bircan et al. 2007; Kafkas et al. 2007).

Table 3. Some fruit quality characteristics of the apricot varieties in the trial (Average of years 2013-2014).

Variety	Fruit weight (g)	Seed weight (g)	Acidity (%)	TSS (%)	Firmness (scale)
Beliana	34.26 c	2.89 a	1.38 d	14.06 a	Medium
Feriana	31.84 d	2.91 a	1.42 c	12.13 b	Medium
Ninfa	45.48 b	2.51 c	1.48 b	13.86 a	Medium
Precoce de Tyrinthe	55.01 a	2.60 b	1.59 a	11.06 c	Hard
LSD (5%)	1.90	0.03	0.02	0.30	-

[a-c]Means with different letters within a column are differ significantly by the Tukey test at 5% (P<0.05).

The pomological values of each cultivar in the study were close to each other for two years. Therefore, the two years average pomological values for each type were given in the table (Table 1 and Table 3). Although they have low values for fruit weight, the biggest seeds were obtained from 'Feriana' with 2.91 g and 'Beliana' with 2.89 g (Table 3). On the contrary, 'Ninfa' had the smallest seed with 2.51 g. This is due to the genetic properties of the varieties. Acidity % of the apricot cultivars was obtained statistically significant and ranged from 1.38% to 1.59% (Table 3). The highest acidity (1.59%) value was found in 'Precoce de Tyrinthe', the lowest acidity (1.38%) was obtained from 'Beliana'. These findings are in accord with those of other studies in different ecological regions of Turkey (Bircan et al. 2007; Kafkas et al. 2007). The findings of Seferoglu and Gulsen (2003), showed parallelism with our research results.

In terms of TSS% content, 'Beliana' was found superior than the others. The lowest TSS% content was found in the cultivar of 'Precocce de Tyrinthe' with 11.06 % (Table 3). These data agree with the results of Kaska and Yilmaz (2001) in Kahramanmaras Mediterranean region. Also the results corresponds with that obtained by Balta et al. (2002) and Yilmaz et al. (2007) who reported different results for apricot cultivars at East Anatolia ecological conditions. Balta et al. (2002), studied with 28 native apricot genotypes in Lake Van Region of Turkey, and their fruit characteristics were determined in comparison with 'Hacıhaliloglu'. All genotypes showed a range of 25–48 g for fruit weight, 11–21% for soluble solids and 0.19–2.90% for acidity. Yilmaz et al. (2007), studied with 'Alkaya' apricot cultivar in Malatya, and reported that TSS value was 19.1%. In our research, TSS ranged from 11.06% 'P. De Tyrinthe' to 14.06% 'Beliana'. These different findings are most likely attributed to the characteristics of different apricot cultivars and different ecological conditions. The Mediterranean region has a much warmer climate than the East Anatolia region for table apricot growing. But it is not expected that TSS values will be high in early apricot varieties. Because the vegetation period and the sum of the temperature values for apricot cultivars is not enough to increase the highest fruit ripening criteria.

Apricots with 2 to 3 pounds-force (libre-force) flesh firmness are considered "ready to eat" (Crisosto et al. 2013). In our study, 'Beliana', 'Feriana' and 'Ninfa' varieties were determined the medium level softening (scale 3= between 4 to 6 libre force). The minimum firmness decrease was determined in 'P. De Tyrinthe' cultivar fruits with hard level (scale 4= between 6 to 8 libre-force) during harvest periods of both years. These results agree with the apricot consumption information of Crisosto et al. (2013) for apricot flesh firmness.

4. Conclusions

'Ninfa' cultivar was investigated to be the superior earliness in both trial years. 'Ninfa' is a very favorable variety in putting early grown fruits on market. But, having low fruit flesh firmness comes out as a negative characteristic. 'Precoce de Tyrinthe' cultivar, despite it ripens after 'Ninfa' cultivar, was investigated as an advantageous cultivar because of its desirableness. These data agree with the results of Bahar and Son (2017) in Silifke Mediterranean Region. 'Precoce de Tyrinthe' had a higher market value due to firmer fruit flesh and better appearance. It is possible that early grown apricot cultivation in Manavgat area will increase rapidly in the years ahead. According to this research results, the cultivars of 'Ninfa' and 'Precoce de Tyrinthe' were initially found promising cultivars in terms of earliness and yield for Manavgat area. However, doing adaptation studies by bringing new table cultivars to the area in the following years will have a very beneficial effect.

This study has characteristics of a guiding light for choosing the early and quality cultivars of study for the Middle East and Mediterranean countries meeting the most part of the need of the World apricot growing such as Turkey being in the first place, Italia, Spain, France and Morocco.

References

Anonymous (1987) Agricultural structure and production (TYU). D. I. E., Ankara.

Anonymous (2015) Meteorological data for Antalya. Retrieved 27 February 2015, from http://www.mgm.gov.tr/veridegerlendirme/il-ve-ilceler-istatistik.aspx?m=ANTALYA#sfB.

Asma BM, Kan T, Birhanli O, Abaci T, Erdogan A (2007) Multiple purpose apricot breeding project. Turkey V. National Horticultural Crops Congress, Erzurum, 1: 145-149.

Ayanoglu H, Saglamer M (1986) The first results on the adaptation of the apricot cultivars grown in the Mediterranean coast line. Derim, 31(1): 3-15.

Ayanoglu H, Kaska N, Yildiz A (1995) Researches on the adaptation of the early apricot cultivars in the Mediterranean Region. Turkey II. National Horticultural Crops Congress, Adana, 1: 144-148.

Bahar A, Son L (2017) Yield and quality characteristics of several table apricot (*Prunus armeniaca* L.) cultivars in the Silifke/Mersin ecological. Journal of the American Pomological Society, 71(2): 97-102.

Baktir I, Ulger S, Yayici ZH (1992) A Research on the development and the adaptation of some foreign origin apricot varieties to the conditions of Antalya. Turkey I. National Horticultural Crops Congress, Izmir, pp. 461-464.

Balta F, Kaya T, Yarılgaç T, Kazankaya A, Balta MF, Koyuncu MA, (2002) Promising apricot genetic resources from the Lake Van Region. Genetic Resources and Crop Evolution, 49: 409–413.

Bircan M, Pinar H, Yilmaz C, Caliskan T (2007) Some pomological fruit characteristics of table apricot cultivars in Mediterranean Region. Turkey V. National Horticultural Crops Congress, Erzurum, pp. 437-443.

Crisosto CH, Mitcham EJ, Kader AA (2013) Recommendations for maintaining postharvest quality. http://postharvest.ucdavis.edu/PFfruits/apricot. Accesed March 20 2013.

Cukadar K, Demirel H, Unlu HM, Aslay M, Bozbek O (2007) Apricot cultivar selection II. Turkey V. National Horticultural Crops Congress, Erzurum, pp. 391-395.

Duzgunes O (1963) Statistics principles and methods in scientific researches. Ege University Press, Izmir, p. 375.

FAOSTAD (2015) Statistical database, www.fao.org. Accessed July 08 2014.

Kafkas E, Paydas S, Burgut A (2007) Yield and some fruit characteristics of table apricot cultivars from Mediterrenean Region. Turkey V. National Horticultural Crops Congress, Erzurum, pp. 235-240.

Karlidag H, Bolat I (2007) Investigation on changes in the physical and chemical characteristics of the fruit Sekerpare and Kabaasi apricot varieties grown at high altitudes. Turkey V. National Horticultural Crops Congress, Erzurum, pp. 776-781.

Kaska N, Onur C, Onur S, Demiroren S (1982) The Problems about the apricot, plum and peach cultivation in the Mediterranean Region. Symposium on the Problems About Horticultural Crops Cultivation, Solving Methods and Researces to be Done in the Mediterranean Region. Incekum-Alanya, pp. 469-496.

Kaska N, Yilmaz KU (2001) Researches on the table apricot growing in Kahramanmaras. I. Stone Fruit Symposium, Yalova, pp. 593-601.

Onal K, Ozakman S, Ozkarakas I (1995) Determining the promising early apricot varieties (*P. armeniaca* L.) in the conditions of Aegean Region. Turkey II. International Horticultural Crops Congress, Adana, pp. 159-163.

Paydas S, Kaşka N, Polat AA, Gubbuk H (1992) Researches on the adaptation of some new cultivars of apricots (*P. armeniaca* L.) to the ecological conditions of Adana (1990-1991 research period). Turkey I International Horticultural Crops Congress, Izmir, pp. 465-469.

Paydas S, Kaska N, Durgac C (1995) Resarches on the yield and fruit quality criterias of some apricot varieties in the Subtropical Conditions. Turkey II. International Horticultural Crops Congress, Adana, pp. 149-153.

Polat AA (1986) Researches on the adaptation of some local and foreign origin apricot cultivars to the conditions of Adana. Undergraduate Thesis, C.U., Institute of Science, Cukurova University, Adana.

Rodrigo J, Julion C (2006) Spring frost damage in buds, flowers and developing fruits in apricot. Acta Horticulturae, 717: 87-89.

Ruiz D, Company JA, Egea J (2006) Chilling requirements of apricot varieties. Acta Horticulturae, 717: 67-69.

Seferoglu HG, Gulsen AD (2003) Development performance of some apricot varieties in Aydin ecology, Turkey IV. National Horticultural Crops Congress, Antalya, pp. 78-80.

Yildiz A, Keles D, Demirtas B, Kaska N, Ilgin M, Paydas S, Eti S, Kuden A, Polat A, Ayanoglu H, Durgac C, Tekintas E, Demirel H, Onur C (2001) The studies on preparation of export-oriented early apricot growing and marketing in the Mediterranean and the Aegean Region. The First Symposium of Stone Fruits, Yalova, pp. 585-592.

Yilmaz KU, Paydas S, Kafkas S (2007) A new apricot variety both dried and table for Malatya provinces. Turkey V. National Horticultural Crops Congress, Erzurum, pp. 647-651.