

Some Fruit and Leaf Characteristics of Different Apricot Cultivars in Kayseri

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Abstract

Since Turkey has different ecological conditions, it allows the cultivation of various fruit species. Among these fruits, apricot (*Prunus armeniaca* L.) is one of the most consumed fruits with its beautiful color, taste and aroma, high vitamin A and dietary fiber content. In this study which was carried out in 2021, leaf and fruit characteristics of 9 different apricots (8 cultivars and 1 genotype) grown in Kayseri province were determined. As a result of the study, significant variations were observed in terms of the parameters examined among the cultivars. Especially SEO (Stark Early Orange) and Rakowsky cultivars became prominent in terms of both leaf and fruit characteristics compared to other cultivars. Leaf length values varied between 64.77 mm and 82.79 mm, while leaf width values differ from 46.42 to 75.02 mm. Castle Bright and Seo varieties produced the lowest and highest values for both parameters, respectively. In terms of petiole length, the most prominent variety was SEO with 35.99 mm, like leaf width and leaf length. The lowest petiole value was found in Palstein cultivar with 21.54 mm. In the petiole thickness value, the SEO cultivar produced the highest value (1.84 mm). As a result of the study, the performances of the apricot cultivars included in the study was evaluated in Kayseri for the first time which is important for farmers and breeders. The obtained results will contribute scientific knowledge and apricot growing in practice.

Keywords: Kayseri, apricot, adaptation, fruit, leaf

Kayseri İlinde Farklı Kayısı Çeşitlerinin Bazı Meyve ve Yaprak Özellikleri

Öz

Türkiye'nin farklı ekolojik koşullara sahip olduğu için çeşitli meyve türlerinin yetiştirilmesine olanak sağlamaktadır. Bu meyveler arasında kayısı (*Prunus armeniaca* L.), güzel rengi, tadı ve aroması, yüksek A vitamini ve diyet lif içeriği ile en çok tüketilen meyvelerden biridir. 2021 yılında gerçekleştirilen bu çalışmada Kayseri ilinde yetiştirilen 9 farklı kayısının (8 çeşit ve 1 genotip) yaprak ve meyve özellikleri belirlenmiştir. Araştırma sonucunda çeşitler arasında incelenen parametreler açısından önemli farklılıklar gözlenmiştir. Özellikle SEO (Stark Early Orange) ve Rakowsky çeşitleri diğer çeşitlere göre hem yaprak hem de meyve özellikleri açısından öne çıkmıştır. Yaprak uzunluğu değerleri 64,77 mm ile 82,79 mm arasında değişirken, yaprak genişliği değerleri 46,42 ile 75,02 mm arasında değişmektedir. Her iki parametre için de sırasıyla Castle Bright ve Seo çeşitleri en düşük ve en yüksek değerleri üretmiştir. Yaprak sapı uzunluğu açısından en öne çıkan çeşit, yaprak genişliği ve yaprak uzunluğu gibi 35.99 mm ile SEO olmuştur. En düşük yaprak sapı değeri ise 21.54 mm ile Palstein çeşidinde bulunmuştur. Yaprak sapı kalınlık değerinde en yüksek değeri Seo çeşidi vermiştir. Özetle bu çalışma ile kayısı yetiştiriciliği için önemli olan adaptasyon sürecinin Kayseri ekolojisindeki durumu ilk kez değerlendirilmiş ve bundan sonraki çalışmalara büyük katkı sağlanması hedeflenmiştir.

Anahtar Kelimeler: Kayseri, kayısı, adaptasyon, meyve, yaprak

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1. Introduction

Turkey has an ecological diversity that allows many fruit species to be grown (Bayram et al., 2010). Turkey is in a position that connects the continents of Europe, Asia, and Africa, and with the gene centers of hundreds of plants, it has undertaken an important mission for these plants to gain economic importance. Although Anatolia is not the main homeland of the apricot (*Prunus armeniaca* L.), a rich genetic variation has occurred in the historical process due to its propagation by seeds for hundreds of years and its adaptation to different ecological conditions (Asma et al., 2017).

One of the important purposes in apricot breeding is climatic adaptation (Hormaza et al., 2007). For apricot production to become widespread in temperate regions, it is necessary to have varieties with less need for chilling. In addition, it is reported that climatic adaptation is very important for disease resistance and good pomological fruit characteristics in different apricot cultivars (Pinar et al. 2010; Asma,2012; Moustafa and Cross, 2019). For fresh consumption, it should have a firm flesh texture, size, appearance (bright orange color or a bright pink color on a cream background), the stone should be separate from the flesh. In canned apricots, features such as a good orange peel and fruit flesh, uniform fruit size, uniform shape, resistance to diseases, small nucleation and good acid-sugar balance are important. High dry matter is required for dried apricots (Özkarakaş et al., 2008). It has been determined that apricots have a wide range of phenotypic and genotypic characteristics, especially depending on ecological adaptation. Based on this gene richness, breeding programs have been organized, many varieties have been developed, and it has been possible to cultivate high-quality fruiting apricot varieties in many regions where temperate climate fruits are grown (Calabrese et al. 2010, Guo et al. 2015).

Environmental conditions are the first among the factors limiting the production and spread of an apricot variety (Asma et al., 2017). On the other hand, most of the existing apricot cultivars are known to have low adaptability. In this study, it was aimed to determine the leaf and fruit characteristics of eight apricot cultivars and a selected genotype grown in Kayseri province of Turkey, where no related studies have been carried out before.

2. Materials and Methods

This study was carried out in 2021 in Apricot Collection Orchard of Erciyes University, Faculty of Agriculture, Department of Horticulture in the province of Kayseri, Turkey. In the study, three plants of eight different apricot cultivars (Bebeco, Hungarian Best, Stark Early Orange (SEO), Palumella, Castle Bright, Beliana, Palstein, Rakowsky) and a promising selected apricot genotype named “İri kayısı” grafted on Zerdali seedling rootstocks were used which were planted in 2014.

The orchard is sandy-loamy in terms of soil structure. Cultural practices such as fertilization, irrigation, pruning and diseases and pests management were routinely carried out in the orchard, and no soil was done.

In the province of Kayseri, where the study was conducted, terrestrial climate conditions with cold and snowy winters and hot and dry summers are seen. Considering the measurement period between 1931-2020 in Kayseri, the average lowest temperature in March is -1.3°C , while the lowest temperature in April is 3.2°C . Meteorological data of pollination, fertilization, and fruit development periods for 2021 year are given in Table 1. Apricot trees, which bloomed early due to the high temperature in March for the last two years in Kayseri province, suffered significant frost damage in April as the air temperature dropped below zero. So we only used 2021 data as there wasn't enough fruit to be evaluated.

Table 1. Meteorological data of Kayseri province

Month	Max. Temperature C)	Min. Max. Temperature ($^{\circ}\text{C}$)	Average Temperature ($^{\circ}\text{C}$)	Wind speed (m/s)	Precipitation (mm)
March	10.7	-0.2	5.0	2.2	1.2
April	16.8	4.4	10.7	2.2	0.7
May	23.5	7.2	15.8	2.1	0.6
June	23.0	9.7	16.2	2.0	1.2

In the study, analyzes were carried out on 10 leaves and 10 fruits from each plant of the variety, in total 30 leaves and fruits for each variety. In the study, different measurements were made on leaves and fruits.

Leaf length and leaf width: in mm with the help of digital caliper, petiole length and thickness: in mm with digital caliper, chlorophyll density: with SPAD device (502 Plus Konica Minolta), fruit length, fruit width: in mm with digital caliper, fruit weight: with precision balance in g, fruit firmness: on a 1-5 scale (1: soft, 3: medium, 5: hard) via sensorial analysis L^* , a^* , b^* color values: with Minolta CM-700d spectrophotometers device, stone length and stone width: in mm with digital caliper, stone weight: in g with precision balance were determined (Son, 2018; Yaman and Uzun, 2020, Yaman and Uzun, 2021).

Statistical Analysis

The study was carried out in three replications according to the randomized plot design. SPSS (Statistical Package for the Social Sciences) 15.0 program was used in the analysis of the data. "LSD" multiple comparison test was used to evaluate the difference between the results. Values for the combinations are presented as mean \pm standard deviation (SD). All statistical analyzes were performed at $p < 0.05$ and $p < 0.01$ significance level.

3. Results and Discussion

According to the results of the study, a wide variation in the leaf parameters was detected. Leaf length values varied between 64.77 mm and 82.79 mm, while leaf width values differ from 46.42 mm to 75.02 mm. Castle Bright and SEO varieties produced the lowest and highest values for both parameters, respectively. In terms of petiole length, the most prominent variety was Seo with 35.99 mm, like leaf width and leaf length. The lowest petiole value was found in Palstein cultivar with 21.54 mm. In the petiole thickness value, the SEO variety produced the highest value, as in the other parameters, but no statistical difference was

observed between the other varieties. Bebeco, Hungarian Best, Palstein and SEO varieties produced better results than other cultivars in terms of chlorophyll density obtained from SPAD measurements. Chlorophyll density values varied between 26.38 and 35.14 (Table 2). In a study conducted in Malatya conditions, wide variations were found in leaf width and leaf length values in apricot genotypes (Yilmaz, 2008). Another study on apricots, it was determined that leaf width values in different cultivars varied between 94.4 mm and 102.8 mm, and leaf lengths varied between 93.7 mm and 105.6 mm (Altan, 2019). On the other hand, in the study conducted by Al-Rawi et al., 2011, it was determined that the chlorophyll density in the leaf varied between 30.68-31.9.

Morphological features, including petiole length and petiole thickness, differ according to ecology (Bilgin ve Misirli, 2016).

Table 2. Leaf characteristics of the evaluated apricot cultivars

Variety	Leaf Length (mm)	Leaf Width (mm)	Petiole Length (mm)	Petiole Thickness (mm)	Chlorophyll Intensity
Bebeco	71.63 ±6.35bc	64.22 ±4.42ab	27.79±3.94de	1.31±0.27b	35.14±1.38a
Hungarian Best	64.94 ±7.43c	56.79 ±5.68cd	31,77±5.45abc	1.24±0.22b	34.95±1.64a
Palstein	71.65 ±6.11bc	58.02 ±5.65cd	21,54±5.24e	1.28±0.20b	34.90±2.07a
SEO	82.79 ±12.79a	75.02 ±13.68a	35,99±6.39a	1.84±0.40a	34.44±1.98a
İri Kayısı	68.72 ±6.05bc	54.48 ±5.43d	30,69±5.40bc	1.36±0.30b	28.03±3.24cd
Castle Bright	64.77 ±5.88c	46.42 ±10.25e	30,03±5.59bc	1.32±0.18b	29.76±1.54bc
Palumella	72.42 ±9.73bc	56.08 ±8.24cd	28,01±2.41cd	1.36±0.26b	26.38±2.37d
Beliana	68.70 ±11.12bc	67.24 ±11.59ab	28,07±4.80cd	1.5±0.22b	30.11±2.04b
Rakowsky	75.73 ±5.61ab	70.23 ±10.20ab	33,95±2.81ab	1.82±0.10a	28.27±1.50bcd
Mean	71.16 ±9.56	60.73 ±11.93	29,32±6.27	1,44±0.33	31,40±3.87

Morphological values such as fruit width, fruit length, fruit weight, firmness and color are among the important quality parameters in fruit species. In the study, wide variations were detected among the parameters examined in the fruit, just as in the leaf values, and these values are statistically significant. In terms of fruit length, the values of the cultivars differed between 33.08 mm and 49.89 mm. In fruit width values, the range is between 31.40 mm and 43.50 mm. Seo and Rakowsky cultivars produced higher results than other cultivars in fruit length and fruit width values. In the fruit weight parameter, as in fruit length and fruit width, Seo and Rakowsky produced heavier fruits and the lowest fruit weight was 22.55 g and the highest weight was 51.77 g. The firmness values of the cultivars were observed as soft, medium, and hard (Table 3). Especially in the studies conducted in the ecology of Kayseri, Yaman and Pınar (2021) determined the effects of different pollinators on fruit set and some fruit quality parameters of Casne Drenova, Ninfa and P. de Tyrinthe cultivars investigated in Kayseri ecological conditions. As a result of the study, it was reported via hybridization breeding the effects of pollinator varieties on fruit set and fruit quality in some foreign apricot cultivars in Kayseri in 2021. It was shown that fruit set values varied between 11.6% and 22.6%. In Hatay ecological conditions, fruit length values of apricot varieties are between 36.3 mm and 41.6 mm, fruit width values between 34.7 mm and 39.5 mm, and fruit weight is between 30.8 g and 37.9 g (Polat and Caliskan, 2013). In another study, it was determined that

fruit weight values ranged from 35.70 g to 69.90 g, and fruit length ranged between 40.0 mm and 62.0 mm (Rezaei et al., 2020). Researchers reported the fruit flesh values as medium and hard in their study on early apricot cultivars (Son and Bahar, 2018). These studies in the literature have similar features with the current study.

Table 3. Fruit length, fruit width, fruit weight and fruit firmness values of apricot cultivars

Variety	Fruit Length (mm)	Fruit Width (mm)	Fruit Weight (g)	Fruit Firmness
Bebeco	33.08±2.58e	34.46±3.51cde	31.77±3.65cd	Hard
Hungarian Best	35.94±1.61de	33.26±2.39de	24.82±3.75e	Hard
Palstein	37.47±1.49d	40.03±2.28b	34.97±2.95c	Hard
SEO	46.89±1.97a	41.48±1.70ab	51.24±4.34a	Medium
İri Kayısı	40.42±2.93c	34.57±2.89cd	43.63±5.25b	Hard
Castle Bright	34.35±5.33e	31.40±4.57e	26.69±9.35de	Hard
Palumella	35.15±4.57de	32.35±3.63de	22.55±2.11e	Hard
Beliana	34.54±1.28e	36.02±2.57c	26.78±3.23de	Soft
Rakowsky	43.21±2.56b	43.50±2.78a	51.77±8.05a	Medium
Mean	37.99±5.04	36.67±4.83	35.48±6.06	-

In the Minolta color measurements performed on the fruit, the "large apricot" genotype produced a higher L^* value with a a^* value of 61.45 compared to other varieties. Palumella variety formed the lowest L^* value with 48.85. The a and b values, which are the other color parameters, Castle Bright with 31.07 and the İri Kayısı genotype with 47.35 took the first place compared to other cultivars (Table 4). For Malatya apricot cultivars. L value varied between 52.5 and 62.2, a^* value ranged from 10.7 to 19.9, and the b^* value ranged from 20.4 to 28.9 (Akin et al., 2018). Apricots originating from China, it was determined that there were wide variations in L^* , a^* and b^* values between genotypes, and the results were similar with the current study (Zhou et al., 2020).

Table 4. Color values in apricot cultivars

Variety	L^*	a^*	b^*
Bebeco	54.00±3.83ab	23.56±9.81ab	34.73±4.99c
Hungarian Best	53.46±2.27ab	11.12±7.23c	37.80±3.25c
Palstein	52.64±1.77ab	12.13±5.60c	35.75±2.34c
SEO	53.93±2.92ab	22.15±12.81b	40.59±5.74abc
İri Kayısı	61.45±3.43a	17.82±7.56bc	47.35±3.69a
Castle Bright	57.35±2.95ab	31.07±4.29a	38.99±3.12bc
Palumella	48.85±3.89b	16.00±12.00bc	37.77±8.06c
Beliana	54.66±6.55ab	16.61±4.19bc	38.13±6.51c
Rakowsky	58.63±8.94a	11.81±10.57c	46.04±6.58ab
Mean	55.11±8.35	17.19±9.99	39.78±7.93

As in all other parameters examined in the study, significant variations occurred between varieties in the values of stone weight, stone length and stone width. Seo cultivars with 3.99 g and Rakowsy cultivars with 4.21 g produced the highest values statistically compared to other

cultivars in stone weight values. The lowest stone weight is 1.93 g in the Castle Bright variety.

Table 5. Some stone parameters in apricot cultivars

Variety	Stone Weight (g)	Stone Length (mm)	Stone Width (mm)
Bebeco	2.44±0.28cd	15.20±1.07e	8.63±0.74e
Hungarian Best	2.57±0.33c	24.36±1.12bc	12.02±1.16bc
Palstein	2.30±0.37cd	20.73±1.49d	11.89±0.80bc
Seo	3.99±0.36a	27.70±2.12a	13.05±0.79b
İri Kayısı	3.40±0.54b	25.43±1.91b	7.83±1.42e
Castle Bright	1.93±0.87d	20.64±3.39d	10.20±1.14d
Palumella	2.23±0.63cd	22.95±2.43c	11.48±1.17c
Beliana	2.18±0.32cd	20.18±0.74d	11.25±1.35cd
Rakowsky	4.21±0.58a	25.44±0.77b	16.05±1.54a
Mean	2.85±0.90	22.48±3.99	11.41±2.64

While the stone length values of the cultivars differed between 15.50 mm and 27.44 mm, the stone width range was observed as 7.83-16.05 mm (Table 5). Different researchers reported that the stone weight values ranged from 2.98 to 5.01 g (Milosevic et al., 2010), between 6 g and 5.5 g, and the stone length and stone width values ranged between 16.60-37.50 mm and 10.00-23.00 mm, respectively (Rezaei et al., 2020). The present study has similar features with these studies in the literature, and the partial differences can be explained by ecology and variety.

4. Conclusions

In summary, the study was carried out in 2021 to determine the leaf and fruit characteristics of some apricot varieties in the ecological conditions of Kayseri province located in the Center of Anatolia. As a result of the study in terms of leaf and fruit characteristics, large variations were detected among the cultivars. Considering the effect of ecology on pomological and plant characteristics in previous studies, especially SEO and Rakowsky cultivars became prominent in terms of both leaf and fruit characteristics compared to other cultivars. It is predicted that the results obtained can be a guide for apricot cultivation and new orchards to be established in the region.

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