International Journal of
Agriculture, Environment and Food Sciences

JAEFS

e-ISSN : 2618-5946

DOI: 10.31015/jaefs.2019.3.12

www.jaefs.com

Research Article

Int J Agric Environ Food Sci 3(3):196-202 (2019)

Determination of morphological and pomological characteristics of pomegranate (*Punica granatum* L.) genotypes grown in Diyarbakır

Mehmet Cicek[1] **Mine Pakyurek**[2,*] **Ferit Celik**[3]

[1]Southeastern Anatolia Region International Center for Agricultural Research, Diyarbakır, Turkey.

[2]Siirt University Faculty of Agriculture, Department of Horticulture, Siirt, Turkey.

[3]Yüzüncü Yıl University Faculty of Agriculture, Department of Horticulture, Van, Turkey.

[*]Corresponding Author: mine.pakyurek@siirt.edu.tr

Abstract

The aim of this study was to determine the pomological and morphological characteristics of pomegranate genotypes grown in Çermik and Dicle districts of Diyarbakır province. As a result of the study carried out on 10 genotypes; fruit weights were found between 198.8 and 366.0 g, seed hardness of the fruit was medium-hard in eight genotypes, hard in two genotypes, aril yield ranged from 58.1 to 70.0% and fruit juice volume was between 63.9 and 135.7 ml. The upper peel color was purple in four genotypes, pink-red in two genotypes, orange-red in one genotype and orange in three genotypes. The bottom peel color is orange-red in seven genotypes and orange in three genotypes. Aril color was dark purple in three genotypes, purple in two genotypes, medium red in two genotypes and pink-red in three genotypes. The acid content was found to be between 0.65 and 1.21% and the amount of total soluable solid (TSS) varied between 15.0 and 21.0%. It was concluded that all 10 genotypes were promising and these genotypes showed superior characteristics.

Keywords: Pomegranate, Pomological properties, Morphology, Dicle, Çermik

Introduction

Pomegranate (*Punica granatum* L.) is the most important species of *Myrtiflorae* order and *Punicaceae* family. Pomegranate, thought to have been brought to Southern Europe by the Carthaginians, is known as *Malum punicum* (Carthagia apple). The name pomegranate, which is derived from the words grained apple, is named "Pomegranate" in English and "Granadapfel" in German (Onur, 1988). In the Middle Ages, the name *Punica granatum* was derived from the term *Pomuni granatum* (apple with seeds) (La Rue, 1980). Many holy books mention pomegranate fruit. In Egypt, Greek and Roman legends, "pomegranate" fruit is mentioned.

Pomegranate has been produced in South Asia and Southwest Asia for thousands of years. Pomegranate is widely growing Afghanistan, China, Morocco, Palestine, India, Iraq, Iran, Israel, Italy, North and South Cyprus, Egypt, Syria, Saudi Arabia, Thailand, America and Tunisia. Compared to other fruit species, production and consumption rate is less than others (Özbek, 1977, Dokuzoğuz and Mendilcioğlu, 1978; Onur, 1983, Özgüven and Yılmaz., 2000).

Many ingredients like starch, mannitol, punicic acid, anthocyanin, polyphenolic, isopelletierin alkaloids, triterpenes, resinous substances, acids, tannins and alkaloids can be found in various structures of pomegranate tree which are root, stem, branch bark, seeds and fruits. Pomegranate is generally used to strengthen the body and heart. It is also used for ceasing diarrhea, cough, constipation, stomach burns and vomiting. It has also been used in folk medicine for centuries due to its antipyretic, diuretic, antipyretic in febrile diseases and prevention of vascular obstruction (Saleh et al., 1964; Onur, 1983; Anesini and Perez, 1993; Ponce-Macotela et al., 1994; Zhang; et al., 1995; Yılmaz et al., 1995; Mavlyanov et al., 1997).

Cite this article as:
Cicek, M., Pakyurek, M., Celik, F. (2019). Determination of morphological and pomological characteristics of pomegranate (*Punica granatum* L.) genotypes grown in Diyarbakır. Int. J. Agric. Environ. Food Sci., 3(3), 196-202
DOI: https://dx.doi.org/10.31015/jaefs.2019.3.12
Received: 02 June 2019 **Accepted:** 12 September 2019 **Published:** 27 September 2019
Year: 2019 **Volume:** 3 **Issue:** 3 (September) **Pages:** 196-202
Available online at : http://www.jaefs.com - http://dergipark.gov.tr/jaefs
Copyright © 2019 International Journal of Agriculture, Environment and Food Sciences (Int. J. Agric. Environ. Food Sci.)
This is an open access article distributed under the terms of the Creative Commons Attribution 4.0 International (CC-by 4.0) Licens

In recent years, understanding of the benefits to human health of pomegranate and increasing economic value have become the leading causes of significant developments occurring in pomegranate cultivation in Turkey. Propagation of pomegranates can be done by seed, layering, cuttings, bottom shoots and budding. Pomegranate is one of the most suitable fruit species can be grown in arid and semi-arid climatic conditions owing to its drought-resistant characteristics.

Turkey is one of the most important pomegranate producer countries in the world and has a rich variety of varieties and genotypes. The suitability of ecological conditions, the abundance of land, domestic and foreign demands increase pomegranate production rapidly. Turkey has a total of 502.000 tons of pomegranate production as of 2017. Besides, 13.662.000 trees are in the yield period in the existing pomegranate farms, and 3.123.000 trees have not yet invested in yield (Anonymous, 2017). Southeast Anatolia Region, on the other hand, ranks third after the Mediterranean and Aegean Region in terms of pomegranate production due to its climatic characteristics (Özgüven and Yılmaz, 2000). Total pomegranate production area in Southeastern Anatolia is 71.980 da. Production amount is 53.352 tons, the total number of trees is 3.564.392 and average yield amount per tree is 21 kg (Anonymous, 2016).

Diyarbakır, the most developed city in terms of agriculture and industry in Southeastern Anatolia, has a continental climate. Genetic resources of the region include pomegranate types that have superior properties in terms of yield and quality. No study on the identification and selection of these pomegranate genotypes have been conducted. With this first study, it was aimed to identify these genotypes grown in Çermik and Dicle districts of Diyarbakır province, to make them a standard genetic variety, to protect them, to preserve them for breeding studies and to expand their cultivation.

Material and Methods

Samples are taken from different pomegranate genotypes grown naturally in Çermik and Dicle districts of Diyarbakır province. The selection criteria to study the pomegranate trees are considered to be abundant and regular in yield, to display good vegetative development, to show adequate flowering, to yield high fruit set, to offer short flowering period, to be adapted to local climate for ripening period, to produce large fruity, reddish, thin-peeled, aromatic, juicy, soft seeded, to be resistant against diseases and pests. The trees presenting superior properties in these criteria are selected.

The villages where the pomegranate cultivation was widespread were determined under the guidance of Çermik and Dicle district Directorate of Agriculture in Diyarbakır. The villages were visited; producers were interviewed and existing types were determined consequently. The identified types are given numbers according to the district code. May-June is the flowering time depending on the local climate and September-November is the harvest time of the pomegranate. Crown height (cm), crown width (cm), trunk number, trunk circumference (cm), branching frequency, cold damage, first foliation date, flowering date and harvesting date of the trees were noted. Depending on these parameters; phenological, morphological and pomological characteristics of genotypes were established. At the harvest, five fruit samples were taken from each predetermined trees and transported in cloth bags. Then, these samples were analyzed in the laboratory of Gap International Agricultural Research and Training Center.

In genotypes, fruit weight (g), fruit length (mm), fruit width (mm), fruit juice yield (fruit juice quantity/fruit weight x100), fruit density (g/cm3), fruit volume (ml), calyx radius (mm)), calyx length (mm), peel thickness (mm), aril color (red and pink), bottom peel color (green, greenish-yellow, yellow), peel thickness (mm), upper peel color (pink, red), weight of the 100 arils, number of chamber, appearance of the calyx (apparent, less pronounced, moderate pronounced), the easiness of aril separating (easy, moderate, difficult), the taste of the fruit (sweet, sour), fruit pulp weight (g), fruit shape index (fruit length/fruit width), aril yield (total aril weight/fruit weight x 100) and total seed weight were measured or calculated. Besides, total soluable solid (%), pH and titratable acidity (%) contents of fruits were determined (Onur 1983; Yılmaz et al. 1995).

The promising genotypes were defined depending on pomological and morphological characteristics through weighed grading method. This method attributes greater percentage values to the properties which are considered to be important. The sum of these values is 100. Genotypes were evaluated according to this scoring system. Utilizing this method, seed hardness was scored as 15%, aril yield 15%, fruit weight 15%, fruit juice volume 15%, upper peel color 10%, aril color 10%, titratable acid ratio 10%, and TSS (total soluable solid) were 10%.

Results and Discussion

Genotype-specific phenological, morphological and pomological features of each are shown in the tables Table 1, Table 2, Table 3.

Results of Fieldwork

This study was carried out in two villages of Çermik and Dicle districts of Diyarbakır province in vegetation period of 2015-2016. Field studies revealed the physical properties of trees. Pomegranate cultivation in the before mentioned districts is widespread in regions where irrigation opportunities are available. Cultivation operations (pruning, fertilizing, irrigation, agricultural spraying, soil tillage, etc.) are not performed by the definition. Failure to perform cultivation related procedures by the definition directly affects the quality and the yield of fruits. Irrigation has a very important place in pomegranate orchards. Irrigation of the pomegranates orchards is provided by various natural water sources. However, irrigation arcs and channels are not consolidated, so water cannot be transported as desired for long distances. This leads to cracks on pomegranate due to irregular irrigation. Cracks on pomegranate is a big problem in terms of marketing. Pomegranates grown in Çermik and Dicle are generally composed of local genotypes.

Physical Properties of Fruits

Physical properties of fruit samples belonging to pome-

granate genotypes were evaluated and the mean values of these values are given in Table 1. Accordingly, the average weight of fruit samples, the lowest 198.8 g (21 ÇR 30) and the highest 366.0 g (21 ÇR 42) were determined. Four genotypes were between 150 and 225 g (40%) and six genotypes were between 225 and 375 g (60%). On the other hand, in a study conducted in the Mediterranean Region, it was found that fruit weights ranged from 213 to 806 g in genotypes (Onur, 1983). Fruit weights in the pomegranates of the Aegean Region ranged between 186 and 499 g (Dokuzoğuz and Mendilcioğlu, 1978). It was reported that the average fruit weight of Mardakyanlı cultivar in Azerbaijan was 237.5 grams and that this value was between 160 and 232 g in other varieties (Onur, 1983). In a study on the adaptation of pomegranates in the Mediterranean Region, it was found that the fruit weight ranged from 411 to 566 g (Yılmaz et al., 1992). In a study on adaptation of pomegranates in the Aegean Region, it was reported that the fruit weight varied between 260 and 308 g (Yılmaz et al., 1995). In our study, it is known that the weight and development of fruit vary depending on many factors, and it is seen that the promising pomegranate types we have selected are superior in terms of fruit weight compared to some studies conducted in other regions and remain lower than others. The average fruit length value was 58.7 mm (21 ÇR 30) and the highest was 79.7 mm (21 ÇR 03). Five genotypes were found to be between 60.0 and 67.0 mm (50%), four genotypes were between 67.0 and 75.0 mm (40%), and one genotype was between 75.0 and 90.0 mm (10%). The lowest fruit width was 68.1 mm (21 DC 27) and the highest was 86.9 mm (21 ÇR 42). Additionally, it was found between 67.0 and 75.0 mm (50%) in five genotypes and between 75.0 and 90.0 mm (50%) in five genotypes. In the study conducted in the Mediterranean region in 1998, the widest fruit width was determined as 96.83 mm in the 01 N 06 Evci variety (Özgüven et al., 2000). In the study carried out in Kırıkhan district of Hatay; fruit width was reported to be 80-94 mm (Polat et al., 1999). The fruit width values obtained in our study were similar between the values obtained in other studies conducted in Turkey.

The mean minimum fruit volume value was 108.3 ml (21 DC 18) and the highest value was 378.9 ml (21 ÇR 42). It also was found between 200 and 250 ml (60%) in six genotypes, 250 and 300 ml (30%) in three genotypes and 300–400 ml (10%) in one genotype. The lowest fruit density values were found to be 0.85 g/ml (21 ÇR 30) and 1.05 g/ml (21 DC 32). It was between 0.78 and 0.85 g/ml (10%) in one genotype and 0.85–1.20 g/ml (90%) in nine genotypes. The calyx radius was 9.5 mm (21 DC 07) and the highest value was 13.8 mm (21 DC 32). It was detected between 9.0 and 10.5 mm (10%) in one genotype, 10.5 and 12.5 mm (40%) in four genotypes, and 12.5–15.0 mm (40%) in five genotypes. The calyx length was found to be 17.5 mm (21 DC 07) and the highest value was 25.0 mm (21 ÇR 30). Three genotypes were found to be between 15.0 and 20.0 mm (30%) and seven genotypes were between 20.0 and 25.0 mm (70%). Mars and Marrakchi (1999) in a study in Tunisia, they found that the calyx length varies between 12.00 and 21.00 mm. For our genotypes, the lowest juice volume was found 63.9 ml (21 ÇR 30) and the highest value was 135.7 ml in genotype 21 ÇR 51, while the two genotypes were between 60.0 and 85.0 ml (20%) and the eight genotypes were between 85 and 140 ml (80%). Al-Maiman and Ahmad (2002) found that the fruit juice volume is 156 ml in their study for variety named as Taifi. Gündoğdu (2006) showed up that the juice volume was between 76.0 and 170.0 ml. Our results are similar to the results of other studies. Fruit taste was determined to be sour (20%) in two genotypes and sweet (80%) in eight genotypes. Fruit aril color was determined as dark purple (30%) in three genotypes, purple (20%) in two genotypes, medium red (20%) in two genotypes and pink-red (30%) in three genotypes. In a study conducted in Çukurca district of Hakkâri in 2008, 20 genotypes were examined. According to this study, aril colors were found to be white in three genotypes, light pink in 10 genotypes, pink in five genotypes and red in two genotypes (Özatak, 2010). Eight genotypes were easy (80%) and two genotypes were medium (20%) in easiness of aril separating.

The lowest weight of the 100 arils was found to be 40.3 g (21 DC 27) and 47.4 g (21 ÇR 45). Eight of ten genotypes were between 40.0 and 45.0 g (80%) and two of ten genotypes were between 45.0 and 50.0 g (20%). In a previous study conducted in Kırıkhan district of Hatay the weight of the 100 arils was measured between 29.0 and 50.0 g (Polat et al., 1999). In another study conducted in the Pervari district of Siirt, weight of the 100 arils was found as 26.50-45.90 g (Gündoğdu, 2006). The values obtained in our study shows similarity in terms of pomological features. In our study, the lowest aril yield was discovered as 58.1% (21 ÇR 48) and the highest value was 70.0% (21 ÇR 42). Previous studies revealed that aril yield was found to be 54-73% in Kırıkhan district of Hatay (Polat et al., 1999). In our study, two genotypes out of ten showed 2.2-3.0 mm (20%) peel thickness eight genotypes displayed 3.0-4.5 mm (80%) peel thickness. In another study carried out in Hizan district, it was found that the peel thickness ranged between 1.3 and 2.8 mm (Yıldız et al., 2003). In our examination, the upper peel color was purple (40%) in four genotypes, pink-red (20%) in two genotypes, orange-red (10%) in one genotype and orange (10%) in three genotypes. The bottom peel color was determined as orange-red (70%) in seven genotypes and orange (30%) in three genotypes. Seed hardness was determined as medium-hard (80%) in eight genotypes and hard (20%) in two genotypes. In the study conducted in the Pervari district of Siirt in 2002, the hardness of the fruits was found to be hard in 12 genotypes, medium-hard in 11 genotypes and soft in two genotypes (Gündoğdu, 2006).

The number of calyx was 7 (90%) in nine genotypes and 8 (10%) in one genotype. The external appearance of the calyx was found to be significant in six genotypes (60%), moderate prominence in two genotypes (20%), and not prominent in both genotypes (20%). According to the another study, the number of calyx was 6 in eight genotypes, 7 in eight genotypes, and 8 in six genotypes. The appearance of the calyx was found to be significant in 17 genotypes and less prominent in eight genotypes. The appearance of the calyx was found to be significant in 25 genotypes (Gündoğdu, 2006). The fruit shape index was found to be the lowest at 0.85% (21 ÇR 30 and 21 ÇR 45) and

the highest 0.93% (21 ÇR 42). In addition, between 0.85 and 0.90% (70%) values were obtained in seven genotypes and between 0.90 and 0.95% (30%) in three genotypes.

Chemical Properties of Fruits

The chemical properties of the fruit samples taken from 10 selected pomegranate genotypes were evaluated and the mean values are given in Table 1. The amount of total soluable solid (TSS) in fruit samples was determined between 10 and 15% (10%) in one genotype and between 15-23% (90%) in nine genotypes. In previous studies, the TSS was found to be between 13.3 and 16.9% in Tunisia, 13.0–16.0% in the Mediterranean Region, 12.8–15.9% in the Aegean and Southeastern Anatolia regions, 14.3–15.8% in the Kırıkhan district (Hatay), 10.0–17.0% in Hizan (Bitlis), 13.0–25.0% in the Pervari district of Siirt, 12.2-17.6% in Çukurca, respectively (Mars and Marrakchi, 1999; Yılmaz et al., 1992; Polat et al., 1999; Yıldız et al., 2003; Gündoğdu et al., 2010; Muradoğlu et al., 2006). Compared to other findings, the TSS values of the pomegranates of the Diyarbakır region are higher than those of the pomegranates grown in other regions. Similarly, Pervari pomegranates present analog values for TSS. In our study, pH values were between 3.3 and 3.6 (70%) in seven genotypes and 3.6–4.0 (30%) in three genotypes. Gündoğdu (2006) revealed that pH values of fruit juice was between 3.30 and 3.56 in 14 genotypes and 3.56–3.90 in 11 genotypes of the samples. The measures were repeated in the same study for next year. The pH of the fruit juice was found 3.6-4.0 in 8 genotypes, 4.00-4.40 in 17 genotypes (Gündoğdu, 2006). The pH values obtained in our study were in parallel with the values of different studies. As another important feature, we checked vitamin C levels in our study. Vitamin C levels in fruit samples were between 70 and 90 mg/100 g in eight genotypes (80%) and 90–120 mg/100 g in two genotypes (20%). Former examination conducted in Siirt were exhibited 18–78 mg/100 g vitamin C level (Kazankaya et al., 2007). It is plausible to conclude that vitamin C values of our study are higher than those obtained in the study in Siirt. Titratable acid content was between 0.5 and 0.9% in seven genotypes (70%) and 0.9–1.3 in three genotypes (30%). In a study conducted in the Mediterranean region, the amount of titratable acid content of fruit juice varied between 0.13 and 1.63 (Yılmaz et al., 1992). In another study conducted in the Mediterranean region, the minimum acid content was determined as 0.20% in genotype 07 N 15; the highest amount of acid was determined to be 2.00% in 33 N 12 genotype (Özgüven et al., 2000). The titratable acid ratio content of the genotypes we studied was much lower than the values obtained in other studies.

Conclusion

According to the results, the average fruit weight of the genotypes was ranged between 198.8 and 366.0 g. Fruit length, width, volume, and density were detected between 58.7-79.7 mm, 68.1–86.9 mm,108.3–378.9 ml and 0.85–1.05 g/ml, respectively. The calyx radius and the length of the calyx were ranged from 9.5 to 13.8 mm and 17.5 to 25.0 mm, respectively. The volume of the fruit juice was determined between 63.9 and 135.7 ml. Fruit taste was as certained as sour in two genotypes and as sweet in eight genotypes. Aril color was determined as dark purple in three genotypes, purple in two genotypes, medium red in two genotypes and pink-red in 3 genotypes. The easiness of aril separating was determined as easy in eight genotypes and medium in two genotypes. Aril weight and aril yield were found between 40.3–47.3 g and 58.1–70.0%, respectively. The thickness of the peel was found between 2.36-3.87 mm. The upper peel color was purple in four genotypes, pink-red in two genotypes, orange-red in one genotype and orange in three genotypes. The bottom peel color was orange-red in seven genotypes and orange in three genotypes. Seed hardness was medium hard in eight genotypes and hard in two genotypes. The external appearance of the calyx in the selected genotypes was found to be significant in six genotypes, moderate in two genotypes and not significant in two genotypes. The number of chamber of the fruits was 7 in nine genotypes and 8 in one genotype. The fruit shape index was found to be between 0.85–0.93%. Vitamin C values were determined between 62 and 110 mg/100 g. The total soluble solid (TSS) ranged from 15.0 to 21.0%. The pH value of the fruits was determined between 3.42 and 3.83%. The titratable acidity of fruit juice varied between 0.65 and 1.21%.

Pomegranate cultivation has been carried out in the Dicle and Çermik districts of the Diyarbakır province where the study was carried out for many years. Up to now, there is no genetic selection study conducted on pomegranate genotypes. In this study, it was uncovered that pomegranate genotypes grown in the region have superior fruit properties. Pronounced quality criteria of pomegranate are big fruit, big arils, juiciness, soft seeds, tastiness, and aroma. The genotypes we have studied have been of higher quality than previously studied ones so far. The fruit size, the volume of fruit juice, taste, ease of graining affects its production and consumption. These parameters are the reasons to choose for table consumption and pomegranate syrup production. Considering these, pomegranates in the region are of importance.

The Dicle and Çermik districts of the Diyarbakır province has optimal climatic conditions for pomegranate cultivation. This is a major opportunity for pomegranate producers. However, the producers do not have the necessary technical knowledge about pomegranate cultivation. This prevents producers to benefit from the climatic advantage. To resolve this problem; universities, research institutes, provincial and district directorates of agriculture and other agricultural organizations should be in cooperation and organize training activities for producers. The economic value of pomegranate has promising potential for them. If cultivation and production become widespread, it might propose an alternative source of livelihood for the people of the region. Currently, we have not encountered any registered pomegranate genotype in our study. In this region, selective breeding activities should be accelerated as soon as possible and genotypes which are well adapted, highly efficient and have superior properties should be registered. These genotypes and varieties should be recommended to producers who will establish new pomegranate orchards.

 DOI: https://dx.doi.org/10.31015/jaefs.2019.3.12

Table 1. Physical and Chemical Properties of 10 Pomegranate Genotypes (Average values).

Properties	21 ÇR 03	21 ÇR 30	21 ÇR 42	21 ÇR 45	21 ÇR 48	21 ÇR 51	21 DC 07	21 DC 18	21 DC 27	21 DC 32
Fruit Weight (g)	201.6	198.8	366.0	250.4	232.8	249.4	239.7	218.7	203.2	234.3
Fruit Length (mm)	63.8	58.7	79.7	68.1	64.7	66.8	68.5	67.1	60.8	69.6
Fruit Width (mm)	72.7	69.0	86.9	79.8	70.5	76.5	78.9	74.6	68.1	77.8
Fruit Volume (ml)	218.1	232.4	378.9	265.3	244.6	254.1	276.4	237.9	207.7	222.5
Fruit Density (g/ml)	0.92	0.85	0.97	0.94	0.95	0.98	0.87	0.92	0.97	1.05
Calyx Radius (mm)	11	11.8	13.7	13.6	11.6	12.8	9.5	10.9	13.2	13.8
Calyx Length (mm)	23.4	25.0	24.9	21.0	19.3	22.3	17.5	19.3	21.6	23.1
Fruit Juice Volume (ml)	64.7	63.9	103.4	110.6	102.3	135.7	127.5	108.3	117.8	108.7
Fruit Taste	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sweet	Sour	Sour
Aril Color	Dark Purple	Dark Purple	Pink - Red	Pink - Red	Pink - Red	Dark Purple	Purple	Purple	Medium Red	Medium Red
Aril Weight (g)	44.1	42.9	46.2	47.4	44.2	40.5	41.6	42.6	40.3	42.1
Aril Yield (%)	61.9	56.5	70.0	63.2	58.1	59.3	62.7	66.8	61.5	60.9
Upper Peel Color	Purple	Purple	Pink - Red	Pink - Red	Purple	Purple	Orange	Orange-Red	Orange	Orange
Bottom Peel Color	Orange-Red	Orange-Red	Orange-Red	Orange-Red	Orange-Red	Orange-Red	Orange	Orange-Red	Orange	Orange
Peel Thickness (mm)	2.44	2.36	3.71	3.54	3.87	3.03	3.34	3.41	3.21	3.30
Seed Hardness	Medium Hard	Medium Hard	Medium Hard	Medium Hard	Medium Hard	Medium Hard	Medium Hard	Medium Hard	Hard	Hard
Dry Matter Ratio (%)	29.7	26.2	29.5	22.7	23.4	26.0	28.9	27.3	38.8	29.7
Fruit Pulp (g)	104.3	88.2	115.4	123.3	112.8	120.8	117.3	101.9	129.0	135.4
Number of Caliyx	7	7	7	8	7	7	7	7	7	7
Clarity of Caliyx Appearance	Clear	Clear	Medium Clear	Clear	Not Clear	Clear	Clear	Clear	Medium Clear	Not Clear
Easiness of Aril Separating	Easy	Easy	Easy	Easy	Easy	Easy	Easy	Easy	Medium	Medium
Fruit Shape Index	0.88	0.85	0.93	0.85	0.92	0.87	0.87	0.90	0.89	0.89
Vitamin C (mg/100 g)	77	62	90	75	87	93	71	89	110	86
TSS (%)	16	20	19	18	21	17	16	19	17	15
pH (%)	3.76	3.42	3.55	3.44	3.51	3.40	3.83	3.52	3.81	3.55
Titratable Acid Ratio (%)	0.9	0.85	0.76	0.83	0.88	0.65	0.92	0.81	1.07	1.21

Table 2. Phenological and Morphological Properties of 10 Pomegranate Genotypes.

Properties	21 ÇR 03	21 ÇR 30	21 ÇR 42	21 ÇR 45	21 ÇR 48	21 ÇR 51	21 DC 07	21 DC 18	21 DC 27	21 DC 32
Crown Width (cm)	318.2	305.8	221.3	274.2	298.6	274.1	388.0	330.8	237.9	276.8
Trunk Number (No)	4	5	4	3	3	4	2	5	4	6
Tree Girth (cm)	16-16-19-20	12-13-15-15-16	13-14-16-17	11-12-12	13-14-16	14-15-17	21-24	12-13-13-14-15	13-13-14-16	15-15-16-17
Density of the Branches	Frequent	Frequent	Frequent	Semi Frequent	Semi Frequent	Frequent	Medium Frequent	Frequent	Frequent	Frequent
Cold Damage	No	No	No	No	No	No	No	No	No	No
First Foliation Date	Apr-18	Apr-15	Apr-24	Apr-25	Apr-15	Apr-11	Apr-14	Apr-8	Apr-11	Apr-17
Flowering Date	May-24	May-17	May-26	May-29	May-18	May-20	May-23	May-17	May-19	May-21
Harvest Date	Oct-21	Oct-19	Oct-25	Oct-21	Oct-14	Oct-23	Oct-26	Oct-25	Oct-23	Oct-24

Table 3. Weighted Grading Method Scores of 10 Pomegranate Genotypes.

Genotype Name	21 ÇR 03	21 ÇR 30	21 ÇR 42	21 ÇR 45	21 ÇR 48	21 ÇR 51	21 DC 07	21 DC 18	21 DC 27	21 DC 32
Score (%)	61.6	53.5	85.1	67.2	63.7	76.8	70.7	67.9	65.8	66.3

Acknowledgement

This article was adapted from Master Thesis belongs to Mehmet Çiçek.

References

Al-Maiman, S. A. and Ahmad, D. (2002) Changes in Physical and Chemical Properties During Pomegranate (Punica granatum L.) Fruit Maturation. Food Chemistry, 76, 437–441. [CrossRef] [Google Scholar]

Anesini, C. and Perez, C. (1993) Screening of Plants Used in Argentine Folk Medicine for Antimicrobiyal Activity. Journal of Ethonopharmacol, 39, 119-128. [CrossRef] [Google Scholar]

Anonymous, (2016) Turkish Statistical Institute. [URL] Date of Access: July 12, 2019

Anonymous, (2017) Agri stat. Agricultural statistics for year of 2017. [URL]. Date of Access: July 12, 2019

Dokuzoğuz, M. and Mendilcioğlu, K. (1978) Pomological studies on pomegranate varieties in Aegean Region. Ege University. Journal of Agriculture Faculty, 15 (12), 133–159.

Gölükçü, M., Tokgöz, H. and Çelikyurt, M.A. (2005) Some Properties of Pomegranate Seed and Fatty Acid Composition of Pomegranate Seed. West Mediterranean Agricultural Research Institute. Derim, 22,(2), 33-40. [Google Scholar]

Gündoğdu, M. (2006) Selection of Local Types in Pomegranate (Punica granatum L.) Populations in Pervari (Siirt) Region. Yüzüncü Yıl University, Institute of Science, Department of Horticulture, Master Thesis, Van. 62 p.

Gündoğdu, M., Yılmaz, H., Şensoy R. İ. G. and Gündoğdu, Ö. (2010) Pomological Characteristics of Pomegranates Grown in Şirvan (Siirt) Region. YYU J. Agr. Sci, 20(2), 138-143. [Google Scholar]

Kazankaya, A., Gündoğdu, M., Doğan, A., Balta, M. F. and Çelik, F. (2007) Physico- Chemical Characteristics of Pomegranate (Punica granatum L.) Selections from Southeastern of Turkey. Asian Journal of Chemistry, 19(2), 2981–2992. [Google Scholar]

LaRue, J. H. (1980). Growing Pomegranates in California, University of California, California Agriculture and Natural Resources Leaflet, No: 2459, 8 p.

Mars, M. and Marakchi, M. (1999) Diversity of pomegranate (Punica granatum L.) germplasm in Tunisia. Genet. Res. Crop Evol., 46, 461-467. [Google Scholar]

Mavlyanov, S. M., Islambekov, S. Y., Karimdzhanov, A. K. and Ismailov, A. I. (1997) Polyphenols of Pomegranate Peels Show Marked Antitumor and Antiviral Action. Khim Prir Soedin 33, 124–126. [Google Scholar]

Muradoğlu, F., Balta, M. F. and Özrenk, K. (2006) Pomegranate (Punica granatum L.) Genetic Resources from Hakkari, Turkey. Research Journal of Agriculture and Biological Sciences, 2(6), 520–525. [Google Scholar]

Onur, C. (1983) Selection of Pomegranates in the Mediterranean Region (in Turkish). PhD Thesis. Alata Horticultural Research Training Center Publication No:46. Mersin.

Onur, C. (1988) Pomegranate (in Turkish). Derim: Pomegranate Special Volume. Citrus Research Institute Publication, 5(4), 147-190.

Onur, C. and Tibet, H. (1993) Adaptation of pomegranate cultivar in Antalya. Derim 10, 3-18.

Özatak, F.Ö. (2010) Characteristics of Local Genotypes in Pomegranate Populations of Çukurca Region. Yüzüncü Yıl University, Institute of Science, Department of Horticulture, Master Thesis, Van. 76 p.

Özbek, S. (1977) General Fruit Production. Çukurova University Faculty of Agriculture Publication, No: 111. Adana, 386 p.

Özgüven, A. I. and Yılmaz, C. (2000a) Pomegranate Growing in Turkey. In: Melgarejo Moreno, P., Martínez-Nicolás, J. J., Martínez-Tomé, J. (eds.). Production, Processing and Marketing of Pomegranate in the Mediterranean Region: Advances in Research and Technology. Zaragoza: CIHEAM-IAMZ, 41-48 pp. [Google Scholar]

Özgüven, A. I. and Yılmaz, C. (2000b). Pomegranate growing in Southeast Anatolia Region. TÜBİTAK Turkish Agriculture Research Projects Publication, TÜBİTAK Printing Press, Ankara, 15p.

Polat, A. A., Durgaç, C., Kamiloğlu, Ö. and Mansuroğlu, M. (1999) Studies on the Determination of Pomological Properties of Some Pomegranate (Punica granatum L.) Types Grown in Kırıkhan District of Hatay. III. National Horticulture Congress of Turkey, 14–17 September, Ankara, 746-750 pp.

Saleh, M. A., Amer, M. K. M., Radwan, A. E. W. and Amer, M. E. S. (1964) Experiments on Pomegranate Seeds and Juice Preservation. Agricultural Research Review, 42, 54-64.

Yıldız, K., Muradoğlu, F., Oğuz, H. I. and Yılmaz, H. (2003) Pomological Pomegranates Grown in Hizan Properties. IV. National Horticulture Congress of Turkey. 08–12 September, Antalya, 238–240 pp.

Yılmaz, H., Şen, B. and Yıldız, A. (1992) Regional Adaptation of Selected Pomegranates in the Mediterranean Region. I. National Horticulture Congress of Turkey. 13–16 October, İzmir, 449-492 pp.

Yılmaz, H., Ayanoğlu, H. and Yıldız, G. A. (1995) Studies on Adaptation of Some Pomegranate Types Selected in the Aegean Region. II. National Horticulture Congress of Turkey. 3-6 October, Adana, 238–240 pp.

Zhang, J., Zhan, B., Yao, X., Gao, Y. and Shong, J. (1995) Antiviral Activity of Tannin from the Pericarp of Punica granatum L. Against Genital Herpes Virus In Vitro. China Journal of Chinese Materia Medica, 20(9), 556-55. [Google Scholar]