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Full Length Research Paper

Fruit characteristics of the selected fig genotypes

Mikdat Şimşek[1]* and Hakan Yildirim[2]

[1]Department of Horticulture, Faculty of Agriculture, Bingöl University, Bingöl, 12000, Turkey.
[2]Department of Horticulture, Faculty of Agriculture, Dicle University, Diyarbakir, Turkey.

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The aim of this research was determine of fruit characteristics and select of some significant fig genotypes grown in Kiziltepe district of Mardin province. No studies have been made on the fig genotypes in Kiziltepe district by researchers up to now. Therefore, this study was very important. In this research, six fig genotypes were evaluated for two years. A lot of pomological characteristics of the selected fig genotypes were determined during years 2007 and 2008. According to the averages in two years, fruit weight ranged between 68.04 and 43.96 g,ostiolum width ranged between 4.55 and 2.46 mm, total soluble solids (TSS) ranged between 21.10 and 16.78% and acidity ranged between 0.28 and 0.22%. In addition, KZTP-32 and KZTP-30 fig genotypes scored the highest in overall quality according to the results of the weighted ranked method.

Key words: *Ficus carica* L., genotype, fruit characteristics, quality, selection.

INTRODUCTION

Turkey is the world's largest fig producing country. According to FAO statistics, world fig production is 1.056,820 tonnes. Turkey's production of 285.000 tonnes is 27% of the world's total production and its 177.900 tonnes of fig exports represents 52% of total world fig exports (Anonymous, 2005). About 70% of Turkey's total fig production is for dry consumption (Aksoy et al., 2003).Because of environmental effects on fruit quality, it wascommonly believed that the highest quality dried figs were grown in limited areas of the big and small Meander valleys where temperature, relative humidity and wind conditions were determined to be optimum for production of high quality dried figs (Özbek, 1978). Fresh fig production, although still environmentally sensitive, appears to be less demanding in terms of climate characteristics.Figs are well adapted to some regions of the Southeast Anatolia.

Bursa are the largest fresh fig region in Turkey with extensive fresh fig exports (Aksoy et al., 1992; Ozeker and Isfandiyaroglu, 1998). However, Turkey's fresh fig production has not yet fulfilled its export (Sahin,1998). Turkey's fresh fig exports only increased to potential.

*Corresponding author. E-mail: miksimsek2001@yahoo.com. Tel: +90-426-213 25 50 – 51. Fax: +90-426-213 28 66.

Recently, the fresh fig trade, confined primarily to localmarkets, has gained international importance 150 tons from 1980 to 6123 tons in 1999 and to 10,376 tons in 2004 (Anonymous, 2004). To increase fig production, it will be necessary to extend the harvesting period by planting in diverse ecological regions to utilize cultivars that differ in their harvest period, and finally to improve quality and increase diversity. In Kiziltepe, none of the fig trees is in solid orchards but is inter-planted with almond trees. The objective of this study was to determine the fruit quality and some important characteristics of the selected fig genotypes to increase the fig production and the export of Turkey. In this context, the Southeast Anatolia Region and the Mediterranean shore have suitable conditions for the fig production (Kaska et al., 1990). Because of increasing demand for fresh consumption types and cultivars, any method to increase the fig production would be of value (Aksoy et al., 1992).

MATERIALS AND METHODS

This study was carried out during years 2007 – 2008 in Kiziltepe district of Mardin province. Six fig genotypes were included in the this study.The genotypes were selected and the fruit qualities were determined. In this context, 30 fruits were randomly taken from each fig tree in each year. Harvested fruits were immediately transferred to ice boxes and then stored at 0°C. After that, they were

Table 1. Evaluation of the selected fig genotypes according to the weighted ranked method.

Characteristics	Weighting factor (coeficient)	Classification and points			
Fruit weight	40	<20.0 g 30.1 - 40.0 g 50.1 - 60.0 g	0 4 8	20.1 - 30.0 g 40.1 - 50.0 g > 60.0 g	2 6 10
Fruit shape index	9	I<0.9 I>1.1	8 6	I=0.9-1.1	10
Neck length	6	<5.0 mm 10.1-15.0 mm	0 6	5.1 - 10.0 mm >15.0 mm	10 2
Fruit skin cracks	10	None-little High	10 0	Medium	6
Peeling of skin	10	Easy Difficult	10 0	Medium	6
Ostiolum width	5	0.0 2.0 mm 4.1-6.0 mm	10 6	2.1 - 4.0 mm >6.1 mm	8 2
Total soluble solid content	10	< 13.0% 16.1 - 20.0% > 25.1%	2 10 6	13.1 - 16.0% 20.1 - 25.1%	4 8
Titrable acidity	10	< 0. 050% 0.126 - 0.225% > 0.301%	0 8 4	0.051 - 0.125% 0.226 - 0.300%	6 10
Total	100				

analysed according to the random blocks design with 3 replication and 10 fruits in each replication for each year. To provide positive contri-butions to the production and export of fig genotypes, the quality evaluation of the genotypes was performed according to a weighted ranked method (Table 1).

Fruit weight was measured with a scale sensitive to 0.01 g. Fruit length and fruit width, neck length and ostiolum, neck length and ostiole width were measured by a digital compass. Total soluble solids were determined with a hand-held refractometer and pH of fruit juice was determined by a pH-meter. Titrable acidity was determined by titrating with 0.1 N NaOH to an endpoint of pH 8.10. The total soluble solid/titrable acidity ratio was calculated. The fruit shape index was calculated by dividing the width by length. In addition, peeling of skin and fruit skin cracks were also evaluated according to the descriptor of Aksoy (1991). Abscission of the stalk from the twig, fruit shape, fruit ribe, the fruit internal cavity, beginning of maturation, full maturity, harvest period, yield, fruit skin colour, drop at the eye, colour of liquid drop, scale size of scales around the ostiolum, their colour and their adhesion were determined based on the fig descriptors (from IPGRI) developed by Anonymous (2003). To compare overall performance of each genotype studied, an evaluation scale was developed based on weighting fruit characteristics considering both local and global consumer preferences. The data were subjected to analysis of variance using JMP 5.0.1. The means were separated by Tukey's test at 0.05.

RESULTS AND DISCUSSION

In this study, 6 fig genotypes were selected with special emphasis on the fruit quality characteristics. Considering 2 years mean (2007 and 2008), fruit weight, fruit width, fruit length, ostiolum, neck length, total soluble solids (TSS), titrable acidity, TSS/titrable acidity and pH of the fruit juice of the fig genotypes were found to be statistically different from each other at 5% level (Table 2).

Fruit weight is one of the most important components for determining size of the fruits and is very important for fresh consumption in figs (Aksoy et al., 1992). According to the averages in the , KZTP-32 had the highest fruit weight (68.04 g) and KZTP-33 had the lowest fruit weight (43.96 g). In some other studies, the fruit weights ranged from 30 to 90 g (Ozeker and Isfandiyaroglu,1998), 28.00 to 107.00 g (Polat and Ozkaya 2005) and from 22.15 to 52.47 g (Caliskan and Polat, 2008). To quantify the length and width, the fruit size were measured as well as fruit weight (Eisen, 1901). KZTP-32 had the highest fruit width (54.11 mm) and KZTP-39 had the lowest fruit width (42.88 mm). The results concerning the fruit width were found to be higher than those of Kuden et al. (2008). They reported that the fruit width ranged between 49.97 and 32.97 mm. KZTP-30 had the highest fruit length (49.38 mm) and KZTP-36 had the lowest fruit length (34.46 mm). These results were found to be lower than those of Polat and Ozkaya (2005). They reported that the fruit length ranged from 59.10 to 34.25 mm.

In this study, no neck was observed in 1 genotype (KZTP-39), while the others had neck and the neck length ranged between 5.87 mm in KZTP-33 and 0.37 mm in KZTP-36. Kuden et al. (2008) found that the neck length changed between 9.00 and 4.80 mm. Ilgin (1995) found that the neck length ranged between 14.50 mm(462-1 Bardak) and 7.30 mm (462-6 Bardak).Both

Table 2. Some fruit characteristics of the selected fig genotypes in Kiziltepe district (2007 – 2008).

Accession code	Fruit weight (g)	Fruit length (mm)	Fruit width (mm)	Neck length (mm)	Ostiolum width (mm)	TSS (%)	Titrable acidity (%)	TSS/ Titrable acidity	pH	Beginning of maturation	Full maturity	Harvest period
KZTP- 30	51.10 b	49.38 b	47.05 c	3.52 c	3.35 b	18.57 bc	0.26 ab	70.63 cd	5.29 bc	20-31 July	1-10 August	21-40 days
KZTP- 32	68.04 a	42.26 a	54.11 a	4.15 b	3.29 bc	16.78 d	0.28 a	60.67 d	6.21 a	20-31 July	11-31 August	41-60 days
KZTP- 33	43.96 c	35.02 c	47.09 c	5.87 a	2.97 c	17.58 cd	0.23 bc	75.50 bcd	5.63 abc	1-15 August	11-31 August	21-40 days
KZTP- 35	45.84 c	35.79 c	46.11 c	3.28 c	3.09 bc	19.73 ab	0.23 bc	86.66 abc	5.24 c	20-31 July	11-31 August	41-60 days
KZTP- 36	51.82 b	34.46 c	49.49 b	0.37 d	4.55 a	20.78 a	0.23 bc	90.84 ab	5.99 ab	1-15 August	11-31 August	21-40 days
KZTP- 39	43.97 c	38.47 b	42.88 d	0.00 d	2.46 d	21.10 a	0.22 c	97.85 a	5.87 abc	20-31 July	11-31 August	41-60 days

TSS, Total soluble solids content. Mean separation within columns by Tukey's test at 0.05 level except the fruit maturations and the harvest period.

Kuden et al. (2008) and Ilgin (1995) also found the neckless fig genotypes. The results in this research were found to be similar to their results. Fruits with necks that are too long are not desired by the table fig industry. The neck length,width and length of the fruit can change according to the genetic charactetistics, maintenance requirements and the ecological conditions.

The ostiolum width of the selected fig genotypes ranged between 4.55 mm in KZTP-36 and 2.46 mm in KZTP-39 (Table 2). Kuden et al. (2008) found that the ostiolum width ranged between 4.32 and 2.50 mm. In addition, Polat and Ozkaya (2005) found that the ostiolum width ranged between 9.43 and 1.04 mm. Therefore, the genotypes in Kiziltepe were suitable for the table fig industry with respect to the ostiolum width. In general, the high ostiolum width is an undesirable characteristic.

The total soluble solids were the highest for KZTP-39 (21.10%) and lowest for KZTP-32 (16.78%) (21.10%). These results were found to be lower than the results of Kaska et al. (1990). They reported that the TSS ratio ranged between 29.00 and 17.40%. High quality table figs in term of the TSS contents are better if they are between 25.10 and 13.00% (Aksoy et al., 1992). These results were better than those of Kaska et al. (1990) and were in agreement with reports of Aksoy et al.(1992). The titrable acidity was highest for KZTP-32 (0.28%) and lowest for KZTP-39 (0.22%).These results were found lower than the results of Caliskan and Polat (2008). They determined the titrable acidity ratio changed from 0.26 to 0.09%.

These results were better than the results of Caliskan and Polat (2008). The differences between the results of these researches in terms of the titrable acidity can change according to the genetic charactetistics, harvested early or late and the ecological conditions. In addition, the pH of the fruit juice was highest for KZTP-32 (6.21) and lowest for KZTP-35 (5.24).

These results were higher than results of Caliskan and Polat (2008). They reported that pH values ranged between 5.40 and 4.60.

The TSS/the titrable acidity is one of the most important factors in fruit taste (Karacali, 2002). Preferred ratio will vary with the use of fig fruits,but ratios will provide guidance in selecting types and cultivars for specific uses (Can,1993). In this study, the TSS/titrable acidity was highest for KZTP-39 (97.85). and lowest for KZTP-32 (60.67).The present results are suitable for table fig.Caliskan and Polat (2008) found a lot of the table figs as in this study as well as a few dried figs which had high TSS/titrable acidity (31-IN-01 (276. 00), 31-IN-10 (254.00), 31-IN-19 (248.00) and 31-IN-09 (214.00).

The initiation of the ripening of the genotypes studied ranged between 20th of July and the 15th of August. Full maturity of all genotypes was in August. The harvesting period was continued for at least 21 - 40 days and the longest was about 41 - 60 days. Caliskan and Polat (2008) reported that all the types and cultivars were harvested in August. The harvest times and periods of the figs can change according to the regions and genetic characteristics.Some fruit characteristics for the fig genotypes selected are shown in Table 3. In this study, because the selected fig genotypes were in the orchards of the producers, their yield values could not be obtained. Therefore, the values were determined as subjective with 1-5 assessment. In the result, medium efficiency (3) in half of the fig genotypes and good efficiency (4) in the other half of the fig genetypes was was observed. Ilgın and Küden (2003) reported that

Table 3. Some fruit characteristics for the fig genotypes selected in Kiziltepe district (2007 – 2008).

Accession code	Yield (1-5)	Yield	Fruit Shape index	Fruit shape	Abscission of the stalk from the twig	Peeling of skin	Fruit skin cracks	Fruit internal cavity	Fruit ribes	Fruit skin colour	Drop at the eye
KZTP- 30	4	Medium efficiency	1.19 c	Oblate	Easy	Easy	None	None	Intermediate	Yellow–green	Absent
KZTP- 32	4	Good efficiency	1.28 b	Oblate	Easy	Easy	None	None	Prominent	Purple	Present
KZTP- 33	3	Medium efficiency	1.34 b	Oblate	Medium	Easy	Medium	None	Intermediate	Yellow–green	Absent
KZTP- 35	4	Good efficiency	1.29 b	Oblate	Easy	Easy	None	None	Intermediate	Purple	Present
KZTP- 36	3	Good efficiency	1.44 a	Oblate	Hard	Medium	Medium	None	Intermediate	Yellow–green	Absent
KZTP- 39	4	Middle efficiency	1.11 d	Oblate	Easy	Medium	Medium	Small	Intermediate	Yellow–green	Absent

Mean separation within column of fruit shape index by Tukey's test at 0.05 level.

Table 3. Contd.

Accession code	Colour of liquid drop	Scales around the ostiolum		
		Scale size	Scale colour	Scale adhession
KZTP-30	Absent	Medium	Different from skin	Detached
KZTP-32	Transparent	Small	Same of skin	Adhered
KZTP-33	Absent	Medium	Different from skin	Detached

the yields of the selected fig types and cultivars changed from 2 to 5 in Kahramanmaraş.

The fruit shape index of the fig genotypes wasfound to be statistically different from each other at 5% level. All the fig genotypes were oblate because the index was changed from 1.11 to 1.44. In general, these results were similar to those of all the Abbas types of Ilgin (1995). Ilgin (1995) determined the fruit shape index ranged from 1.40 to 1.20 for the studied Abbas types in Kahramanmaras. The fruit index can change according to the genetic characteristics. In this study, the abscission of the stalk from the twig of the selected fig genotypes was easy in 4 genotypes and difficult in 2 genotypes. These results were similar to those of Ilgin (1995) and Özkaya (1997). According to the results in this study, it was reported that the fig genotypes had medium or easy peeling of skin. These results were similar to those of Polat and Ozkaya (2005). In addition, it was reported that the fig genotypes had medium or no fruit skin cracks. These results were similar to those of Ilgin and Kuden (1997).

Characteristics of the selected fig genotypes were identificated in this study. It was shown that the fig genotypes had small or no fruit internal cavity, prominent or intermediate fruit ribe, purple or yellow-green fruit skin colour, absent or present drop at the eye and transparent colour of liquid drop. In addition, it was reported that the fig genotypes had small or medium size scales around the ostiolum, same or different skin, adhered or detached colours and adhered or detached adhession.

In this study, results of weighted characterization for the fig genotypes selected are shown in Table 4. According to the averages in the two years, the total point was found to be highest at 894 in KZTP-32 and lowest at 654 in KZTP-39.

These results were found to be different from those of Şimşek and Küden (2008). They reported that the total point ranged between 950 and 559.

The reason for differences in the two studies in terms of total point could be the genetical properties and enviromental conditions of the figs.

Also, names, origins, coordinates and altitudes of the fig genotypes were shown in Table 5.

As a result, Turkey is the world's largest fig pro-

Table 4: The results of weighted characterization for the selected fig genotypes in Kiziltepe district according to the averages of years 2007 and 2008.

Accession code	Fruit weight	Fruit shape index	Neck length	Fruit skin cracks	Peeling of skin	Ostiolum width	TSS	Titrable acidity	Total Points
KZTP- 30	320	54	0	100	100	40	100	100	814
KZTP- 32	400	54	0	100	100	40	100	100	894
KZTP- 33	240	54	60	60	100	40	100	100	754
KZTP- 35	240	54	0	100	100	40	100	100	734
KZTP- 36	320	54	0	100	60	30	80	100	744
KZTP- 39	240	54	0	100	60	40	80	80	654

TSS, Total soluble solids content.

Table 5. Names,origins, coordinates and altitutes of the selected fig genotypes.

Accession code	Type names	Origins	Coordinates	Altitutes (m)
KZTP- 30	Karpaklı	Kızıltepe	37643997 E – 4129568 N	704
KZTP- 32	Reyhani	Kızıltepe	37644026 E – 4129565 N	698
KZTP- 33	Turaç	Kızıltepe	37644169 E – 4129529 N	698
KZTP- 35	Karpaklı	Kızıltepe	37644196 E – 4129524 N	708
KZTP- 36	Hımri inciri	Kızıltepe	37644140 E – 4129506 N	700
KZTP- 39	Zerşin	Kızıltepe	37643910 E – 4129560 N	710

ducing country. The country represents more than half of the world fig export. Kiziltepe district is a micro center of fig genotypes in the country. In this study, KZTP-32 fig genotype is the best fig genotypes because it has the highest total score. The fruit quality characteristics of the fig genotypes should be determined and the good quality fig genotypes should be export to increase the revenue.

REFERENCES

Aksoy U (1991). Descriptors for fig (*Ficus carica* L. and related *Ficus* sp.). Ege Uni. Faculty of Agriculture. Department of Horticulture, Izmir,Turkey.

Aksoy U, Seferoglu G, Misirli A, Kara S, Sahin N, Bulbul S, Duzbastilar (1992). Selection of the table fig genotypes suitable for Egean Region. I. In: Proceedings of the first national horticultural congress. (in Turkish), pp. 545-548.

Aksoy U, Balci B, Can HZ, Hepaksoy S (2003). Some significant results of the research-work in Turkey on fig. Acta Hortic. 605: 173-181.

Anonymous (2003). Descriptors for fig. International Plant Genetic Resources Institute, Rome, Italy, and International Centre for Advanced Mediterranean Agronomic Studies, Paris, France, ISBN 92-9043-598-4.

Anonymous (2004). Food and agriculture organization of the United Nations. http://apps.fao.org/page/collections?subset=agriculture.

Anonymous (2005). Food and agriculture organization of the United Nations.http://apps.fao.org/page/collections?subset=agriculture.

Can HZ (1993). The investigation of some horticultural characteristics of some selected fig genotypes in Aegean Region. Master Thesis, Ege Uni. Izmir, Turkey (in Turkish, with English abstract).

Condit IJ (1941). Fig characteristics useful in the identification of varieties. Hilgardia, 14: 1-69.

Çalışkan O, Polat AA (2008). Fruit characteristics of table fig (*Ficus carica*) cultivars in subtropical climate conditions of the Mediterranean region. Sci. Hort. 115(4): 360-367.

Eisen G (1901). The Fig, Its history, culture and curing. USDA Bull. 9: 201-283.

Ilgın M (1995) The investigation of fertilization biology of some fig genotypes selected from Kahramanmaraş Region. PhD Thesis, Cukurova University, Adana, Turkey (in Turkish, with English abstract).

Ilgin M, Kuden AB (1997). Table fig selection study in the Kahramanmara province of Turkey. Fifth International Symposium on Temperate Zone Fruits in the Tropics and Subtropics. 29th May-1st June, 1996, Acta Hort. 441: 351-357.

Ilgın M, Küden AB (2003). Kahramanmaraş Bölgesinde ncir Seleksiyonu ve Selekte Edilen Tiplerin Bitki Özelliklerinin ncelenmesi. Türkiye V. Ulusal Bahçe Bitkileri Kongresi, Akdeniz Üniversitesi Ziraat Fakültesi Bahçe Bitkileri Bölümü, 08-12 Eylül 2003, Antalya.

Karacali I (2002). Storage and marketing of horticultural products. Ege Uni. Faculty of Agriculture (in Turkish). p. 494.

Kaska N, Kuen AB, Kuden A, Cetiner S (1990). The investigation of adaptation of Aegean figs and figs selected from Cukurova region. (in Turkish, with English abstract). Cukurova Uni. Faculty of Agriculture, 5: 77-86

Kuden AB, Beyazit S, Cömlekcioglu S (2008). Morphological and pomological characteristics of fig genotypes selected from Mediterranean and South East Anatoli Regions. Proceedings of the Third International Symposium on Fig. ISHS, Acta Hort. 798: 95-102.

Özbek S (1978). Özel Meyvecilik. Çukurova Üniversitesi, Ziraat Fakultesi Yayınları, Vol. 128, Adana, (in Turkish). p. 486.

Özeker E, Isfandiyarog lu M (1998). Evaluation of table fig cultivars in Çesme Peninsula. Acta Hort. 480: 55-60.

Ozkaya M (1997). Selection studies on fig genotypes grown in Antakya region. Master Thesis, Mustafa Kemal University, Antakya, Hatay (in Turkish).

Polat AA, Ozkaya M (2005). Selection studies on fig in the Mediterranean region of Turkey. Pak. J. Bot. 37(3): 567-574.

Sahin N (1998). Fig adaptation studies in western Turkey. Acta Hortic. 480: 61-70.

Şimşek M, Küden AB (2008). Diyarbakır koşullarında incir genetik materyalinin seleksiyonu ve tanımlanması. Cukurova University Institute of Natural and Applied Science, Adana, Turkey. J. Sci. Eng. Cilt. 18: 2.