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Fruit Characteristics of Some Turkish Walnut Genotypes and Cultivars (*Juglan regia* L.)

¹A. Dogan, ¹A. Kazankaya, ²A. Gün, M.A. Askin, ¹H.İ. Oğuz and ¹F. Celik

¹Department of Horticulture, Faculty of Agriculture, Yuzuncu Yil University Van, Turkey

²Directorate of Department of Agriculture of Denizli Province

³Department of Horticulture, Faculty of Agriculture, Suleymen Demirel University Isparta, Turkey

Abstract: In this study selected nine walnut genotypes and seven standard cultivars grown naturally from seedling originated in Denizli Province of Turkey were evaluated during 2002-2003. Variations in nut and kernel traits in these seedling trees were found. Nut weight of expected genotypes varied from 8.62 (DE 83) to 15.70 g (DE 64), kernel weight from 3.84 (DE 03) to 8.36 g (DE 80), the kernel yield from 34.07 (DE 03) to 61.83% (DE 80), nut length from 35.36 (DE 83) to 43.19 mm (DE 101), fruit width from 29.82 (DE 01) to 35.78 mm (DE 44), cheek from 30.40 (DE 01) to 38.16 mm (DE 64) and shell thickness from 1.12 (DE 83) to 2.02 mm (DE 03), nut weight of standard cultivar changed from 7.82 (Altınova) to 24.34 g (Kaplan 86), kernel weight from 4.10 (Altınova) to 10.30 g (Kaplan 86), kernel yield from 39.44 (Yalova 2) to 61.55 (Şebin)%, nut length from 31.43 (Altınova) to 54.40 mm (Kaplan 86), fruit width from 27.00 (Altınova) to 45.48 mm (Kaplan 86), cheek from 28.91 (Altınova) to 45.50 mm (Kaplan 86), shell thickness from 1.34 (Yalova 4) to 2.04 mm (Yalova 2). Fruits from expected genotypes and standard cultivars ripened between the early September and mid-October.

Key words: Walnut, Denizli, fruit characteristics, cultivars, genotypes

INTRODUCTION

Turkey is the oldest place for settlement to many civilizations and the motherland of many fruit species because of geographic locations, diverse climatic conditions and soil types. Walnut is an important crop species among them and an ancient species originating in Turkey. Anatolia plays bridge role in extending of walnut to many Western countries^[1]. Among Juglandaceae in the world, 21 species have known. The most popular walnut species spread out throughout the world that have commercial value are *Juglans regia* L.^[1,2]. Walnuts grown in Anatolia belong to these species and produced from seedling. Because of continuous seed propagation a great number of seedling walnut trees have occurred creating valuable walnut genetic resources^[1,3]. Factors used for selecting of promising genotypes vary depending on the researchers^[1,3-5]. In walnut production, it is important to use standard varieties and local promising selections for commercial production. In recent years, walnut genotypes obtained from the selection propagated also by grafting. In this study, walnut genotypes and standard cultivars selected according to selection criteria grown from Denizli Province of Turkey were evaluated with regard to fruit traits.

MATERIALS AND METHODS

Standard walnut trees grown naturally from seedling originated in the center of Denizli Province and subordinate villages were used. Denizli lies in west part of Turkey having 37°46'N latitude and 29°04'E longitude. The region was searched thoroughly during 2003 and 2004. Samples were taken from 9 expected healthy genotypes and 7 standard healthy cultivars. For measurements and evaluations, thirty samples of fruits were chosen randomly from the each tree. The evaluated fruit traits were nut weight (g), kernel weight (g), kernel yield (%)- (kernel weight/nut weight), length and width of nut (mm), cheek, color of shell and kernel, shell thickness (mm), roughness of shell, kernel fullness, kernel defect, shell breakage, shell streak, shriveled kernel (%)^[1,4,6]. The average values for each trait were reported.

RESULTS AND DISCUSSION

Good kernel quality is desirable and important properties for walnut cultivar improvement. Walnut fruit traits varied in nut size and kernel yields depending on genotypes and cultivars (Table 1 and 2). Nut traits of the genotypes ranged from 8.62 (DE 83) to 15.70 g (DE 64) for

Table 1: Nut traits of studied walnut varieties in Denizli Province

		Nut weight(g)	Kernel weight(g)	Kernel yield (%)	Nut length(mm)	Nut width (mm)	Cheek (mm)	Shell Color	Roughness of shell
Genotype	DE 01	9.54	5.26	55.13	36.42	29.82	30.40	Moderate	Moderate
	DE 03	11.18	3.84	34.07	38.84	33.12	32.10	Moderate	Moderate
	DE 17	11.69	5.91	50.80	39.54	33.86	35.81	Moderate	Moderate
	DE 44	11.17	5.97	55.44	42.50	35.78	34.91	Moderate	Moderate
	DE 64	15.70	7.57	55.82	41.84	35.50	38.16	Moderate	Moderate
	DE 69	11.24	6.57	58.45	42.56	33.94	33.36	Moderate	Moderate
	DE 80	13.52	8.36	61.83	41.38	32.78	33.32	Light	Rough
	DE 83	8.62	5.18	60.09	35.36	31.52	31.76	Moderate	Moderate
	DE 101	12.75	6.71	52.62	43.19	33.89	34.66	Moderate	Moderate
	Cultivar	Altınova	7.82	4.10	52.42	31.43	27.00	28.91	Moderate
Kaplan 86		24.34	10.30	41.20	54.40	45.48	45.50	Moderate	Rough
Şebın		10.30	6.34	61.55	36.96	33.32	31.18	Moderate	Moderate
Yalova 1		16.44	7.98	48.49	42.56	34.57	35.69	Moderate	Moderate
Yalova 2		18.94	7.47	39.44	56.55	35.73	39.30	Light	Rough
Yalova 3		12.28	7.28	59.56	41.00	31.14	33.00	Moderate	Moderate
Yalova 4		10.48	5.70	54.43	38.37	30.73	33.95	Moderate	Moderate

Table 2: Nut traits of studied walnut varieties in Denizli Province

		Shell thickness (mm)	Shell breakage	Kernel fullness	Kernel defect(%)	Kernel color	Kernel removal	Streak	Shrivel	Harvest date
Genotype	DE 01	1.48	Easy	Good	-	Yellow	Good	Moderate	-	Mid Sep.
	DE 03	2.02	Easy	Good	-	Yellow	Moderate	Moderate	-	Mid Sep.
	DE 17	1.15	Moderate	Moderate	-	Dark	Good	Streaked	-	Late Sep.
	DE 44	1.25	Easy	Good	-	Dark	Moderate	Moderate	-	Late Sep.
	DE 64	1.33	Easy	Moderate	-	Yellow	Good	Moderate	-	Late Sep.
	DE 69	1.15	Easy	Moderate	-	Yellow	Good	Moderate	-	Early Oct
	DE 80	1.20	Easy	Good	-	Dark	Good	Moderate	-	Mid Sep.
	DE 83	1.12	Easy	Good	-	Yellow	Moderate	Moderate	-	Late Sep.
	DE 101	1.47	Easy	Moderate	-	Dark	Good	Moderate	-	Mid Oct
	Cultivar	Altınova	1.50	Easy	Good	-	Dark	Moderate	Moderate	-
Kaplan 86		1.62	Easy	Good	-	Yellow	Good	Moderate	-	Late Sep.
Şebın		1.38	Easy	Good	-	Yellow	Good	Moderate	-	Late Sep.
Yalova 1		1.83	Easy	Good	-	Dark	Good	Moderate	-	Late Sep.
Yalova 2		2.04	Moderate	Moderate	-	Yellow	Good	Moderate	-	Late Sep.
Yalova 3		1.50	Easy	Good	-	Yellow	Good	Moderate	-	Late Sep.
Yalova 4		1.34	Easy	Good	-	Dark	Moderate	Moderate	-	Early Oct

nut weights; from 3.84 (DE 03) to 8.36 g (DE 80) for kernel weights; from 34.07 (DE 03) to 61.83% (DE 80) for kernel yield. The genotypes had a range of 35.36 (DE 83) to 43.19 mm (DE 101) for nut lengths, 29.82 (DE 01)-35.78 mm (DE 44) for nut width, 30.40 (DE 01)-38.16 mm (DE 64) for cheek and 1.12 (DE 83)-2.02 mm (DE 03) for nut shells (Table 1 and 2).

In standard cultivars, nut weights varied from 7.82 (Altınova) to 24.34 g (Kaplan 86), kernel weights from 4.10 (Altınova) to 10.30 g (Kaplan 86), kernel yield from 39.44 (Yalova 2) to 61.55% (Şebın), fruit lengths from 31.43 (Altınova) to 54.40 mm (Kaplan 86), fruit width from 27.00 (Altınova) to 45.48 mm (Kaplan 86), cheeks from 28.91 (Altınova) to 45.50 mm (Kaplan 86), shell thicknesses from 1.34 (Yalova 4) to 2.04 mm (Yalova 2) (Table 1).

Harvest period of genotypes and standard cultivars extended from early September to mid-October as (Table 2). Most genotypes had fruit ripening period from mid-September to late-September. Ripening period of native standard cultivars was mostly late-September. In general, genotypes and standard cultivars had no shriveled and bruised kernel. The kernels were removed as whole and the shell colors were moderate. Shell breakage

was mostly easy. The selections had also no shriveled and bruised kernels.

Differences were found in fruit and kernel weight and kernel yield among the standard cultivars in the earlier study^[3]. Fruit weights of Yalova 1, Yalova 2, Yalova 3, Yalova 4 and Şebın as standard cultivars were 15.5, 16.5, 12.1, 12.9 and 9.4, respectively. Kernel weights were 7.5, 7.6, 6.4, 6.8 and 6.6, respectively. The highest ratio obtained in Şebın with 63%, Yalova 3 and Yalova 4 followed that with 53%. Yalova 2 and Yalova 1 had the ratio of 46 to 48%, respectively. In this study, Şebın also had the highest kernel yield with 61.55%, Yalova 3 and Yalova 4 followed that with 59.56 and 54.43%. In another study accomplished in the Malatya with the same standard cultivars, from the high to low kernel ratios were belong to Şebın, Yalova 1, Yalova 3 and Yalova 2 with the value of 58.7, 49.6, 47.1, 39.7%. Şebın had the lowest nut weight (8.2 g), but the highest kernel yield^[7]. The performance of Yalova 1, 2 and 3 cultivars in Denizli was better than that grown in the other locations. Yalova 4 and Şebın had the similar fruit traits as performed in the other location. In the study carried out in Çameli and Bozkurt districts of Denizli Province nut weights were found

between 12.56 and 18.40 g, kernel weights between 7.61 and 9.92 g, kernel yield between 53.49 and 64.27%, shell thickness between 0.83 and 1.36 mm^[8]. In terms of kernel attributes, kernel weight over 7 to 8 g, kernel yields over 50% and light colored kernels are desirable in the selection of walnut varieties. Selection for high nut quality should include increased kernel weight and increased kernel yield and low shell weight.

Several studies on walnut genotypes in Turkey yielded various findings. The most important consideration from these studies is that Turkey has rich population in terms of walnut genotypes. In one study accomplished in Bahçesaray of Van Province in Turkey, nut weight varied from 9.7 to 17.6 g, kernel weight from 5.35 to 8.09 g, kernel ratio from 47 to 66%, shell thickness from 1.00 to 1.90^[9]. In another study carried out in Çatak of Van for determination of walnut fruit traits, nut weights changed from 4.21 to 11.31 g, kernel weight from 1.47 to 5.23 g, kernel ratio from 24 to 57%, shell thickness from 0.76 to 2.06 mm; nut weight at the second year from 6.54 to 13.45 g, kernel weight from 2.13 to 5.80 g, kernel yield from 27 to 57%, shell thickness from 0.98 to 2.20 mm^[10]. Similar results from native selection studies were obtained by some other researchers^[1,11-14].

In one another study carried out in the east black sea region of Turkey, 15 native genotypes were found as promising. The genotypes had a range of 11.8 to 18.7 g for nut weight, 6.25 to 9.23 g for kernel weight, 48 to 60% for kernel yield^[15]. In another selection study performed in the district of Gevaş located in the Lake Van Region of Eastern Anatolia, selections had nut weight between 10.38 to 17.04 g, kernel weight between 5.85 to 7.88 g, kernel ratio 45.09 to 59.27%, shell thickness between 0.86 to 1.75 mm and light colored^[16].

The study revealed that native walnut genotypes from this location were found as promising in terms of fruit traits. Nut traits of genotypes and cultivars selected for the study found similar to that of walnuts grown in the other regions of Turkey or even better. Among the samples, kernel yields over 55% indicate the superiority of 6 genotypes used in the study. Because walnut production is under relatively high genetic control further information on the nature and degree of genetic diversity present in walnuts in the area would help to identify the valuable trees to produce uniform nuts and kernels of desirable quality.

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