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Promising Native Walnut Genotypes (*Juglans regia* L.) of The East Black Sea Region of Turkey

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Abstract

In order to select promising native walnut genotypes, characteristics of trees situated on the Black Sea Region of Turkey during 1997 to 1999 were examined with regard to fruit properties. The walnut population consisted of 4200 seedling trees. Fifteen native genotypes selected were evaluated as promising. The genotypes exhibited a range of 11.8-18.7 g for inshell fruit weight, 6.25-9.23 g for kernel weight, 48-60% for kernel percentage, 1.02-1.75 mm for shell thickness, 65-100% for terminal fruitfulness and 30-75% for lateral fruitfulness.

Introduction

As the main commercial species *Juglans regia* L. is native to a large area in the world (1, 2, 3). In most parts of Anatolia, this species is cultivated in scattered populations since ancient times (3, 4). Continuous seed propagation for thousands of years has given rise to the occurrence of a great number of seedling walnut trees and valuable walnut genetic resources. Native trees, the numbers of which are estimated to be over 4.5 million, posses large genetic variability which might contribute to breeding programs desiring high yield, good nut and kernel characteristics, high lateral bud fruitfulness, late bud breaking, late flowering, winter hardiness and tolerance to diseases. Selection studies in Turkey were conducted in the Marmara Region

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(5) and in the North Eastern Anatolia and Eastern Black Sea Region (6). Then, these studies were extended to many other parts of Anatolia. From these studies, the most promising selections have been described with regard to several tree and fruit characteristics (7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19) and even some of them have been released as standard cultivars (3, 4, 7, 10). The importance of these standard varieties and local promising selections for commercial production in Turkey has been recognized. Their use and demand are rapidly increasing in recent years, supported by the related official and civilian associations. The goal of this research was to select the most promising walnut genotypes for further breeding efforts, and to identify their desirable fruit and tree characteristics.

Material and Method

The study was conducted on seedling walnut trees (*Juglans regia* L.) in Ikizdere and its villages in the Rize province located in the East Black Sea Region of Turkey during 1997 to 1999. Annual rainfall averages 1102 mm and average relative humidity is approximate 75 percent (20). The seedling population consisted of 4200 walnut trees (21). After these trees were investigated for the first year, 119 of them were selected. Selected trees were not infected by walnut diseases such as anthracnose and walnut blight. In the second and third years, fifteen genotypes, which have kernel weight over 6 g were selected and important fruit and tree characteristics were described. Samples of ten fruits chosen randomly from the tree were used for evaluations and measurements. Tree characteristics such as height (m), width (m), trunk circumference (m), trunk length (m), time of leafing, flowering, flowering habit, terminal and lateral fruitfulness (%) on ten shoots chosen at random were determined (15, 19). In addition, data concerning fruit dimension (mm), inshell fruit weight (g), kernel weight (g), kernel percentage (%), shell thickness (mm), fruit shape, shell color, kernel color, kernel defect (%), kernel removal and kernel fullness were recorded (6,15,19). The selections were named as RWS (Rize walnut selections).

Results and Discussion

Seedling walnut trees belonging to Rize selections (RWS) had 5-32 m heights, 3-11.5 m widths, 0.35-1.85 m trunk circumferences and 0.95-2.85 m trunk lengths (Table 1). Differences in tree size was largely due to differences in tree ages. Selected genotypes were not infected by walnut diseases such as anthracnose and walnut blight.

The altitudes of native trees varied from 490 m to 915 m. The leafing and flowering occurred in April. Between 1998 and 1999, differences in flowering and leafing dates were observed. Although three selections (RWS-4, RWS-10 and RWS-13) had homogamous flowering habit, flowering habit was protandrous for the majority. All shoots from terminal buds of 'RWS-4' and 'RWS-7' produced pistillate flowers and fruits. Terminal fruitfulness for these two selections was 100%. Whereas, the others had terminal fruitfulness percentages ranging from 65% to 95%. 'RWS-13' had the highest rate (75%) of lateral fruits. In nine genotypes, the average percentage of lateral fruitful-

Table 1. Measurements on tree size of native walnut selections (1998).

Rize Walnut Selections	Tree height (m)	Tree Width (m)	Trunk circumference (m)	Trunk length (m)
RWS-1	32	11.5	1.45	2.85
RWS-2	5	2.5	0.35	1
RWS-3	23	8.5	0.95	2.25
RWS-4	28	13	1.84	2.35
RWS-5	16	9	1.25	2.7
RWS-6	8	3.7	0.58	1.5
RWS-7	13	7.4	1.2	1.8
RWS-8	23	9.5	1.35	2.55
RWS-9	7	4	0.63	1.15
RWS-10	11	4.5	0.65	2.7
RWS-11	27	13	1.85	2.15
RWS-12	14	8	1.05	1.75
RWS-13	22	11	1.25	1.9
RWS-14	6	3	0.65	0.95
RWS-15	11	4	1.07	2.42

Table 2. Time of leafing and flowering and fruiting characteristics of native walnut genotypes (1998-1999).

Rize Walnut Selections	Altitude of tree place	Leafing (April)	Flowering (April	Flowering habit	Terminal Fruitfulness (%)	Lateral Fruitfulness (%)	AFN on terminal shoots	AFN on lateral shoots	Harvest
RWS-1	490	10-14	14-23	PR	90	40	2.28	1.50	Mid-Sep.
RWS-2	750	10-15	15-24	PG	70	55	2.57	1.81	Late-Sep.
RWS-3	750	9-14	14-23	PR	90	45	1.94	1.68	Late Sep.
RWS-4	610	8-12	13-20	HM	100	30	2.25	2.00	Mid-Sep.
RWS-5	645	8-12	14-22	PG	90	45	2.36	1.78	Early Oct.
RWS-6	760	3-8	11-18	PR	70	40	2.38	1.53	Early Oct.
RWS-7	750	4-10	11-20	PR	100	65	2.55	1.92	Early Oct.
RWS-8	740	7-12	10-20	PR	85	65	2.60	1.62	Early Oct.
RWS-9	645	7-10	12-18	PR	65	55	2.55	1.48	Late Sep.
RWS-10	775	8-13	11-19	HM	85	60	2.26	1.42	Early Oct.
RWS-11	495	10-15	12-20	PR	80	40	2.50	1.88	Mid-Sep.
RWS-12	905	4-9	10-20	PG	90	65	2.14	1.68	Mid-Sep.
RWS-13	915	4-8	11-19	HM	90	75	2.34	1.45	Mid-Sep.
RWS-14	795	10-16	12-25	PR	95	55	2.06	1.36	Late Sep.
RWS-15	905	8-17	22-28	PR	65	50	2.36	1.70	Mid-Oct

PR: Protandrous; PG:Protogenous; MH:Homogamous; AFN: The average fruit number.

ness was higher than 50%. The average fruit number (AFN) changed between 1.94 and 2.60 on terminal shoots, and between 1.36 and 2.00 on lateral shoots. Also, harvest period extended from mid-September to mid-October (Table 2).

Inshell fruit dimensions showed fruit cheek varied from 31.3 mm to 42.3 mm. Fruit suture was between 29.7 mm and 41.7 mm, and fruit length were determined between 34.5 mm and 48.6 mm. The 'RWS-13' had the highest inshell fruit weight with 18.7 g, this selection was followed by 'RWS-10' (15.4 g), 'RWS-2' (15.3 g), 'RWS-4' (14.9 g), 'RWS-14' (14.5 g) and 'RWS-3' (14.3 g), respectively. Inshell fruit weights ranged between 11.8 g (RWS-12) and 18.7 g (RWS-13). In addition, selections produced kernels from 6.2 g (RWS-7) to 9.2 g (RWS-13). Kernel weights were over 7.0 g in eleven selections. Kernel percentages ranging from 47.0% to 60.2% were higher than 50% in eleven selections. On the other hand, shell thickness was between 1.0 mm (RWS-1) and 1.8 mm (RWS-9) (Table 3).

Fruit shape, color and kernel characteristics varied as shown in Table 4. For the majority of selections, kernel removal was "easy" and kernel fullness was "good".

Good inshell fruit and kernel quality are desirable and important properties for walnut cultivar improvement (1, 2, 3, 22). Commercial walnut cultivars grown in

Table 3. Inshell fruit dimensions, inshell fruit weight, kernel percentage and shell thickness of native walnut selections from 1997, 1998 and 2000 harvests.

Rize Walnut Selections	Inshell Fruit				Kernel Weight (g)	Kernel Percentage (%)	Shell Thickness (mm)
	Cheek (mm)	Suture (mm)	Length (mm)	Weight (g)			
RWS-1	31.9	29.9	42.3	12.5	7.5	60.2	1.0
RWS-2	36.0	41.7	48.0	15.3	7.7	50.3	1.2
RWS-3	34.6	36.0	42.1	14.3	7.9	55.4	1.2
RWS-4	31.3	33.1	35.7	14.9	8.0	54.0	1.5
RWS-5	31.3	33.4	38.4	12.2	6.9	57.5	1.0
RWS-6	32.1	31.9	40.9	14.5	8.0	55.0	1.6
RWS-7	34.1	30.9	39.9	11.8	6.2	52.6	1.1
RWS-8	33.5	31.7	38.2	13.3	7.0	52.9	1.1
RWS-9	32.2	31.8	40.6	13.8	6.6	48.6	1.8
RWS-10	35.3	37.3	39.7	15.4	7.2	47.0	1.1
RWS-11	33.3	29.7	41.4	12.1	6.3	52.0	1.3
RWS-12	34.0	33.0	34.5	11.8	6.4	54.4	1.5
RWS-13	42.3	41.2	48.6	18.7	9.2	49.5	1.6
RWS-14	31.8	32.2	41.9	14.5	7.1	49.1	1.7
RWS-15	33.3	37.7	40.9	11.8	6.4	54.5	1.5

California such as Payne, Hartley, Franquette, Chico, Sunland, Vina, Chandler, Pedro and Cisco, McGranahan and Leslie (2) reported a range of 10.9-17.5 g for inshell fruit weights, 5.0-9.9 g for kernel weights, 46-57% for kernel percentages and 5-95% for lateral fruitfulness. Hendricks (23) summarized similar fruit and tree characteristics of Californian walnut cultivars. The values of inshell fruit weight, kernel weight, kernel percentage and lateral fruitfulness percentage, McGranahan et al. (24) recorded as 13.3g, 7.1g, 75% and 78% for the cultivar 'Tulare', and 10.7g,

Table 4. Fruit shapes, shell colors and other important traits of native walnut selections (1997-1999).

Rize Walnut Selections	Fruit shape	Shell color	Kernel Color	Kernel defect (%)	Kernel removal[X]	Kernel fullness[Y]
RWS-1	oval	medium	blond	5	easy	good
RWS-2	round	dark	blond	11	easy	good
RWS-3	oval	medium	lightblond	0.5	easy	good
RWS-4	round	dark	lightblond	4	medium	medium
RWS-5	round	medium	blond	0	easy	good
RWS-6	oval	medium	lightblond	3.5	easy	good
RWS-7	round	medium	lightblond	0	easy	good
RWS-8	round	medium	lightblond	0	easy	good
RWS-9	oval	dark	lightblond	0	medium	medium
RWS-10	round	medium	lightblond	3	medium	medium
RWS-11	oval	medium	lightblond	0	easy	good
RWS-12	round	medium	blond	9	medium	good
RWS-13	round	medium	blond	11	easy	good
RWS-14	oval	medium	lightblond	0	medium	medium
RWS-15	round	medium	lightblond	0	medium	medium

[X]The ease of kernel removal.
[Z]The fullness of kernel in an inshell fruit.

5.0g, 69% and 91% for 'Chico', respectively.

Native walnut genotypes from this study were evaluated as promising with regard to fruit characteristics. Similar evaluations have been reported from many selection studies conducted in various parts of Turkey, and the most promising selections have been described (7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19). Turkish walnut cultivars such as 'Yalova-1', 'Yalova-3', Yalova-4', 'Kaplan-86', 'Sebin', 'Bilecik', '60 TU 1'. 'Sen-1', '1Sen-2', and 'Altinova' have been released from native selection studies. Celebioglu et al. (7) and Sen (3), recorded that Turkish walnut cultivars have good fruit characteristics, and lateral fruitfulness percentages ranging from 2% to 70%. In addition, Sen (25) and Sen (26) reported desirable fruit characteristics of Turkish cultivars and selections and their lateral fruitfulness percentages. Our evaluations have identified promising walnut genotypes. That will be used to further breeding efforts.

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