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Full Length Research Paper

Selection of walnut types with high fruit bearing and quality in Sanliurfa population

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This study was conducted to determine walnut types with high fruit bearing and fruit quality within seedling population in Siverek and Hilvan districts of Sanliurfa province and their villages in Turkey during years 2005 and 2006. No studies have been made about walnut trees in these areas up to now. Therefore, this research is very important with respect to be first study about the walnut types in these locations. During this research, firstly about 900 walnut trees were surveyed and 125 types in them were marked and evaluated. Based on the results of these evaluations, eleven walnut types were selected. It was determined that average fruit weight, fruit length, kernel weight, kernel ratio and form index of the selected types were changed from 14.31 to 9.63 g, from 44.93 to 34.00 mm, from 6.99 to 5.38 g, from 62.16 to 44.06% and 1.36 - 1.08, respectively. It was determined that moisture, ash, oil and protein ratios of the selected types were changed from 4.73 to 1.63%, from 2.89 to 1.88%, from 65.64 to 58.88% and from 20.18 to 13.70%, respectively. In addition, it was observed that protandrous and protogynous ratios of the selected types were found to be 63.63 and 33.37%, respectively. According to the weighted ranked method, in all walnut types, SU–5 and SU- 83 which had the higher scores were evaluated to be best walnut types.

Key words: Walnut, fruit properties, selection, Sanliurfa.

INTRODUCTION

Walnut *(Juglans regia* L.) is one of the main commercial species around the large parts of the world. This species is found throughout the world such as in the West Indies, Japan, China, Southern Asia from India and Turkey, in South Eastern Europe to the Carpathian Mountains of Poland, in the eastern and southern parts of the United States, in Mexico and Central America from Colombia to Argentina (McGranahan and Leslie, 1990).

Turkey with various eco-geographical regions is one of the major centers for Persian walnut diversity. Native walnut populations are widely present in our country (Jay-Allemand et al., 1996). and are found as scattered individuals or groups of several trees in the borders of agricultural lands, orchards or by the rivers, usually close to human settlements (Ferna´ndez-lopez et al., 2003). Turkey has a population of 4.926.985 walnut trees (Anonim, 2007). Nearly all of the walnut production of our country has been provided from walnut trees propagated by seeds (Celebioglu et al., 1988). With this number of walnut trees, the country is one of the top walnut produ-cers in the world (Germain, 1986; Sen, 1988). Various studies made out in several regions of Turkey have star-ted to fructify for last years and some high quality walnut types were obtained (Olez, 1976; Sen, 1980; Akca and Sen, 1994; Askin and Gun, 1995; Kuden et al., 1995; Akca and Ayhan, 1996; Akca and Osmanoglu, 1996; Akca and Muratoglu, 1996; Karadeniz and Sahinbas, 1996; Beyhan, 2005; Simsek and Osmanoglu, 2010). Some walnut types like Payne, Corne, Marbot, Parisienne and Sibisel were obtained by means of selection. They have been grown as standart types in several countries. (Germain, 1980; Radicati et al., 1990; Hsu, 1969). In Southeast Aanatolia Region of Turkey, summers are generally hot and arid and winters are mostly cold and rainy. The present study was carried out to the aim of selection of

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Table 1. Evaluation of the selected walnut types according to the weight-ranked method.

Characteristics	Weighting factor (coeficient)	Classifications and points		Characteristics	Weighting factor (coeficient)	Classifications and points	
Fruit weight	25	<17 g 15 - 17 g <15 g	25 20 15	Kernel ratio	20	<50% 45 - 50% < 45%	20 15 10
Shell roughness	15	Smooth Medium Roughness	15 10 5	Peel color	15	Light Dark Brown	15 10 5
Fruit width	5	<35 mm 30 - 35 mm	5 3	Shell adhesion	5	Weak Strong	5 3
Fullness ratio of kernel	5	90 - 100% 80 - 90% < 80%	5 3 1	Wholeness ratio of kernel	5	90 - 100% 80 - 90% < 80%	5 3 1
Shell thickness	5	< 1.2 mm 1.2 - 1.5 mm 1.5 mm <	5 3 1				
Kernel weight	25	<8.0 g 7 - 8 g < 7.0 g	25 20 15	Kernel ratio	20	<50% 45 - 50% < 45%	20 15 10
Inward color	20	Light Dark yellow Brown	20 15 10	Shell removal	15	Easy Medium Hard	15 10 5
Fullness ratio of kernel	5	90 - 100% 80 - 90% < 80%	5 3 1	Wholeness ratio of kernel	5	90 - 100% 80 - 90% < 80%	5 3 1
Ratio of non-sheriveling kernel	5	90 - 100%	5				

the unique walnut types in Siverek and Hilvan districs and their villages.

MATERIALS AND METHODS

The present study was carried out for selection of promising walnut types in Siverek and Hilvan districts of Sanliurfa province and in their villages during years 2005 – 2006, in Turkey. The promising walnut trees from seedlings were used as material. At the end of the pre-investigation in about 900 walnut trees, 125 types were found to be suitable for investigation. After having taken the fruit samples from the types, green outer peelings were peeled and the fruits were dried in a shade for a week. Then, they were dried in a drying chamber at 30°C for 24 h in order to homogenise their moisture levels (Solar, 1990; Szentivanyi, 1990). In 125 walnut types in 2005, 60 types which had less than 9.00 g of the fruit weight, less than 5.00 g of the kernel weight and less than 40.00% of the kernel ratio were eliminated. Afterwards, the investi-gated 65 types were evaluated with Weight-Ranked Method. The determination of selection criterions and constitution for the property classes were performed according to Sen (1980). It was multiplied weighting factor with cassification point for each property of the types. Then, the scores of all the properties of each type were collected. In this study, 30 nuts which were randomly chosen in each type were evaluated in each year (Table 1). While determining the selected types, flower habits, open date of male and female flowers, ratios of protogynous and protandrous trees were taken into account in 2006. In addition, dry matter was determined by using a 5 ± 0.01 g sample and drying in a thermostat at 105°C (24 h) to a constant weight. The moisture was calculated on a dry weight and fresh weight basis. The ash contents of the types were determined by using a ash furnace at 200°C with 24 h and then at 560°C with 12 h. The protein contents of the samples was

Table 2. The coordinates, altitudes and scores of the selected walnut types.

Type no.	Coordinate (East)	Coordinate (North)	Altitude (m)	Scores according to the walnut with shell	Scores according to the walnutwith kernel
SU-5	37535354	4179170	912	1170	1475
SU-11	37535270	4179065	907	930	1175
SU-24	37530321	4154024	768	985	1375
SU-43	37530301	4154046	768	955	1475
SU-50	37497754	4162837	582	1060	1375
SU-64	37497441	4162933	593	955	1475
SU-71	37497074	4162785	598	960	1275
SU-79	37487706	4160772	590	810	1275
SU-83	37488495	4160697	598	1170	1475
SU-87	37475217	4157560	580	845	1375
SU-95	37473365	4157443	562	955	1275

determined by using Kjeldahl method (Jung et al., 2003). The standard method for analyzing the oil content of the samples was made by hexan extraction in a soxhlet extractor (Seung, 1981). Percent con- tent of other matters in the samples was calculated and derived from moisture, ash, oil and protein contents (Akyuz and Kaya, 1992). The altitudes and coordinates of the types were determined by using GPS tool. At the and of the evaluation, eleven promising types were selected for advanced studies.

RESULTS AND DISCUSSION

Coordinates, altitudes and scores

The coordinates (in 2006), the altitudes (in 2006) and scores (average values of years 2005 - 2006) of the selected types were given in Table 2. According to the average values in the two years, the total scores of walnut with shell and with kernel changed from 1170 to 810 and from 1475 to 1175, respectively. The results of the scores in this research were partly different from that of Ozatar (1996) and Simsek and Osmanoglu (2010). Ozatar (1996) determined that the total scores of walnut with kernel and shell of the selected types changed from 1320 to 1475, from 1070 to 1290, respectively. In addition, Simsek and Osmanoglu (2010) determined that the total scores of walnut with kernel and shell of the selected types changed from 1575 to 1250, from 1295 to 1070, respectively. Scores of walnut types and cultivars can change according to the genetic characteristics, the maintenance requirements and the ecolojical conditions.

The coordinates of SU-5 type were 37535354 E-4179170 N and the coordinates of SU-95 type were 37473365 E-4157443 N. The altitudes of the selected types changed from 562 to 912 m. Simsek and Osmanoglu (2010) determined similarly the coordinates and altitudes of selected walnut types. Coordinates and altitudes of trees can change according to the point in their locations.

Physical properties

According to the average values of years 2005 - 2006, some physical properties of the selected walnut types were showed in Table 3. In this study, some significant results were obtained. It was determined that the weight, length width and height of the fruits, the shell thickness, the weight and ratio of the kernels and the form index changed from 14.31 to 9.63 g, from 44.93 to 34.00 mm, from 34.45 to 29.53 mm, from 35.92 to 29.69 mm, from 1.76 to 1.13 mm, from 6.99 to 5.38 g, from 62.16 to 44.06% and from 1.36 to 1.08, respectively. These results were partly different from those of some researchers. For example, Beyhan and Demir (2006) determined that the fruit weight and the kernel weight varied from 24.19 to 5.31 g and 10.73 to 2.06 g, respectively. Akca and Sen (2001) determined that the fruit weight, the kernel weight, the shell thickness, the fruit width and the fruit length changed from from 13.93 to 7.49 g, from 5.73 to 2.61 g, from 2.45 to 1.32 mm, from 32.26 to 22.30 mm and from 49.25 to 32.90 mm, respectively. Kuden et al. (1995) determined the kernel ratio changed from 41.44 to 56.25%. Beyhan and Ozatar (2007) determined the form index changed between 1.03 and 1.52. It was determined that all the selected types had easy shell leaving, 0.00% empty fruit ratio, 100% whole-ness and fullness ratios of kernel and no internal decay-ness. The shell roughness is one of the most significant criteria for the fruit quality properties. The shell rough-nesses of six types were smooth or medium. The kernel color of these types was light or brown. The peel color of the types was light or dark. The internal core status of the selected types was smooth or coreless. The internal ratio of non-shrink was 90 or 100% and they were smooth or coreless. Shell adhesion of the types was strong or weak. These results were partly similar to those of Beyhan and Ozatar (2007). They determined to be fair or smoorh of shell roughness, dark or light of peel color, light yellow, yellow, yellow brown and brown of kernel

Table 3. Some physical properties of the selected walnut types (average of years 2005 - 2006).

Type no	FW	FL	FWi	FH	KW	KR	ST	FI	RNSK	SR	KC	PC	SA	ICS
SU-5	11.01	34.00	31.61	31.63	6.40	58.31	1.44	1.08	100	Sm	L	L	St	Sm
SU-11	12.54	44.11	33.76	35.92	6.19	49.48	1.27	1.27	90	Sm	B	D	St	C
SU-24	14.17	39.45	33.98	32.08	6.99	49.38	1.76	1.19	100	M	L	L	St	Sm
SU-43	10.09	39.00	30.10	29.69	6.27	62.16	1.38	1.31	100	M	L	D	W	C
SU-50	14.16	38.58	33.83	33.23	6.50	45.90	1.76	1.15	90	Sm	L	L	St	C
SU-64	9.63	32.84	29.53	30.46	5.38	55.85	1.46	1.09	90	M	L	D	W	Sm
SU-71	13.15	44.93	32.79	33.36	5.78	44.06	1.67	1.36	100	Sm	L	L	St	C
SU-79	14.23	44.38	34.45	34.69	6.37	44.74	1.58	1.29	90	Sm	L	D	St	C
SU-83	11.05	38.83	31.47	31.11	6.43	58.17	1.21	1.24	90	Sm	L	L	St	Sm
SU-87	14.31	39.32	33.09	30.94	6.96	48.67	1.43	1.23	90	M	L	D	St	Sm
SU-95	11.34	39.81	31.00	31.51	6.53	57.61	1.13	1.27	100	M	B	D	St	C

FW: Fruit weight (g), FL: Fruit length (mm), FWi: Fruit width (mm), FH: Fruit height (mm), KW: Kernel weight (g), KR: Kernel ratio (%), ST: Shell thickness (mm), FI: Form index, RNSK: Ratio of non-shriveling kernel (%), SR: Shell roughness, KC: Kernel color, PC: Peel color, SA: Shell adhesion, ICS: Internal core status, Sm: Smooth, M: Medium, L: Light, B: Brown, D: Dark, St: Strong, W: Weak, C: Coreless.

Table 4. Some phenological (in 2006) and chemical (average values of years 2005 - 2006) properties of the selected walnut types.

Type no	FLT	FH	OTMF	OTFF	FBB	TFF	FBLS	HT	M	As	O	P	OM
SU-5	21-22 M	PD	30 M	6 A	4-5 A	11-12 A	90	5-15 Se	3.50	2.43	58.88	16.75	18.44
SU-11	21-22 M	PG	1 A	29 M	26-27 M	3-4 A	75	5-15 Se	2.54	2.89	62.60	18.88	13.09
SU-24	27-28 M	PG	6 A	3 A	1-2 A	8-9 A	80	10-15 Se	1.63	2.50	64.22	14.05	17.60
SU-43	27-28 M	PG	6 A	3 A	1-2 A	8-9 A	80	15-20 Se	2.55	2.42	65.16	13.70	16.17
SU-50	22-23 M	PD	30 M	7 A	3-4 A	10-11 A	90	10-15 Se	3.86	2.33	63.96	20.18	9.67
SU-64	25-26 M	PG	4 A	1 A	5-6 A	10-11 A	75	10-20 Se	4.73	2.41	59.17	17.00	16.69
SU-71	22-23 M	PD	30 M	7 A	3-4 A	10-11 A	90	10-15 Se	2.92	2.64	63.68	16.46	14.30
SU-79	22-23 M	PD	30 M	7 A	3-4 A	10-11 A	90	10-15 Se	3.54	2.87	64.74	19.60	9.25
SU-83	22-23 M	PD	30 M	7 A	3-4 A	10-11 A	90	10-15 Se	3.44	2.05	62.76	18.32	13.43
SU-87	22-23 M	PD	30 M	7 A	3-4 A	10-11 A	90	10-15 Se	1.98	2.66	63.47	14.55	17.34
SU-95	22-23 M	PD	30 M	7 A	3-4 A	10-11 A	90	5-15 Se	2.33	1.88	65.64	19.10	11.05

FLT: First leafing time, FH: Flower habit, OTMF: Opening time of male flowers, OTFF: Opening time of female flowers, FBB: First bud breaking, TFF: Time of full flowering, FBLS: Fruit bearing in the lateral shoots (%), HT: Harvest time, M: Moisture (%), As: Ash (%), O: Oil (%), P: Protein (%), OT: Other matters (%), PD: Protandrous, PG: Protogynous, M. March, A: April, Se: September.

color and the higher than 90% of ratio of non-shriveling kernel of the selected types. Kernel and peel colors of walnut types and cultivars can change according to the genetic proper-ties and light density.

Phenological and chemical properties

Phenological and chemical properties of the selected types were given in Table 4. According to Table 4, it was determined that first leafing time, opening time of male and female flowers, first bud breaking and time of full flowering, fruit bearing in the lateral shoots and harvest time of the selected types changed between 21 - 22 and 27 - 28 March, 30 March - 6 April and 29 March - 7 April, 26 - 27 March and 5 - 6 April, 3 - 4 April and 11 - 12 April, 90 - 75% and 5 - 15 September and 15 – 20 September, respectively. In addition, it was determined that the protandrous and the protogynous of these types observed as 63.63 and 33.37%, respectively. These results were partly similar to the those of Beyhan and Ozatar (2007). They observed that the flowering habit of the selected types was determined as 58.59% protan-drous, 28.30% protogynous and 13.20% homogomous. Many phenological properties of walnut types and culti-vars can change according to the genetic characteristics and the climatic conditions.

In addition, it was determined that the moisture, the ash, the oil, the protein and the other matter content of the selected types changed from 4.73 to 1.63%, from 2.89 to 1.88%, from 65.64 to 58.88%, from 20.18 to 13.70% and from 18.44 to 9.25%, respectively. In this research, the chemical properties of each selected type were different from both those of

the other types in this research and the those of some researchers. For examle, Dogan and Akgul (2005) determined that the oil content of the walnut types changed from 70.00 to 65.00%. Oguz and Askin (2007) determined that the protein, the oil, the moisture and the ash content of the walnut types changed from 20.75 to 12.11%, from 67.63 to 54.07%, from 3.79 to 2.70% and from 2.22 to 1.00%, respectively. Chemical properties of walnut types and cultivars can change according to the genetic characteristics, the maintenance requirements and the ecological conditions.

Conclusion

The selected eleven walnut types appear promising with some unique properties for further investigations. For example, SU-83 type has the highest with respect to total score. In addition, the selected types can be suitable for the regions as in the Southeast Anatolia Region. In addition, these types should be done of the adaptations in the same ecological conditions with standard walnut types and cultivars. Then, as a result of adaptation, the best walnut types and cultivars can be produce and contribute to the economy of our country. As a result, it is believed that if the production and growing processes of the selected types are controlled scientifically, these results can be much more satisfactory.

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