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Physical and Chemical Properties of Superior Walnut Types in Cermik and Cungus Populations

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Abstract

This study was conducted out to determine physical and chemical properties of the superior walnut types within seedling population in Cermik and Cungus Populations and their bound villages of Diyarbakır province in Turkey during years 2006 and 2007. No studies have been made about walnut trees in these populations up to now. Therefore, the study is very significant with respect to be first study about the walnut types in these areas. Firstly, 850 walnut trees were surveyed and 105 types in them were marked and evaluated. Based on the results of these evaluations, 12 walnut types were selected as ''promising types'' with respect to fruit quality properies. Average fruit weight, the fruit length, the kernel weight, and the kernel ratio of the types were changed between 15.22-10.19 g, 42.89 mm – 34.42 mm, 7.33 g – 5.26 g and 59.75 – 48.24%, respectively.
The moisture, the ash and the oil of the types were changed between 4.07-1.90%, 3.90-1.75% and 67.88-58.44%, respectively. In addition, the protandrous, the protogynous and homogynous ratios of the types were determined to be 50.00%, 33.33% and 16.66%, respectively.

Key words: Walnut, Physical and Chemical Properties, Weighted ranged method, Diyarbakır

INTRODUCTION

Walnut (*Juglans regia* L.) is an significant fruit in the nut species. The species are 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 (1). Turkey with various eco-geographical regions is one of the major centers for Persian walnut diversity. Native walnut populations are widely present in this region (2) 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 (3).

Turkey has a population of 4.926.985 walnut trees (4), most of which are wild walnut trees grown from seeds. With this number of walnut trees, the country is one of the top walnut producers in the world (5, 6). Nevertheless, lack of standardization in these products may cause some problems in marketing. Furthermore, it may be stated that unless productivity is increased, standardization is provided in production of walnuts and covered gardens are established with these standard varieties, some problems even in domestic consumption of these products will be inevitable in near future. This potential constitutes a very rich genetic source for Turkey. So, the first and the most important thing to do is to select the walnuts with highest fruit quality properties among these various types of walnuts by means of "selection", and to promote the plantation of these types throughout the country. In this aim, various studies made out in several regions of Turkey for last years have started to fructify and some high quality walnut types were obtained (7-16) . Some walnut types like Marbot, Payne, Corne, Parisienne and Sibisel are grown as standart types in several countries and they have obtained by means of selection (17-19). This study was carried out to select and determine physical and chemical properties of the walnut types within seedling populations in Cermik and Cungus districts and their bound villages of Diyarbakır province. The results obtained from this study also proved the importance of the research.

MATERIALS and METHODS

This study was carried out on walnut populations naturally grown in Cermik and Cungus districts and their bound villages of Diyarbakır province of Turkey during 2006–2007. 105 walnut types were marked and evaluated from about 850 walnut trees. In this context, 30 fruits were randomly selected from the each walnut tree in each year. 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 hours in order to homogenise their moisture levels (20, 21). After that, the fruits were analysed according to the randomly blocks design with 3 replication and 10 fruits in each replication for the each year. According to specifications of these walnuts, twelve walnut types were selected via weighted ranged method (8). The fruit weight and kernel weight were measured with a scale sensitive to 0.01 g. The fruit height, the fruit length, the fruit width and the fruit thickness of the types were measured by a digital compass. The data were subjected to analysis of variance using JMP 5.0.1. The means were separated by Tukey's test at 0.05. In addition, dry matter was determined by using a 5±0.01 g sample and drying in a thermostat at 105 ^{o}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 ^{o}C with 24 h and then at 600 ^{o}C with 10-12 h. The determination of the protein contents of the samples were determined by using Kjeldahl method (22). The standard method for analyzing the oil content of the samples was made by hexan extraction in a Soxhlet extractor (23). Percent contents of other matters in the samples were calculated with deriving from the moisture, the ash, the oil and the protein contents of walnut samples (24).

RESULTS and DISCUSSION

Average findings and volatilities (min-max) of superior walnut genotypes in first and second years

In this research, Cermik and Cungus districts and their bound villages in Diyarbakır province thought to be rich in walnut tree population were visited and about 850 walnut trees were observed and the the fruit samples were taken from 105 trees among them according to their fruit and tree quality specifications in 2006. In 105 walnut types in the same year, 50 types which have 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. After that, According to weighed ranged method, the data regarding some fruit properties obtained from 55 superior walnut types in years 2006 and 2007 were given in Table 1. According to the average values in the first year, the fruit weight, the kernel weight, the kernel ratio, the shell thickness, the fruit length, the fruit width, the fruit height and the form index of selected walnut types were determined to be 11.99 g, 5.79 g, 48.84%, 1.58 mm, 37.27 mm, 30.45 mm, 31.90 mm and 1.20. In the same year, the min. and max. volatilities in these figures were changed between 9.44-16.00 g, 5.19-7.19 g, 42.02-59.85%, 1.13-1.94 mm, 33.91-43.86 mm, 28.27-32.49 mm, 28.94-34.99 mm and 1.08-1.39. In addition, according to the average values in the second year, the fruit weight, the kernel weight, the kernel ratio, the shell thickness, the fruit length, the fruit width, the fruit height and the form index of the types were determined to be 11.96 g, 5.83 gr, 49.22 %, 1.55 mm, 37.22 mm, 30.86 mm, 31.84 mm and 1.19, respectively. Also, in the second year, the min. and max. volatilities in these figures were changed between 9.47-14.87 gr, 5.11-8.78 gr, 40.05-70.66 %, 1.30-1.89 mm, 33.12-42.71 mm, 28.30-33.10 mm, 29.06-35.00 mm and 1.09-134, respectively. These results were similar to mostly those of Beyhan (16). He (16) determined that the fruit weight, the kernel weight, the kernel ratio, the shell thickness, the fruit length, the fruit width, the fruit height and the form index of the types were determined to be 14.22 g, 7.45 g, 52.73%, 1.09 mm, 43.06 mm, 35.16 mm and 36.95 mm, respectively. In addition, He determined that the min. and max. volatilities in the figures changed between 11.16–16.00 g, 6.18–9.88 g, 43.43%-67.73%, 0.66–1.33 mm, 39.38-44-56 mm, 32.92-37.25 mm and 34.26-40.26 mm, respectively. According to the average findings of superior walnut types in first year, Beyhan and Ozatar (25) determined that the fruit weight, the kernel weight, the kernel ratio, the shell thickness, the fruit length, the fruit width and the fruit height changed 14.70 g, 7.08 g, 49.08%, 1.51 mm, 40.25 mm, 33.87 mm and 34,91 mm, respectively. In addition, they determined that the min. and max. volatilities in the figures changed between 10.30–23.15 g, 6.05–10.48 g, 40.00-60.08%, 0.91–1.90 mm, 34.98–50.08 mm, 28.21-40.44 mm and 28.95-40.07 mm. The reason of difference partly between the results of these researchs in term of the types can chance according to properties such as genetic characteristics, the maintenance requirements and the ecolojical conditions.

Table 1. Some fruit properties of the types (average values in years 2006 and 2007).

Characteristics	Average findings (2006)	Volatility (min-max) (2006)	Average findings (2007)	Volatility (min - max) (2007)
Fruit weight (gr)	11.99	9.44-16.00	11.96	9.47-14.87
Fruit length (mm)	37.27	33.91-43.86	37.22	33.12-42.71
Fruit width (mm)	30.45	28.27-32.49	30.86	28.30-33.10
Fruit height (mm)	31.90	28.94-34.99	31.84	29.06-35.00
Shell thickness (mm)	1.58	1.13-1.94	1.55	1.30-1.89
Kernel weight (gr)	5.79	5.19-7.19	5.83	5.11-8.78
Kernel ratio (%)	48.84	42.02-59.85	49.22	40.05-70.66
Form index	1.20	1.08-1.39	1.19	1.09-1.34

Physical properties of superior walnut types

According to the average values of years 2006-2007, some physical properties of the superior types were showed in Table 2. The fruit weight, the fruit length, the fruit width, the fruit height, the shell thickness, the kernel weight, the kernel ratio and the form index of types were changed between 15.22-10.19 g, 42.89 mm – 33.77 mm, 32.71 mm – 29.46 mm, 34.17 mm – 29.84 mm, 1.90 mm - 1.23 mm, 7.33 g – 5.26 g, 59.75 – 46.84 % and 1.35 - 1.10, respectively. The results in this research were different from partly those of Küden et al. (11) , Beyhan and Ozatar (25) and Akça and Sen (26). They (11) determined that the kernel ratio changed between 51.29 and 56.25% except D-1 (41.44%). They (25) determined that the form index changed between 1.03 and 1.52. They (26) determined that the fruit weight, the kernel weight, the shell thickness, the fruit width and the fruit length were changed between 7.49 g - 13.93 g, 2.61 g - 5.73 g, 1.32 - 2.45 mm, 22.30 - 32.26 mm and 32.90 - 49.25 mm, respectively. The reasons of the difference between this research and the other researches can chance according to properties such as genetic characteristics, the maintenance requirements and the ecolojical conditions.

Some other physical properties of the superior types were showed in Table 3. The shell roughness is one of the most significant criteria for the fruit quality properties. The shell roughnesses were smooth of three types, medium of five types and roughness of four types. The kernel colours of the types were light, yellow or brown. The peel colours of the types were light, brown or dark. Shell adhesions of the types were strong or weak. Shell leaving of types was strong or weak. The results in this study were partly different from those of Beyhan and Ozatar (25). They (25) determined to be fair or smoorh of shell roughness, dark or light of peel color, light yellow, yellow, yellow brown and brown of kernel colour and the higher than 90% of internal ratio of non-shrink of types. In addition, it was determined that all the types had 0.00% empty fruit ratios, 90 % internal ratio of non-shrink, 100% wholeness ratios of kernel and no internal decayness. Kernel colour and peel colour of walnut types and cultivars can change according to the genetic properties and light density.

Chemical Properties of Superior Walnut Types

According to the average values of years 2006-2007, the chemical properties of the superior walnut types were given in Table 4. According to the Table 4, the moisture, the ash, the oil, the protein and the other matters of the types were changed between 4.07-1.90%, 3.90-1.75%, 67.88-58.44%, 18.78-13.41% and 20.60-11.77%, respectively. In this research, the results related to chemical properties of superior walnut types were mostly similar to the results of Dogan and Akgül (27) and Oguz and Askın (28). They (27) determined that the oil contents of the walnut types changed between 65.00 and 70.00%. They (28) determined that the protein, the oil, the moisture and the ash contents of the walnut types changed between 12.11-20.75%, 54.07-67.63%, 2.70-3.79% and 1.00-2.22%, respectively. The protein, the

Table 2. Some physical properties of superior walnut types (average of years 2006-2007).

Type No	Fruit Weight (g)	Fruit length (mm)	Fruit width (mm)	Fruit height (mm)	Kernel weight (g)	Kernel ratio (%)	Shell thickness (mm)	Form index
CE-6	15.22 a	38.36 d	32.71 a	33.82 b	7.33 a	48.24 c-f	1.62 c	1.15 fg
CE-10	11.54 e	35.02 h	31.47 b	30.55 f	5.41 bc	46.84 c-f	1.52 d	1.13 h
CE-18	11.60 e	34.42 ı	30.24 d	32.03 e	5.26 c	45.35 def	1.90 a	1.11 ı
CE-30	12.91 c	34.62 ı	30.34 cd	32.54 d	5.41 bc	41.94 f	1.75 b	1.10 ı
CE-43	10.22 fg	40,01 b	28.90 f	30.33 fg	5.75 bc	56.32 ab	1.47 d	1.35 a
CE-51	13.34 b	37.66 e	31.27 b	33.76 b	5.96 bc	44.81 def	1.54 d	1.16 f
CI-57	12.35 d	42.89 a	31.33 b	34.17 a	6.26 b	50.66 b-e	1.48 d	1.31 b
CI-65	10.39 fg	33.77 j	29.58 e	29.66 h	6.17 b	59.75 a	1.23 f	1.14 gh
CI-72	12.29 d	38.62 cd	30.77 c	32.55 d	5.56 bc	45.31 def	1.35 e	1.22 d
CI-77	10.60 f	35.81 g	29.54 e	29.84 g	5.70 bc	54.16 abc	1.64 c	1.21 de
CI-83	13.07 bc	38.78 c	32.28 a	32.92 c	5.66 bc	43.33 ef	1.63 c	1.19 e
CI-96	10.19 g	36.96 f	29.46 e	30.23 g	5.26 c	51.65 bcd	1.66 c	1.24 c

oil, the moisture and the ash contents of the walnut types can change according to the genetic characteristics, the maintenance requirements and the ecological conditions.

Total score, location, altitude and flower habit of the superior walnut types

Total score, location, altitude and flower habit of the superior walnut types were showed in Table 5. According to the average values in the two years, the total scores of walnut with shell and with kernel were changed between 920–1330 and 1125–1550, respectively. The results of the scores in this research were different from mostly those of Ozatar (29). He (29) determined that the total scores of walnut with kernel and shell of the selected types were found to be between 1320–1475, 1070–1290, respectively. Scores of walnut types and cultivars can chance according to the genetic characteristics, the maintenance requirements and the ecolojical conditions. The locations of CE-6, CE-10, CE-18, CE-30, CE-43 and CE-51 types were Cermik and the locations of the other types were Cungus. The altitudes of superior walnut types were changed between 721 m and 1040 m. The altitudes of the selected almond types were determined (30, 31). The altitudes of trees can change according to the point in their locations. In addition, flower habit of the types were determined to be 50.00% for Protandrous, 33.33% for Protogynous and 16.66% for Homogynous, respectively. Flower habits of superior walnut types and cultivars can chance according to the genetic characteristics.

Table 4. Chemical properties of superior walnut types (average of years 2006-2007).

Type No	Protein (%)	Oil (%)	Moisture (%)	Ash (%)	Other matters (%)
CE-6	13.41	65.77	2.98	2.55	15.29
CE-10	16.10	64.46	1.97	2.43	15.04
CE-18	15.65	66.07	2.41	2.29	13.58
CE-30	14.55	67.65	3.12	2.91	11.77
CE-43	13.44	67.88	3.99	1.75	12.94
CE-51	15.32	64.11	3.21	1.88	15.48
CI-57	16.66	64.56	3.45	2.83	12.50
CI-65	19.31	63.11	3.28	1.99	12.31
CI-72	15.87	58.44	3.11	2.54	20.04
CI-77	14.45	64.28	1.90	2.64	16.73
CI-83	16.98	55.13	3.39	3.90	20.60
CI-96	18.78	63.39	4.07	2.77	10.99

CONCLUSION

In the research, the superior walnut types within seedling population of Cermik ad Cungus districts and their bound villages of Diyarbakır province in Turkey were seen their outperform in point of the properties and some very important results were been obtained with regard to the physical properties which had important measures as "selection criteria". Chemical properties in the research were found to be similar to many walnut studies in the country. This could be explained by the fact

Table 3. Some other physical properties of the types (average of years 2006-2007).

Tip no	Shell leaving	Shell adhesion	Fullness ratio (%)	Shell roughness	Kernel colour	Peel Colour
CE-6	Strong	Strong	90	Smooth	Brown	Dark
CE-10	Easy	Weak	90	Medium	Light	Light
CE-18	Easy	Weak	90	Medium	Light	Light
CE-30	Medium	Weak	80	Smooth	Yellow	Dark
CE-43	Medium	Weak	90	Roughness	Yellow	Dark
CE-51	Medium	Weak	80	Roughness	Yellow	Brown
CI-57	Medium	Weak	90	Smooth	Yellow	Brown
CI-65	Easy	Weak	90	Medium	Light	Light
CI-72	Easy	Weak	90	Medium	Light	Brown
CI-77	Easy	Weak	90	Roughness	Light	Light
CI-83	Medium	Weak	90	Roughness	Yellow	Dark
CI-96	Easy	Weak	90	Medium	Light	Light

Table 5. Location, altitudes, flower habit and total Scores (average of years 2006-2007) of superior walnut types

Type no	Score according to the walnut with shell	Score according to the walnut with kernel	Flower habit	Altitude (m)	Location
CE-6	1260	1225	Protandrous	722	Cermik
CE-10	1220	1450	Protogynous	721	Cermik
CE-18	1220	1450	Protogynous	725	Cermik
CE-30	995	1125	Protandrous	789	Cermik
CE-43	1105	1375	Protandrous	768	Cermik
CE-51	920	1125	Protogynous	736	Cermik
CI-57	1330	1375	Homogynous	1018	Cüngüş
CI-65	1320	1550	Protandrous	924	Cüngüş
CI-72	1155	1450	Homogynous	1040	Cüngüş
CI-77	1235	1550	Protogynous	940	Cüngüş
CI-83	995	1275	Protandrous	890	Cüngüş
CI-96	1320	1550	Protandrous	902	Cüngüş

that ecological factors do not solely affect the composition of walnuts, genetic factors and horticultural applications might also be responsible for their composition. As a conclusion, it is believed that if the production and growing processes of the superior walnut types are controlled scientifically, these results can be much more satisfactory.

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