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DETERMINATION OF SOME PHYSICAL AND CHEMICAL PROPERTIES OF WALNUT (*JUGLANS REGIA L.*) GENOTYPES GROWN IN THE CENTRAL DISTRICT OF BITLIS/TURKEY

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Abstract

This research was carried out to determine the superior walnut genotypes grown within seedling population between 2009-2012 years in the Central District of Bitlis. For this purpose, fruit samples were taken from 120 walnut genotypes. It was found that 17 walnut genotypes were determined as promising with regard to fruit characteristics. The quantity of fruit weight, kernel weight and kernel ratio were determined as 10.42-14.25 g, 4.52-7.44 g, 42.38-54.07 % respectively for the promising genotypes. The contents of protein (12.45 - 20.04 %), fat (58.44 - 67.14%) and ash (1.44 - 2.14 %) were determined as the quantity in the selected genotypes. The quantity of K, Ca, Mg, Cu and Zn contents in kernels of the selected genotypes were analyzed. The following results were found for K contents changing from 408.37 to 569.48 mg/100g, for Ca contents 194.79 to 267.85 mg/100g, for Mg contents 241 to 426 mg/100g, for Cu contents 0.72 to 1.43 mg/100g and while Zn contents were determined as 1.93-3.47 mg/100g in kernels. In conclusion, some of these selected genotypes can be recommended for the farmers in the region.

Key words: *walnut, genotypes, breeding, pomology, selection, Bitlis, Turkey.*

INTRODUCTION

Starting from the south of the Carpathian Mountains, Eastern Europe and Turkey, Iraq, Iran and the Himalayan Mountains to the east beyond the remaining countries well into the area of walnut having a very broad habitat. Although 18 species are known where on earth *Juglans regia* L. is cultivated in Turkey.
Walnut production in Turkey where inside of orchards and grown in garden borders scattered with walnut trees grown from seed are common practices (Şen, 1980). However, in the last few years there have been positive developments in the cultivation of walnuts. In recent years, walnut orchards established with the grafted nursery plants in the form of the closure is seen that production started to spread (Akça, 2001; Çiftçi, 2004).
It has been emphasized that primary importance of fruit quality criteria in selection breeding of walnut are fruit weight, fruit length, kernel weight, internal rate, shell thickness, shell and interior color, ash content, protein and fat ratio (Germain, 1997; Mitroviç et. al., 1988; Akça, 2005; Yarılgaç, 1997; Muradoğlu, 2005).
In this research, within very dense population of the walnut trees grown from seed in Bitlis district is intended to reveal the superior quality of genotypes. Therefore, it was aimed to determine some physical and chemical properties of walnut (*Juglans regia L.*) genotypes grown in the central district of Bitlis/Turkey.

MATERIALS AND METHODS

This work was carried out in the center of the province of Bitlis between the years 2009-2012. In this study, 120 walnut genotypes were determined and used as plant material on 3 consecutive years. The samples were taken from the fruit of these trees. Measurements and weighing were taken randomly 30-60 fruit from the trees.
Fruits physical measurements were made after drying in the shade. Features such as shelled fruit weight, kernel weight, kernel ratio, shell thickness, fruit length, fruit width, fruit height were determined (Şen, 1980). While weighing 0.001 g was performed with sensitive precision

scales, measuring was made with 0.01 mm precision digital caliper.

Walnut kernels were grinded and moisture determination were made before chemical analysis. Protein ratio with Khejdal method (Flagged, 1987) and fat content of kernels with Soxholet method (Akyuz and Kumar, 1992) was determined. In the determination of ash content, grinded kernels were analyzed after the furnacing at the 100, 200, 600 °C kept until the gray-white colors (Şen, 1980).

In walnut kernels, in order to determine content of potassium, iron, copper, calcium, sodium, manganese, magnesium and zinc, 0.5 g samples were taken and these samples were burned at 200 °C for 2 hours, 6 hours at 500 °C. For cooling the samples, 5 ml of 3 N HCL and 10 ml of pure water was added after 5 min. After the filtration with Whatman 42 filter paper the samples was completed to 50 ml with distilled water in the 50 ml round-bottomed flask. 0.5 g kernels filtrates obtained by dry combustion of the spectrophotometer phosphorus, potassium readings were performed and results were reported in ppm.

RESULTS AND DISCUSSIONS

In terms of fruit properties, evaluated as superior 17 genotypes were identified as promising compared to other genotypes. Some physical and chemical properties of the promising 17 genotypes were determined and are presented in Table 1, 2 and 3.

Table 1. Some physical properties of walnut genotypes

Genotypes	Fruit weight (g)	Kernel weight (g)	Kernel ratio (%)	Shell thickness (mm)	Fruit width (mm)	Fruit height (mm)	Fruit length (mm)
13 BİT 01	11.25	5.24	46.58	1.20	32.46	30.47	40.25
13 BİT 02	13.76	7.44	54.07	1.35	32.68	31.41	36.70
13 BİT 03	13.92	6.32	45.40	1.45	33.86	31.64	37.48
13 BİT 04	11.85	5.73	48.35	1.15	32.85	31.14	41.48
13 BİT 05	10.42	4.52	43.38	1.76	31.45	30.64	37.17
13 BİT 06	12.62	5.80	45.96	1.62	28.67	25.02	32.97
13 BİT 07	11.74	6.21	52.90	1.42	29.24	26.79	34.14
13 BİT 08	14.24	6.56	46.07	1.54	32.76	29.48	37.24
13 BİT 09	11.42	4.84	42.38	1.80	31.98	30.12	37.17
13 BİT 10	12.69	5.80	45.71	1.32	30.45	28.42	35.56
13 BİT 11	12.45	5.97	47.95	1.47	33.48	30.87	39.35
13 BİT 12	11.48	5.84	50.87	1.34	32.76	31.29	38.15
13 BİT 13	13.26	5.98	45.10	1.57	29.70	26.22	34.08
13 BİT 14	14.25	6.54	45.89	1.48	30.06	28.43	35.37
13 BİT 15	12.74	6.07	47.65	1.36	32.76	31.04	43.24
13 BİT 16	11.66	5.87	50.34	1.27	32.47	30.14	37.43
13 BİT 17	12.98	6.05	46.61	1.74	31.07	29.04	36.18

The lowest nut weight 10.42g (13 BIT 05) and the highest 14.25g (13 BIT 14) were identified in the selected genotypes. The lowest kernel weight 4.52g (13 BIT 05) and the highest kernel weight 7.44g (13 BIT 02) were determined, whereas the lowest % 42.38 (13 ICT 09) and the highest kernel ratio 54.07% (13 BIT 02) were identified. Muradoğlu and Balta (2010) carried out a survey in Ahlat region and reported 9.91-15.22g fruit weight, 5.00-6.24g kernel weight, 40.9-52.3 % kernel ratio for 15 genotypes as promising. In the same survey, the shell thicknesses were determined between 1:22 to 2:05 mm. In our study, as the thin shell thickness 1.20 mm (13 BIT 01) was determined as the highest shell thickness was for 13 ICT 09 genotype (1.80 mm). In the study carried out in the region of Kastamonu, a selection of promising genotypes was identified as 9:04-14.13g fruit weight, kernel weight 5.79-8.58g and the kernel rate of 53-65.38% (Abdis, 2010).

This study revealed that, the 13 bit 03 genotype had widest fruits (33.86 mm), the narrowest fruits (28.67 mm) were obtained from 13 bit 06 genotype. Fruit height changed between 25.2 mm (13 BIT 06) - 31.64 mm (13 BIT 03). Fruit length was found between 32.97 mm (13 BIT 06) - 41.48 mm (13 BIT

04). Şimşek (2010), found that selecting types of walnut fruit length 33.1-42.5 mm, fruit width 28.9-35.4 mm, 27.7-34.9 mm for the height of the fruit obtained in Diyarbakir region. The values found in similar studies conducted in our country (Oğuz and Aşkın, 2007; Şimşek and Osmanoğlu, 2010; Karadeniz, 2011; Çelik et. al., 2011) are in line with the values in our study

The protein, fat, moisture and ash contents of the promising walnut genotypes are given in Table 2.

Table 2. Some chemical properties of walnut genotypes

Genotypes	Protein (%)	Fat (%)	Humidity (%)	Ash (%)
13 BİT 01	12.48	64.84	2.82	1.75
13 BİT 02	13.65	62.14	3.24	2.01
13 BİT 03	14.98	65.47	3.84	1.65
13 BİT 04	18.35	66.79	2.14	1.44
13 BİT 05	20.04	67.41	2.48	1.87
13 BİT 06	17.54	62.78	2.44	1.82
13 BİT 07	16.76	63.96	3.07	1.61
13 BİT 08	12.45	58.44	3.98	1.44
13 BİT 09	14.29	67.14	2.85	1.52
13 BİT 10	13.25	64.72	2.19	1.79
13 BİT 11	17.98	66.78	2.99	1.82
13 BİT 12	16.84	65.80	2.44	1.76
13 BİT 13	12.47	59.42	2.75	1.63
13 BİT 14	15.14	65.48	3.14	1.25
13 BİT 15	15.48	67.11	3.04	2.14
13 BİT 16	18.93	67.09	2.46	1.95
13 BİT 17	19.47	64.48	2.17	1.47

These genotypes protein ratio were detected between 12.45% (13 Bit 08) and 20.4% (13 Bit 05). Most low-fat ratio were identified as 58.44% (13 BIT 08) and the highest fat content as 67.14% (13 BIT 09). It was found that moisture ratio was between 14.2 (13 bit 04)-3.98 (13 bit 08) % and the ash ratio 1.44 (13 BIT 04)-14.2% (13 bit 15) in the selected genotypes. Northeast Anatolia and Eastern Black Sea region selection made in the study of fat and protein content of 70-80% were reported to vary between 20-52% (Sen, 1980). In a research conducted in Hakkari district and Ahlat region, protein ratio was found between 13.9-23.3%, whereas oil 51.3-59.9%, ash 1.01-2.51 and humidity 1.0-4.2%.

In other study conducted in Ermenek region, the protein contents were determined as 12.11-20.75%, oil ratio 54.08-67.63%, moisture ratio 2.70-3.79%, ash 1.00-2.22% (Oğuz, 1998). In another study conducted in the region of Gevaş, fat, protein and ash were determined as 54.89-68.20%, 12.11 to 23.43% and 1.62-3.21% respectively (Yarılgaç, 1997). With the findings obtained in other studies are consistent with the findings in this study.

Some mineral contents in walnut kernels are given in Table 3.

Table 3. Kernels mineral elements content of walnut genotypes

Genotypes	K (mg)	Ca (mg)	Mg (mg)	Fe (mg)	Mn (mg)	Cu (mg)	Zn (mg)
13 BİT 01	428.98	254.21	328	2.45	2.78	1.12	2.14
13 BİT 02	552.16	241.48	345	3.26	2.84	0.84	3.14
13 BİT 03	435.48	194.79	367	2.47	3.48	0.99	2.98
13 BİT 04	478.87	267.85	287	3.36	2.12	0.65	2.26
13 BİT 05	524.76	246.24	248	2.35	3.56	1.16	3.02
13 BİT 06	489.32	213.68	259	1.78	3.24	0.72	2.48
13 BİT 07	492.47	224.78	332	2.84	2.84	0.90	2.90
13 BİT 08	472.42	216.98	314	2.44	2.63	0.78	2.00
13 BİT 09	408.37	284.40	278	2.58	2.55	1.43	2.04
13 BİT 10	569.48	224.75	256	3.98	1.24	1.26	2.14
13 BİT 11	524.82	253.13	241	1.15	1.04	0.84	2.12
13 BİT 12	423.96	264.77	426	1.08	3.62	0.76	2.07
13 BİT 13	487.42	279.82	241	2.57	1.42	1.20	1.93
13 BİT 14	499.04	212.34	349	2.63	1.03	1.05	1.98
13 BİT 15	514.74	234.42	264	2.98	1.09	0.78	2.68
13 BİT 16	529.45	248.75	289	1.02	2.00	0.87	3.47
13 BİT 17	489.34	203.20	277	3.36	1.09	0.84	2.88

The examined genotypes potassium ratio was found between 408.37 mg (13 BIT 09) and 569.48 mg (13 BIT 10) according to analyzes results of the 100 g samples. The amount of calcium was changed between 194.79 mg (13 BIT 03) and 267.85 mg (13-bit 04). In the promising genotypes were determined as the content of magnesium 241 mg (13 bits 13) and 426 mg (13 bit 12). The amount of iron in the selected genotypes were determined as 1.02 mg (13 BIT 14) and 3.98 mg (13 bit 10) and manganese content 2.55 mg (13 BIT 09) and 3,24 mg (13 bit 06). The amount of copper was between 0.72 -1.43 mg (13 BIT 06) and the zinc content was determined as 1.93 (13 BIT 13) and 3.47 mg (13 ICT 16). High amounts of potassium (390-700 mg/100g), phosphorus (310 to 510 mg/100g) and magnesia (90 -140 mg/100g) and lower amounts sodium content (1-15 mg/100g) were reported in walnut kernels (Ravai, 1992; Payne, 1985; Feinberg et. al., 1987; Klepping et. al., 1989; Souci et. al., 1994).

Muradoğlu et. al., (2011) in Bingol region reported in a study that the amounts of calcium changed between 60.34 and 278.76 mg and average amount of calcium was determined as 148.76 mg in 100 g kernels. The average amount of Mg in the promising genotypes were reported to be 166.75 mg. The same researchers reported as average content of iron, manganese, copper and zinc 3.41, 1.93, 1.27 and 2.01 mg/100g respectively in the kernels of selected genotypes. (Muradoğlu et al., 2011).

In the other study conducted at Bahçesaray districts and Van region the values of Mg (1020 -1680 mg/kg), Ca (640 -1180 mg / kg), Mn (18.80 -50.60 mg / kg), Zn (19.6 -43.60 mg/kg), Fe (28.0 -139.8 mg/kg) and Cu (10 - 27.20 mg/kg) were determined for the macro and micro nutrients in selected walnut genotypes (Koyuncu et. al., 2002). The results obtained in this study were consistent with the values reported by other researchers.

CONCLUSIONS

In this study, the promising walnuts grown from seed at the center of Bitlis some physical and chemical properties were investigated. The results showed that our selected qualified walnut genotypes compete with the selected genotypes in other studies. In addition, our selected genotypes under better care conditions are thought to give better results. With the future adaptation studies in the same environmental conditions, our selected genotypes, domestic varieties and some walnut cultivars, yield, fruit quality and flowering properties should be investigated in terms of determination of true capacity. After this stage, statistical analyses are needed to identify those genotype/genotypes with the best qualities which can be recommended for the farmers in the region

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