

## Research on walnut germoplasm in Western Romania

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**Abstract** Walnut is among the oldest widespread tree species. In the past, and particularly in the Tertiary, walnut was spread more than it is nowadays. A tree species with important ecological and economic potential, appreciated since times immemorial by the entire Earth, walnut also draw attention due to the food and therapeutic value of its fruit and for the quality, finesse and resistance of its wood. Needed in the confectionary industry, in family kitchen, in pharmaceuticals and in technical industries, walnut kernel is highly rated in nut trade due to its high content of fat substances, carbohydrates, vitamins and minerals.

### Key words

walnut, walnut biotype, germoplasm, biometrics

The current state of Romanian agriculture (undergoing privatisation) is the ground for developing walnut culture on intra-villanous lands, industrial sites, and green areas of spas, along the transport routes, the rivers and even on large walnut plantations.

In walnut, the amount and quality of production depend a lot on biological features and productivity of walnut cultivars. One of the most important tasks of scientific research is to collect valuable walnut biotypes with more than 45% kernel and maximum productions.

Expanding walnut plantations on as large areas as possible asks for checking the response of existing walnut cultivars and walnut biotypes in these areas to establish the most adequate assortment. Previous research can be found in 1, 2, 3, 4, and 5.

### Biological Material and Method

This paper presents a few walnut biotypes from Western Romania where we could collect our biological research material. Walnut trees are cultivated within villages and rarely in the neighbourhood of dwellings. The walnut cultivar Geoagiu 65 was the control. We sampled each walnut biotype in three different years and collected randomly 100 walnuts that were later analysed in the laboratory.

The walnut biotypes studied were 1001, 1002, 1003, 1004, 1005, 1006, 1007, 1008, 1009 and the walnut cultivar Geoagiu 65.

### Results and Discussions

Large diameter, small diameter and height were measured with sliding callipers: we calculated means, mean error, variability coefficient and the significance of differences to the control.

Gravimetric measurements consisted in sample weighing (30 fruits per walnut cultivar), cracking, and weighing the kernel, the shells and the septa. The shares of kernel weight and of whole fruit, i.e. the ratio kernel: shells is a characteristic of the walnut biotype. There are walnut biotypes whose kernel is larger and fills the entire cavity. In other walnut biotypes, the kernel is small with gaps particularly toward outer cavity; some walnut biotypes have a kernel that is so little developed that half of the cavity is empty. When shattering the walnut trees, the kernel (completely detached from the shell) hits the cavity walls and produces a characteristic sound, hence the name "sounding walnuts". The share of these components from the total weight of the fruit was calculated as a percentage and is presented in the tables below.

The main biometrics values of walnuts are presented in Table 1 below.

Table 1

**Fruit biometrics (mean of the years 2011-2013)**

Genotype	Form size (mm)			Im	If	Kernel size
	D	d	H			
Geoagiu 65	36.28	34.92	46.72	39.30	131.23	ellipsoidal
1001	38.13	36.90	51.68	42.23	137.77	ellipsoidal
1002	30.08	28.42	33.32	30.60	113.91	ovoid
1003	30.97	29.64	34.47	31.69	113.76	ovoid
1004	31.82	30.01	36.51	32.78	118.11	ovoid
1005	43.15	40.96	49.58	44.56	117.90	ovoid
1006	28.87	27.41	37.62	31.30	133.68	ellipsoidal
1007	34.32	31.96	40.72	35.66	122.87	ovoid
1008	41.82	35.36	38.67	38.61	100.20	spheroid
1009	40.64	38.62	49.99	43.08	126.14	ellipsoidal

Fruit size index ( $I_m$ ) has values ranging between 30.60 mm in the walnut biotype 1002 and 44.56 mm in the walnut biotype 1005, and the walnut cultivar Geoagiu 65 (control) reached 39.30 mm. The rest of the walnut biotypes have values within these limits.

Fruit shape index (If) is calculated to determine with accuracy fruit shape. Shape index has values ranging between 137.77 in the walnut biotype 1001 and 100.20 in the walnut biotype 1008. A more

thorough analysis of this index shows that four walnut cultivars and the control walnut cultivar are ellipsoidal, five are ovoid and one is spheroid.

The physical and mechanical composition of the fruit is essential in determining walnut quality. International standards stipulate values of above 42-50% kernel of the whole weight, thin shell and pleasant taste. The physical and mechanical composition of the studied walnut biotypes is shown in Table 2.

Table 2

**Physical and mechanical composition of walnut fruits (mean of the years 2011-2013)**

Genotype	Mean weight (g)	% kernel	% shell
Geoagiu 65	20.06	44.89	55.11
1001	30.60	33.33	66.67
1002	8.20	37.80	62.20
1003	9.30	46.23	53.77
1004	12.40	38.70	61.30
1005	24.40	38.52	61.48
1006	6.60	31.63	68.37
1007	13.20	50.00	50.00
1008	17.30	36.41	63.59
1009	18.50	30.00	70.00

Mean weight varies between 6.60 g (“almost the size of a hazel-nut”) in the walnut biotype 1006 and 30.60 g in the walnut biotype 1001.

The kernel percentage varies from 31.63% in the walnut biotype 1006 to 50.00% in the walnut biotype 1007. The kernel percentage is rather varied in the studied walnut biotypes: three of the walnut biotypes and the walnut cultivar have a good kernel percentage (over 40.00%); four of the studied walnut biotypes have a satisfactory kernel percentage (between 35.00% and 40.00%); three of the studied walnut biotypes have a low kernel percentage (between 30.00% and 35.00%).

The walnut biotypes with valuable fruit (large fruit with a high percentage of kernels) are 1007 with 50.00%, followed by the walnut biotype 1003 with 46.23% kernel and by the control walnut cultivar Geoagiu 65 with 44.89% kernel.

The chemical composition of the walnut kernel is shown in Table 3 below. We can see that the fat substance index ranges between 22.36 in the walnut biotype 1005 and 35.00 in the walnut biotypes 1002 and 1006; these walnut biotypes are good for walnut oil extraction.

The protein substance index ranges between 6.69 in the walnut biotype 1008 and 11.10 in the walnut biotype 1004.

Table 3

Chemical composition of walnut kernel (%)

Walnut biotype	Chemical composition of the kernel (mg %)							Index of fat substances	Index of protein substances
	Fresh substance				Dry substance				
	Water	Minerals	Fat substances	Protein substances	Minerals	Fat substances	Protein substances		
1001	3.50	2.02	64.65	16.88	2.30	66.98	17.50	30.60	7.97
1002	4.62	1.62	64.96	15.00	1.78	68.10	15.70	35.40	8.17
1003	3.17	1.40	63.61	18.04	1.53	65.69	18.63	34.89	9.89
1004	3.47	1.80	63.14	22.03	1.86	65.41	22.82	31.82	11.10
1005	3.17	2.00	63.66	19.14	2.06	65.75	19.77	22.36	6.72
1006	2.52	1.90	69.85	15.92	1.94	71.66	16.34	35.26	8.03
1007	2.67	1.80	69.04	16.47	1.84	70.94	16.93	32.10	7.65
1008	2.81	1.85	63.84	19.61	1.90	65.69	19.15	22.96	6.69
1009	3.50	1.70	64.62	16.84	1.85	66.98	17.50	30.60	7.97
Geoagiu 65	1.50	1.50	66.34	18.82	1.54	68.38	19.46	36.29	10.30

## Conclusions

From times immemorial, humans have been interested in walnut trees. This is obvious in their attempts to spread the species bearing valuable fruit easy to store and to carry. When spreading the species, humans chose valuable fruit thus operating a certain selection.

On the other hand, natural conditions in the new culture areas – particularly harsh compared to the places of origin of walnut trees – have produced a natural selection through the removal of the less rustic types. Therefore, there are more chances to find valuable walnut cultivars at the extreme limits of the current distribution than in the places of origin of the species.

Data show that in Western Romania the germoplasm pool in walnut tree is extremely diversified from the perspective of fruit size and quality. In general, in Romania, walnut tree germoplasm is very diverse and rich given that the spreading was carried out naturally, through seeds.

Among the studied valuable walnut tree biotypes are 1007 with 50.00% kernel, and 1003 with over 46.00% kernel; this is why we recommend the continuation and the expansion of research to identify valuable biotypes.

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