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THE BEHAVIOR OF SOME MELON GENOTYPES (*CUCUMIS MELO* L.) GROWN ON SANDY SOILS FROM SCDCPN DABULENI

Felicia FRĂTUȚU, Ștefan NANU, Cristina BIRSOGHE, Loredana SFÎRLOAGĂ

Research - Development Station for Plant Culture on Sands - SCDCPN Dăbuleni, Călărași, Dolj County, Romania

Corresponding author email: nanu.st@scdcpndabuleni

Abstract

The study was carried out in the period 2022-2023 on the sandy soils of SCDCPN Dăbuleni, characterized by low natural fertility. Six melon genotypes were studied. A great diversity of their morphological and biochemical characteristics was observed. Morphological characteristics such as fruit weight, fruit length and diameter, pulp thickness and fruit shape index were determined for the analyzed fruits. The biochemical characteristics of the fruits, such as total dry matter, soluble dry matter, titratable acidity, carbohydrates, vitamin C and water content, were also analyzed. The best results regarding fruit weight in 2022 (2.48-3.12 kg) were recorded for genotypes: L16, L13, L14 and in 2023 for genotypes L14, L11 and L16 (2.89-3.45kg). The content of soluble dry matter varied in the two years of study between 8.36% at genotype L12 and 9.02% at L14, being a character of the variety, which can also be influenced by environmental conditions. As a result of the study, a great diversity of morphological and biochemical characters was identified, which can be used in the future in the breeding process of existing varieties.

Key words*: melon****,*** *morphological characteristics, biochemical characteristics, sandy soils.*

INTRODUCTION

Melon (*Cucumis melo* L.) is one of the most important species, from an economic point of view, in the Cucurbitaceae family. *Cucumis melo* (L.) is native to Africa (Nasrabadi et al., 2012; Kerge and Grum, 2000; Robinson and Decker-Walters, 1999). Currently, both wild and cultivated forms of melons are cultivated worldwide (Nasrabadi et al., 2012; Pitrat, 1991). The world production of yellow melon is over 31 million tons being obtained predominantly by the mediterranean countries and East Asia, of which China provides 51%, followed by Iran and Turkey with a percentage of 5 and 6%, respectively of the world production (Maleki et al., 2018; Pavan et al., 2017; FAO, 2016).

Cucumis melo L. is cultivated because of its juicy and aromatic fruits, which are consumed fresh at physiological maturity, they are rich in vitamins (C, B1, B2, B6), carotene, mineral salts (Ca, P, K, Fe), proteins and carbohydrates (Frătuțu et al., 2023; Drăghici et al., 2018; Ciuciuc, 2003; Cabello et al., 2009).

The information regarding the genetic variability of the *Cucumis melo* L. species is useful to breeders in the process of selecting valuable parental genotypes, which can be used in breeding processes in order to obtain new cultivars (Naroui Rad et al., 2017; Naroui Rad et al., 2015; Naroui Rad et al., 2014).

This main objective of this study is the analysis of the local melon germplasm and the morphological characterization of the cultivated genotypes, with the aim of using them in future breeding programs.

MATERIALS AND METHODS

The experiment was established on the sandy soils of the research field of SCDCPN Dăbuleni, at its location using the randomized block method. The plant material used to establish the experience in the two years of study 2022-2023 was represented by six melon genotypes L11, L12, L13, L14, L15 and L16.

Some physical properties of the fruits were determined, such as the height and diameter of the fruits (cm), the diameter of the fruit cavity (cm), the shape index, the weight of the fruit (kg) and the thickness of the pulp (cm), according to the methodology described by Ionică (2014).

The chemical properties of the fruits were also determined according to the methodology described by Ionică (2014). Soluble dry matter (SUS) was determined by the refractometric

method, the results being expressed as percentages (%). To determine the content of total dry matter (SUT), the gravimetric method was applied based on the removal of water by evapotranspiration from the average analytical sample used, keeping it in the oven at a temperature between 85-105°C. The results were expressed in percentage of total dry matter (%). The determination of titratable acidity (TA) was carried out using the method described by Ionică (2014), the results were expressed in grams of malic acid/100 g of fresh substance.

To determine the vitamin C content, the iodometric method described by Croitoru (2021) was applied, which is based on the oxidation of ascorbic acid with excess iodine, the results being expressed in mg of ascorbic acid.

Carbohydrates were determined according to the Fehling Soxhelt method described by Croitoru (2021), the results being expressed in percentages.

Statistical analysis

The obtained data were processed statistically, using the statistical analysis program (Stat Point Technologies, Warrenton, VA, USA). Relationships between fruit physical characteristics were quantified using correlations.

RESULTS AND DISCUSSIONS

Abiotic factors including temperature, light, water and nutrients can affect the development of physiological processes and fruit size (Katsumi et al., 1999). Following the soil analyses according to the data in Table 1, a carbon content of the soil was recorded, at the depth of 0-20 cm, in the amount of 0.56% and at 20-40 cm a content of 0.37%, and a value of 0.96% humus at the depth of 0-20 cm and the pH recorded values between 7.10 and 7.12.

Table 1. Analysis of sandy soil composition from experimental field of RDSPCS Dăbuleni

The variant	The depth (cm)	Nt (%)	Extractable phosphorus (ppm)	Exchangeable potassium (ppm)	Carbon organic (%)	Humus (%)	pH
Experimental field	0-20	0.07	20.8	76.8	0.56	0.96	7.12
	20-40	0.03	36.28	44.8	0.37	0.63	7.10
Fertility status		LOW	MEDIUM	LOW	LOW	LOW	NEUTRAL

Melon loves heat, needing an optimal soil temperature of 20-25°C, being a species that prefers light soils with a pH between 6 and 7 (Toma et al., 2011). Table 2 presents the results obtained in 2022 regarding the main biometric characteristics of the fruits of the analyzed melon genotypes.

Table 2. Biometric characteristics of fruits from melon genotypes studied in 2022

Genotype	Statistical analysis	Fruit weight (kg)	Fruit height (cm)	Fruit diameter (cm)	Pulp thickness (cm)	IF
L11	Mean ± SD	2.17 ± 0.65	26.38 ± 1.92	13.80 ± 1.54	3.10 ± 0.68	1.92 ± 0.08
	Variation limits	1.49 / 2.92	24.20 / 28.50	12.00 / 15.40	2.00 / 3.70	1.84 / 2.02
	CV %	29.8	7.27	11.19	21.88	4.25
L12	Mean ± SD	1.72 ± 0.42	21.18 ± 3.93	14.68 ± 0.35	3.57 ±0.61	1.44 ± 0.25
	Variation limits	1.43/2.47	17.20 / 26.90	14.30 / 15.10	2.53 / 4.00	1.20 / 1.79
	CV %	24.61	18.53	2.37	17.11	17.34
L13	Mean ± SD	2.68 ± 0.33	26.13 ± 2.21	15.30 ± 1.42	3.53 ± 0.44	1.72 ± 0.19
	Variation limits	2.30 / 3.13	24.20 / 28.57	14.20 / 17.30	2.80 / 4.00	1.50 / 2.01
	CV %	12.31	8.46	9.28	12.58	10.78
L14	Mean ± SD	3.12 ± 0.97	24.62 ± 3.21	17.86 ± 2.50	4.04 ± 0.80	1.39 ± 0.15
	Variation limits	2.07 / 4.69	19.90 / 28.60	15.50 / 21.50	3.30 / 5.20	1.24 / 1.65
	CV %	31.15	13.02	14.02	19.85	11.07
L15	Mean ± SD	1.95 ± 0.87	23.62 ± 2.81	13.64 ± 2.80	3.42 ± 0.64	1.76 ± 0.23
	Variation limits	1.10 / 3.37	21.10 / 28.10	10.51 / 18.00	2.50/4.00	1.56 / 2.01
	CV %	44.45	11.91	20.54	18.56	12.86
L16	Mean ± SD	2.48 ± 0.83	26.02 ± 6.18	15.44 ± 1.74	3.86 ± 0.42	1.70 ± 0.41
	Variation limits	1.51 / 3.78	17.90 / 34.00	13.20 / 17.50	3.50 / 4.40	1.23 / 2.08
	CV %	33.62	23.73	11.24	10.78	24.39

IF = Shape index; CV = coefficient of variability; SD = standard deviation.

In the year 2022, the melon fruits showed an average height that varied between 26.38 cm for the genotype L11 and 21.18 cm for the fruits of the genotype L12. The diameter of the fruits presented an average value between 17.86 cm for the L14 genotype and 13.64 cm for the L15 genotype. The shape index showed average values that varied between 1.92 for genotype L11 and 1.39 for genotype L14, which indicates an elongated shape of the melons analysed. Regarding the length of the fruits and their diameter, in the literature, Rad et al. (2017), reported lower values than those obtained in this study, namely 20.00 cm with variation limits between 11.00 and 33.00 cm for the length of the fruits; and a diameter of 12.03 cm with variation limits between 6.5 and 15.8 cm.

Figure 1. Fruit from L12 genotype (original)

An important characteristic analysed in melon fruits is their weight, which recorded in 2022 the highest value of 3.12 kg for the L14 genotype, with variation limits between 2.07 and 4.69 kg, and the lowest weight of 1.72 kg in the L12 genotype with variation limits between 1.43 and 2.47 kg. For the genotypes studied in 2022, the pulp thickness recorded the highest value of 4.04 cm for the fruits of the L14 genotype with variation limits between 3.30 and 5.20 cm, and the lowest for the L11 genotype, respectively 3.10 cm, with variation limits between 2.00 and 3.70 cm. The results obtained are in accordance with the specialized literature, but higher than those reported by Rad et al. (2017), for the studied genotypes respectively an average fruit weight of 1.52 kg with variation limits between 0.495 and 3.128 kg. Regarding pulp thickness, Rad et al. (2017), reported a mean value of 7.04 cm with ranges of variation between 5.00 and 8.75 cm, much higher than those reported in the present study. Regarding the coefficient of variability, according to the data in Table 2, it can be seen that in 2022 its highest values were recorded for fruit weight, which recorded values between 12.31% (L13) and 44.45% to the L15 genotype. It can thus be noted that in 2022 the genotype L14 stood out with the highest average values obtained for fruit weight and pulp thickness. Table 3 presents the results regarding the biometric characteristics of the melon fruits analysed in 2023.

Table 3. Biometric characteristics of fruits from melon genotypes studied in 2023

Genotype	Statistical analysis	Fruit weight (kg)	Fruit height (cm)	Fruit diameter (cm)	Pulp thickness (cm)	IF
L11	Mean ± SD	2.92 ± 0.98	24.76 ± 4.12	15.66 ± 1.60	3.94 ± 0.95	1.59 ± 0.25
	Variation limits	1.73/4.18	19.00 / 30.00	13.30 / 17.50	2.80 / 5.40	1.27 / 1.84
	CV %	33.46	16.63	10.2	24.19	15.46
L12	Mean ± SD	2.77 ± 0.75	26.6 ± 5.55	16.24 ± 2.19	3 ± 0.61	1.63 ± 0.23
	Variation limits	1.44 / 3.24	20.00 / 35.00	13.00 / 19.00	2.00 / 3.50	1.47 / 2.03
	CV %	27.04	20.86	13.47	20.41	14.14
L13	Mean ± SD	1.74 ± 0.44	20.42 ± 1.85	14.44 ± 1.32	3.16 ± 0.78	1.42 ± 0.11
	Variation limits	1.288 / 2.248	18.00 / 23.00	13.00 / 16.30	2.00 / 4.00	1.29 / 1.54
	CV %	25.28	9.07	9.12	24.57	7.95
L14	Mean ± SD	2.89 ± 0.46	23.6 ± 3.07	17.52 ± 1.79	3.94 ± 0.36	1.35 ± 0.14
	Variation limits	2.53 / 3.65	20.50 / 27.50	15.70 / 20.00	3.40 / 4.40	1.15 / 1.49
	CV%	15.75	13.01	10.19	9.08	10.66
L15	Mean ± SD	1.99 ± 0.37	16.88 ± 1.68	16.52 ±2.09	4.02 ± 0.18	1.04 ± 0.17
	Variation limits	1.39 / 2.39	15.00 / 19.00	13.00 /18.50	3.80 / 4.30	0.86 / 1.27
	CV %	18.56	9.96	12.66	4.45	16.27
L16	Mean ± SD	3.45 ± 0.63	25.44 ± 1.56	16.92 ± 0.50	4.2 ± 0.24	1.5 ± 0.10
	Variation limits	2.88 / 4.48	24.00 / 28.00	16.20 / 17.50	4.00 / 4.60	1.42 / 1.68
	CV %	18.25	6.14	2.94	5.83	6.57

IF = Shape index; CV = coefficient of variability; SD = standard deviation.

The highest value of fruit weight was recorded for genotype L16, respectively 3.45 kg, with variation limits between 2.88 and 4.48 kg, in contrast to genotype L13 which recorded this year the lowest average weight of fruits respectively 1.74 kg with variation limits between 1.28 and 2.24 kg. Regarding the height of the fruits, the highest value was recorded for the fruits of L12 genotype, respectively 26.6 cm, and the lowest height for the fruits of L15 genotype, respectively 16.88 cm. The diameter of the fruits recorded the highest value of 17.52 cm for genotype L14, with variation limits between 15.70 and 20 cm, and the smallest for the fruits of genotype L13, respectively 14.44 cm with variation limits between 13.00 and 16.30 cm. The thickness of the flesh in the fruits of the analysed melon genotypes in 2023 had values between 3.00 and 4.20 cm in genotypes L12 and L16, respectively. Regarding the shape of the fruits we can see according to the data in the table regarding the shape index as they were elongated in shape with a shape index value between 1.04 and 1.63. Considering the specialized literature, we can specify that the data obtained in the present study are consistent with those reported by Nasrabadi et al. (2012), respectively an average length of the fruits between 22.64 and 48.10 cm, the diameter of the fruits with values between 15.15 and 19.56 cm, and a fruit weight that varied between 2.30 and 4.92 kg. With the help of correlations, the relationships between the biometric characteristics of the fruits were examined, the results being shown in Table 4.

Analysing the data in Table 4, we can see that in both years of the study, positive correlations were calculated between the height of the fruit and the weight of the fruit (r = 0.69, respectively r = 0.74), and between fruit diameter and weight (r = 0.81, respectively r = 0.61).

Figure 2. Fruit from L15 genotype (original)

A positive correlation was also calculated between the diameter and thickness of the fruit pulp (r = 0.72 and r = 0.51, respectively).

Tabel 4. Correlations between the fruit characteristics of the melon genotypes studied in the two years 2022-2023

Year	Fruit weight (kg)		Fruit height (cm)		Fruit diameter (cm)		Pulp thickness (cm)		IF
	2022	2023	2022	2023	2022	2023	2022	2023	2022
Fruit weight (kg)	1	1							
Fruit height (cm)	0.69	0.74	1	1					
Fruit diameter (cm)	0.81	0.61	0.33	0.37	1	1			
Pulp thickness (cm)	0.51	0.58	0.04	0.26	0.72	0.51	1	1	
IF	0.53	0.41	0.17	0.83	0.63	-0.21	0.36	-0.06	1

IF = Shape index

The data obtained from the correlations in the present study are consistent with those reported in the literature by Rad et al. (2017), who reported positive correlations between fruit weight and length (r = 0.77), between weight and fruit diameter (r = 0.63) and between fruit pulp weight and thickness (r = 0.32). The taste of fruits is the main determinant of their quality. The amount of sugar influences the sweetness and economic value of melon fruits (Kolayli et al., 2010). In order to highlight the nutritional and taste qualities of melons, chemical properties shown in Table 5 were selected and evaluated. According to the recorded data, we can see that the soluble dry matter recorded an average value between 9.06% for the L14 genotype and 8.36% for the L12 genotype in the two analysed years. The total dry matter content showed values that varied between 7.05% (L15) and 9.64% at L12. Regarding the vitamin C content, it varied in the analysed genotypes, between 16.26 mg/100 g FW in L15, and 29.04 mg/100 g FW in the L13 genotype.

Tabel 5. Chemical properties of fruits from melon genotypes studied during 2022-2023

Genotype	SUS %	SUT %	TA g ac malic/100 g substance	Vit. C mg	Glucide %	Water %
L11	8.80	7.93	0.23	22.00	6.36	92.07
L12	8.36	9.64	0.26	27.72	7.78	90.37
L13	8.96	7.30	0.21	29.04	6.19	92.71
L14	9.06	9.36	0.24	20.68	7.40	90.65
L15	8.75	7.05	0.18	16.26	7.62	92.95
L16	8.76	9.16	0.22	18.92	7.40	90.85

* SUT = total dry substance; SUS = total soluble substance; TA = titrable acidity; Vit. = vitamin

Titratable acidity and carbohydrates had values that varied between 0.18 g (L15) and 0.26 g (L12) malic acid/100 g FW, respectively 6.19% and 7.78% carbohydrates; and the water content between 90.37% (L12) and 92.95% (L15).

The variability of the sugar content of the fruits of melon genotypes was also reported in the literature by Rad et al. (2017) and Kolayli et al. (2010), who mentioned a sugar content that oscillated between 2.25% and 8.75% and 6.90% and 9.60% Brix respectively; the values reported in the present study being higher than those reported by Rad et al. (2017) and consistent with those reported by Kolayli et al. (2010). Kolayli et al. (2010) reported at the analysed melon genotypes a content of ascorbic acid with values between 5.38 and 22.47 mg/100 g FW.

Figure 3. Determination of biochemical characteristics (original)

CONCLUSIONS

Following the research carried out in the two years of study, the genotypes L14 and L16 were noted. Genotype L14 stood out in both years of study in terms of fruit diameter (17.86 cm and 17.52 cm, respectively) and soluble dry matter content of 9.06% Brix. Genotype L16 stood out in 2023 due to the weight and thickness of the fruit pulp, respectively 3.45 kg and 4.20 cm.

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