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THE BEHAVIOR OF SOME WATERMELON GENOTYPES ON SANDY SOILS FROM SCDCPN DĂBULENI

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Abstract

Watermelon is an important species well-known for its social and economic benefits. During the period 2022-2024 at the Research - Development Station for Plant Culture on the Dăbuleni Sands, was studied the behavior of 19 watermelon genotypes by evaluating morphological characteristics and biochemical properties. Following the determinations carried out, were noted the H1.10 and H2.1 genotypes with fruits of medium-sized and an average weight of 5.32 and 5.46 kg, respectively. From the point of view of biochemical content, the genotype H1.14 stood out for the analyzed period with the highest soluble dry matter content, respectively 10.73%. The best productions were also recorded for the genotypes H1.10 and H2.1, respectively 36.48 and 35.34 t / ha. The results obtained provided us valuable information regarding the adaptability of the analyzed genotypes to the pedo-climatic conditions from the Research and Development Station for Plant Culture on Dăbuleni Sands during the evaluated period.

***Key words**: watermelon, biochemical characteristics, sandy soils, production*

INTRODUCTION

Watermelon (*Citrullus lanatus*) is part of the *Cucurbitaceae* family and is an economically important species, which is mainly grown in warm areas. The fruits are consumed fresh or processed in the form of juices, pickles, candied fruits, jam, etc.

Watermelon contains over 90% water, with small amounts of protein, fat, minerals and vitamins. In some arid areas it is considered a rich source of water (Wehner, 2008). The fruit skin is smooth and the juicy and crunchy pulp is red, orange, yellow or white (Oregbunam et al., 2016). For consumers, in addition to morphological and production-related characteristics, the sweetness of the fruit or the total soluble dry matter content expressed in Brix degrees is also of particular importance. Most commercial varieties have fruits with a total soluble dry matter content greater than or equal to 8% Brix (Correa, et al., 2020). For a significant improvement of watermelon crops, it is necessary to have rich genetic resources, useful for plant breeders and specialists to better understand the diversity of species in order to find ideal varieties adapted to pedoclimatic conditions (Ng & Ng, 1991; Orgaebunam, 2016). The study carried out, aimed to evaluate the main morphological and biochemical characteristics of the 19 watermelon genotypes grown on sandy soils at SCDCPN Dăbuleni

MATERIALS AND METHODS

The experiment was established in the period 2022-2024 on sandy soils in the research field of the Research and Development Station for Plant Culture on

Dăbuleni Sands. The randomized block method was used to set up the experiment. The study material was represented by 19 watermelon genotypes: D1, D3, D4, D5, D9, D18, D19, H1.2, H1.4, H1.5, H1.6, H1.7, H1.8, H1.10, H1.11, H1.12, H1.14, H2.1, H2.3, the fruits of which were harvested at physiological maturity.

The physical characteristics determined were the length (cm), diameter (cm) and shape index of the fruits, as well as their quantitative characteristics, namely the weight of the fruits and peel (kg), the thickness of the peel (cm) and the percentage of the fruit core (%), according to the methodology described by Ionică M. E. (2014). Based on the results obtained in the three years of study, a classification of fruits by shape and size was performed. The classification of fruits by size was performed according to the method described by Khater & Bhansawi in 2016 (<5kg= small fruits; 5-8 kg= medium fruits; 8-11 kg= large fruits and >11 kg= very large fruits), and the classification according to the shape index was performed according to the method described by Dou et al. in 2018 (<1.8= elongated shape; 1.4 -1.6= oval shape and between 1.0-1.10= spherical shape).

The determination of the chemical properties of the fruits such as soluble dry matter content (%), total dry matter (%), carbohydrates (%), titratable acidity (g malic acid/ 100g fresh matter), and vitamin C (mg), was performed according to the methods described by Croitoru (2021).

The soluble dry matter (SUS) was determined by the refractometric method, the results being expressed in percentages (%). The determination of the total dry matter (SUT) content was carried out using the gravimetric method based on the removal of water by evapotranspiration from the average analytical sample used, keeping it in an oven at a temperature between 85-105°C, the results being expressed in percentages of total dry matter (%).The determination of the titratable acidity (TA) was carried out according to the method described by Ionică (2014), the results being expressed in grams of malic acid/100g of fresh substance. To determine the vitamin C content, the iodometric method described by Croitoru (2021) was used, 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.

Regarding the determination of plant productivity, at the end of the vegetation period the total production was calculated for each experimental variant and the production was reported in tons/ha.

The data obtained were statistically processed, using the statistical analysis program (Stat Point Technologies, Warrenton, VA, USA

RESULTS AND DISCUSSIONS

The minimum temperature for the growth and development of watermelon plants is between +12°C and up to +15°C (depending on the cultivar), a possible decrease in temperature below this level slows down the development of the plants. Fruits grow best on sunny days, with temperatures between +25°C and +35°C (Khurramovna, 2022; Frătuțu et al., 2024).

Table 1 presents the climatic conditions in the research area where the experience was located during the study period. According to the data, it can be seen that the highest average temperature value was recorded in July, respectively 25.71°C, and also the highest absolute average temperature, respectively 41.52 °C.

Table 1. Climatic conditions recorded during April-July, 2022-2024

The climatic element	IV	V	VI	VII
Mean temperature (°C)	12.67	17.27	23.05	25.71
Absolute maximum temperature (°C)	27.97	29.80	37.07	41.52
Absolute minimum temperature (°C)	-0.13	6.10	11.51	10.98
Rainfall (mm)	55.80	78.00	57.13	37.07
Multiannual average temperaures (°C)°C	11.88	16.94	21.56	23.32

From the point of view of the rainfall recorded during the study period, it is observed that during the study period, May recorded the highest amount of rainfall, respectively 78mm/m².

Table 2 presents the results with regard to the physical characteristics obtained during the study period. Thus, it is observed that among the 19 genotypes analyzed during the period 2022 – 2024, the H 2.1 genotype stood out with the highest average fruit length value, respectively 28.45 cm, followed by the D1 and H 1. 10 genotypes with an average length of 25.91 cm and 23.84 cm, respectively.

The results obtained are lower than those reported in the literature by Hakimi & El Madidi in 2015, respectively 31.07 cm.

Regarding the quantitative characteristics of the fruits, it is observed according to Table 3 that during the study period there was a great variability of the characteristics of the fruits in the genotypes analyzed.

Thus, the weight of the fruits had values ranging between 3.53 kg for the D9 genotype, and 5.46 kg for the H 2.1 genotype.

Although the H 2.1 genotype stood out during the study period, due to the highest value of the average weight of the fruits, in terms of the percentage of core it was surpassed by the H 1.4 genotype with a percentage of 63.64% core and an average skin thickness of only 1.01 cm.

Table 2. Physical characteristics of watermelon fruits from genotypes studied during 2022 – 2024

Genotypes	Fruit length (cm)	Fruit diameter (cm)	Shape index
D1	25.91	19.59	1.32
D3	19.93	18.75	1.06
D4	22.43	20.94	1.05
D5	22.49	20.31	1.11
D9	19.95	19.93	1.00
D18	22.83	20.63	1.10
D19	21.70	19.69	1.10
H1.2	22.62	20.87	1.09
H1.4	21.48	19.34	1.11
H1.5	21.63	20.81	1.05
H1.6	21.96	19.81	1.11
H1.7	20.94	19.49	1.07
H1.8	22.34	20.06	1.11
H1.10	23.84	22.31	1.07
H1.11	22.33	19.99	1.12
H1.12	22.44	20.67	1.03
H1.14	21.79	20.29	1.07
H2.1	28.45	20.85	1.40
H2.3	18.43	20.39	1.13

Table 3. Quantitative characteristics of watermelon fruits from genotypes studied during 2022 – 2024

Genotypes	Quantitative characteristics of fruits			
	Fruit weight (kg)	Peel weight (kg)	Peel thickness (cm)	Pulp percentage (%)
D1	4.85	2.33	1.09	59.34
D3	3.61	1.79	1.03	57.55
D4	4.81	2.19	1.02	62.77
D5	4.32	2.07	1.15	60.32
D9	3.53	1.82	1.00	58.02
D18	4.09	2.10	1.04	58.85
D19	4.07	2.10	1.16	56.61
H1.2	4.26	2.31	1.31	57.51
H1.4	3.87	1.70	1.01	63.64
H1.5	3.84	2.50	1.35	49.07
H1.6	3.54	2.03	1.19	56.73
H1.7	3.63	1.99	1.37	57.07
H1.8	4.12	2.17	1.33	55.28
H1.10	5.32	2.72	1.29	58.12
H1.11	4.13	2.25	1.21	55.97
H1.12	4.35	2.24	1.35	56.41
H1.14	3.90	2.01	1.33	58.49
H2.1	5.46	2.98	1.37	56.32
H2.3	3.99	2.26	1.3	56.76

Table 4 Fruit classification of the studied watermelon genotypes, according to their shape index and weight

Genotip	Greutate fruct*(kg)	Mărime	Indice de formă*	Formă
D1	4.85	Mici	1.32	Sferic-ovală
D3	3.61	Mici	1.06	Sferică
D4	4.81	Mici	1.05	Sferică
D5	4.32	Mici	1.11	Sferic-ovală
D9	3.53	Mici	1.00	Sferică
D18	4.09	Mici	1.10	Sferică
D19	4.07	Mici	1.10	Sferică
H1.2	4.26	Mici	1.09	Sferică
H1.4	3.87	Mici	1.11	Sferic-ovală
H1.5	3.84	Mici	1.05	Sferică
H1.6	3.54	Mici	1.11	Sferic-ovală
H1.7	3.63	Mici	1.07	Sferică
H1.8	4.12	Mici	1.11	Sferic-ovală
H1.10	5.32	Medii	1.07	Sferică
H1.11	4.13	Mici	1.12	Sfeic-ovală
H1.12	4.35	Mici	1.03	Sferică
H1.14	3.90	Mici	1.07	Sferică
H2.1	5.46	Medii	1.40	Ovală
H2.3	3.99	Mici	1.13	Sferic-ovală

The results obtained in terms of fruit weight are lower than those obtained by Hakimi & El Madidi in 2015 and Frătuțu et al., in 2024, respectively 8.30 – 12.55 kg. Regarding the percentage of core, higher values than those obtained were reported in the specialized literature, namely 65.70% core (Khater and Bahnasawy, 2016).

Based on the results obtained regarding the weight and shape index of the fruits, a classification of the genotypes was made according to the method proposed by Khater and Bhanasawi (2016).

Thus, according to table 4, most of the genotypes analyzed in the period 2022-2024 presented small-sized fruits with a weight ranging between 3.53 kg (D9) and 4.85 kg (D1).

Medium-sized fruits were presented by only 2 genotypes out of the 19 analyzed, respectively H 1.10 (5.32 kg) and H 2.1 (5.46 kg). Regarding the shape of the fruits, it is observed that the analyzed genotypes presented spherical-shaped fruits with a shape index ranging between 1.00 (D9) and 1.10 (D19). Spherical-oval fruits were presented by the genotypes D5, H 1.4, H 1.6, H 1.8, and D 1 with a shape index value between 1.11 and 1.32. The H 2.1 genotype stood out due to its oval-shaped and medium-sized fruits.

In the literature, Dou et al., (2018) mentioned that the watermelon fruits analyzed in the study presented a shape that ranged between elongated (if> 1.8) and spherical (if= 1.0-1.1). The watermelon fruits analyzed by Frătuțu et al., 2025 also presented a spherical-oval shape (if= 1.13-1.39).

The chemical properties of the fruits (table 5) showed that during the studied period the soluble dry matter presented values ranging between 7.73% Brix at H 1.4 and 10.73% Brix at H1.14.

Table 5. Chemical properties of watermelon fruits from genotypes studied during 2022 – 2024

Genotypes	Water (%)	Total dry substance (%)	Soluble dry substance (%)	Soluble carbohydrates (%)	Titratable acidity (g malic acid per 100 g s.p.)	Vitamin C (mg/100 g s.p)
D1	91.40	8.60	9.60	8.26	0.27	14.37
D3	89.06	10.94	10.27	8.83	0.24	13.79
D4	89.62	10.38	10.20	8.77	0.26	11.71
D5	90.54	9.46	10.00	8.60	0.22	15.25
D9	88.91	11.09	10.47	9.00	0.43	12.61
D18	89.89	10.11	9.57	8.48	0.24	13.48
D19	90.51	9.49	9.33	8.02	0.22	14.08
H1.2	90.05	9.95	9.53	8.20	0.23	15.25
H1.4	91.36	8.64	7.73	6.88	0.33	13.79
H1.5	89.83	10.17	10.67	9.17	0.25	12.61
H1.6	89.33	10.67	10.47	9.00	0.41	14.94
H1.7	89.92	9.78	9.87	8.58	0.38	15.84
H1.8	89.15	10.85	9.87	8.49	0.20	12.61
H1.10	89.60	10.40	9.73	8.37	0.22	10.85
H1.11	90.40	9.60	10.07	8.65	0.27	11.73
H1.12	91.31	8.69	10.33	8.89	0.21	12.91
H1.14	89.06	10.94	10.73	9.23	0.21	14.67
H2.1	91.14	8.86	9.13	7.85	0.20	12.03
H2.3	86.42	12.55	9.67	8.31	0.22	11.73

Figure 1. Some of the watermelon genotypes, studied in the period 2022 - 2024

The highest total dry matter content was recorded in the studied period in genotype D 9 (11.09%) and the lowest in genotype D1 (8.60%). Carbohydrates showed values ranging between 6.88% in H1.4 and 9.23% in H1.14. Vitamin C showed values ranging between 10.85 mg/100 g fresh matter in genotype H1.10 and 15.84 mg/100 g fresh matter in H1.7 in the genotypes studied in the period 2022-2024.

The data obtained are higher than those in the specialized literature where Victoire et al., 2023 reported lower values of soluble dry matter content (7.06-7.89%) and total dry matter content (1.53 – 5.37%) in the analyzed cultivars. In the literature, Frătuțu et al., 2024 reported lower values than those obtained in the present study in terms of vitamin C content (8.80 – 14.96 mg / 100g fresh matter), and relatively similar in terms of total dry matter content (8.5- 14.38%).

Table 6 presents the data obtained regarding the average production recorded by each genotype during the 2022-2024 study period. Thus, the highest production was recorded for the H1.10 genotype, respectively 36.48 t/ha, with a difference of 6.68 t/ha compared to the control, this difference being statistically insignificant. The lowest production recorded during the study period was 22.76 t/ha for the D19 genotype.

Table 6. Average fruit production recorded in the period 2022-2024 for the studied watermelon genotypes

Genotype	Average production (t/ha)	Relative production (%)	Difference (t/ha)	Semnification
D1	34.22	114.84	4.42	ns
D3	24.59	82.53	-5.21	ns
D4	29.72	99.75	-0.08	ns
D5	31.32	105.10	1.52	ns
D9	24.47	82.11	-5.33	ns
D18	33.54	112.58	3.75	ns
D19	22.76	76.40	-7.03	ns
H1.2	30.12	101.08	0.32	ns
H1.4	28.63	96.08	-1.17	ns
H1.5	30.26	101.56	0.46	ns
H1.6	31.97	107.30	2.17	ns
H1.7	27.56	92.51	-2.23	ns
H1.8	27.87	93.55	-1.92	ns
H1.10	36.48	122.42	6.68	ns
H1.11	28.94	97.14	-0.85	ns
H1.12	32.66	109.60	2.86	ns
H1.14	27.39	91.93	-2.41	ns
H2.1	35.34	118.61	5.54	ns
H2.3	28.29	94.94	-1.51	ns
Witness	**29.80**	100	0.00	mt
DL 5% 16.68;		DL 1% 22.35;	DL 0.1% 29.50	

The results obtained are relatively similar to those reported in the literature by Shrefler et al., in 2015 (12-37 t/ha) but lower than those reported by Frătuțu et al., 2025 (23.18-47.86 t/ha).

CONCLUSIONS

The results obtained from the study carried out in the period 2022-2024 provide useful information in future breeding programs.

In terms of productivity and quality, the results can constitute criteria in choosing cultivars appropriate to the pedo-climatic conditions of southern Oltenia.

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