EVALUATION OF THE QUALITY OF SOME WATERMELON VARIETIES GROWN ON SANDY SOILS

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Abstract

The objective of this study is to present the biochemical composition of 3 watermelon varieties: Dulce de Dăbuleni, Oltenia, De Dăbuleni, in the pedo-climatic conditions of the Dăbuleni area. The observations were made during 2022-2023 at SCDCPN Dăbuleni. The climatic conditions at SCDCPN Dăbuleni were favorable for the development of the watermelon culture. The experiment was located on a sandy soil, according to the method of randomized blocks in 4 repetitions. The following observations and determinations were made: the soil content in total nitrogen, extractable phosphorus, exchangeable potassium, organic carbon, pH; the biochemical content of the fruits: total dry matter, water, dry soluble substance, simple soluble carbohydrates, titratable acidity and vitamin C. The soil content in total nitrogen and exchangeable potassium was reduced, and in extractable phosphorus it was normal. Organic carbon showed values between 0.37%-0.56%, the state of soil supply being reduced towards the middle. The pH of the soil on which the experiment was placed oscillated between 7.1 and 7.12, indicating a neutral soil reaction. Cultivation technology specific to sandy soils was applied. The varieties Dulce de Dăbuleni and Oltenia stood out for the amount of vitamin C contained, while the De Dăbuleni variety had the lowest content in vitamin C (8.8 mg/100 g fresh substance). The content in soluble carbohydrates varied between 7.74% in the Oltenia variety and 10.49% in the Dulce de Dăbuleni variety.

Key words**: **watermelon, titratable acidity, vitamin C

INTRODUCTION

Watermelon (*Citrullus lanatus*) is part of the *Cucurbitaceae* family. Watermelons are grown in warm regions, the main producing countries are: China, Japan, Iran, Mexico worldwide, and in Europe: Spain, Italy, France, Greece, Portugal (Apahidean et al., 2001). It is cultivated for its physiologically mature fruits, which are appreciated by consumers due to their balanced, sweet, fine and pleasant taste. The fruits have an energy value of 26-29 calories/100 g fresh substance, with a water content of 89-94%, and in sugar of 7-11%. Due to its chemical composition, nutritive and caloric value, watermelon is considered to be ahealthy food. Watermelon has a high content of sugar, areason to be appreciated as a high glycemic food (Davis et al., 2007; Foster-Powell et al., 2002). It is an annual plant with a vegetation period of 90-130 days. The fruits have a high storage capacity of about 30 days and a good resistance to transport, being able to be used in the northern areas of the country, where they are not cultivated.

Watermelon is native to South and Central Africa, where it grows spontaneously.

Watermelon fruits have nutritional and medicinal values (Gwana et al., 2014). According to Perkins et al., 2022, quoted Popescu A., 2012, watermelon is rich in vitamins C and A, antioxidants, lycopene. Lycopene is the natural pigment that gives red color and is a powerful antioxidant used successfully in the fight against breast, prostate, endometrial cancer.

Watermelon is rich in iron, iron is important in the formation of hemoglobin, which carries oxygen from the lungs to all the cells of the body and prevents anemia (https://news.softpedia.com/news/Watermelon-The-Iron-Fruit-30079.shtml) by it is also rich in citrulline, an amino acid used by the body to create arginine, which is able to lower blood pressure (www.eva.ro/diet). According to Goda, 2007, quoted by Olayinka et al, 2018, in Nigeria, Sudan and Egypt the pulp is cooked and the seeds are eaten.

It has a root system that penetrates the soil at 1-1.5 meters, and horizontally it grows up to 4-5 meters (Ciofu et al., 2003). The stem is slightly branched and reaches 3-4 meters in length. As in the case of other vegetable plants in the *Cucurbitaceae* family, adventitious roots easily grow from the stems, under suitable conditions. Watermelon seeds vary in size and color depending on the variety and have a thick outer skin that makes germination difficult. Watermelon is very picky about heat. The greatest amount of heat is required during fruiting and fruit ripening.

Watermelon consumes a lot of water, the value of the transpiration coefficient being on average 700. However, it shows the highest resistance to drought among all cucurbits. The largest amount of water is consumed during flowering and fruit growth (Bălașa,1973).

Good precursor crops for watermelons are peas, beans, potatoes, onions, tomatoes. They can also be cultivated with good results after soybeans or grassy cereals. The watermelon crop can return to the same land after a minimum of 3 years, the measure being mandatory for varieties sensitive to *Fusarium oxysporum* (Toma et al., 2014).

Watermelons are sensitive to drafts, which is why crops are established between curtains of tall plants. The plant's demands for water are high, but the strongly developed root system ensures the needs during the vegetation phases. The application of 2-3 waterings during the period of flowering and fruiting determines the achievement of high productions.

The best soils for the cultivation of watermelons are those with a sandy or sandy-loam structure, which heat up quickly. Regarding light, the demands of the species are very high, needing 1500 hours of sunshine. In insufficient light, the plants are poorly developed, the flowers abort, the production is reduced, and the sugar content decreases.

MATERIALS AND METHODS

The experiment was monofactorial and located in the experimental field according to the method of randomized blocks, in 4 repetitions. Seedlings were produced in the greenhouse. Seedlings were planted at 1.8 meters between rows and 1.5 meteres between plants/row. The following observations and determinations were made:

- soil content in:
* total nitrogen (%) – Kjeldahl method;
* extractable phosphorus (ppm) – Egner – Riehm – Domingo method;
* exchangeable potassium (ppm) – Egner – Riehm – Domingo method;
* organic carbon (%) – titrimetric method;
* pH – potentiometric method.

- the biochemical content of fruits in:
* total dry matter and water (%) – gravimetric method,
* dry soluble substance (%) – refractometric method;
* simple soluble carbohydrates (%) – Fhling Soxleth method;
* titratable acidity (g malic acid /100 g fresh substance) – titrimetric method;
* vitamin C (mg/100 g fresh substance) – iodometric method.

RESULTS AND DISCUSSIONS

The table 1 shows the climatic conditions recorded in the years 2022 and 2023, during the vegetation period of the watermelon crop. In the April-July period, the average air temperature was higher by 0.9 ºC in 2022, compared to the same period in 2023. The absolute maximum was 41.6 ºC in 2022 and 42 ºC in 2023. The lowest temperature was -3.1 ºC and was recorded in April 2022. The amount of precipitation was higher in 2023 , 118.8 mm more than in 2022. The average temperatures during the vegetation period of the watermelon crop were 1.11 ºC higher than the multiannual average temperature of the respective months in 2022, and 0.2 ºC higher in 2023.

Watermelon plants grow well at temperatures of 25-30 ºC. Mature plants tolerate well temperatures slightly above 40 0C, the climatic conditions at SCDCPN Dăbuleni were favorable for the development of the watermelon culture. The summer months were hot, with maximum temperatures above 30 ˚C and low rainfall. The water deficit during the vegetation period was supplemented by irrigation.

Table 1. Climatic conditions during the vegetation period of the watermelon crop

2022-2023

	2022						2023					
	Luna				Max/ Min	Media/ Suma	Luna				Max /Min	Media/ Suma
Elementul climatic/Luna	IV	V	VI	VII			IV	V	VI	VII		
Temperatura medie ^{0}C	11.7	18.3	22.9	25.2		19.52	11.1	16.8	21.2	25.4		18.62
Maxima absolută ^{0}C	26.3	31.8	35.7	41.6	41.6		23.5	29	37.6	42	42	
Minima absolută ^{0}C	-3.1	3.5	11.8	12.5	-3.1		0	7.4	11.4	10.2	0	
Precipitaţii mm	73.6	38.4	48.6	15		175.6	57.8	81.6	81.4	73.6		294.4
Umiditate %	62.6	56.8	61.6	50.6		57.9	67.1	66.9	70.6	61.6		66.55
T. medie lunară multianuală (1956-2022) ^{0}C	11.88	16.95	21.550	23.29		18.41	11.868	16.947	21.544	23.321		18.42
Precipitaţii Suma lunară multianuală (1956-/2022)mm	46.97	62.39	69.838	54.00		233.19	47.129	62.672	70.008	54.288		234.09

Table 2. The chemical composition of the soil under the cultivation of watermelons on the sandy soils of the south of Oltenia

Depth (centimeters)	Total nitrogen (%)	Extractable phosphorus (ppm)	Exchangeble potassium (ppm)	Organnic carbon (%)	pH
0-20	0.07	20.8	76.8	0.56	7.12
20-40	0.03	36.28	44.8	0.37	7.10

The obtained results highlight an unevenness of the soil, a factor specific to sandy soils. The nitrogen content was between 0.03% and 0.07%, values that indicate a reduced state of nitrogen supply to the soil (table 2).

Extractable phosphorus showed values between 20.8 ppm and 36.28 ppm, characterizing the soil as being normally supplied with phosphorus. A good supply of phosphorus helps plants to have a rich root system, having a positive influence on plant growth.

Exchangeable potassium was between 44.8 ppm and 76.8 ppm indicating a medium supply condition.

Organic carbon showed values between 0.37%-0.56%, the state of soil supply being reduced to medium, characteristic of sandy soils. The pH of the soil on which the experiment was placed oscillated between 7.1 and 7.12, indicating a neutral soil reaction.

To achieve a high level of production, plants extract large amounts of nutrients from the soil. Excess nitrogen damages fruit formation and ripening, but potassium and phosphorus favorably influence fruiting and fruit quality.

The lowest, but also the highest water content in watermelons was recorded in 2022. The lowest content was recorded in the *Dulce de Dăbuleni* variety (85.62%) and the highest content was recorded in the *Oltenia* variety (91.5%) (table 3).

In 2022, the *Oltenia* variety presented the lowest amount in total dry matter (8.5%), soluble dry matter (9%) and carbohydrates (7.74%), while the *Dulce de Dăbuleni* variety had 14.38% total dry matter, 12.2% soluble dry matter and 10.49% soluble carbohydrates.

The highest titratable acidity values were recorded in 2022, at the *Dulce de Dăbuleni* variety (0.32 g malic acid per 100 g fresh substance), and the lowest content in titratable acidity was recorded in 2023 at the *Oltenia* variety (0.23 g malic acid per 100 g fresh substance.

The vitamin C content varied between 8.8 mg in the *De Dăbuleni* variety (8.8 mg/100 g fresh substance), in 2022 and 14.96 mg/100 g fresh substance to the *Dulce de Dăbuleni* variety, in 2023.

Table 3. Biochemical composition of watermelon fruits according to the genotype and harvest year conditions

Year	Variety	Water (%)	Total dry matter (%)	Dry soluble substance (%)	Simple soluble carbohydrates (%)	Titratable acidity (g malic acid/ 100 g fresh substance)	Vitamin C (mg/100 g fresh substance)
2022	*Dulce de Dăbuleni*	85.62	14.38	12.2	10.49	0.32	10.56
	Oltenia	91.5	8.5	9	7.74	0.31	11.44
	De Dăbuleni	91.1	8.9	9.6	8.25	0.25	8.8
2023	*Dulce de Dăbuleni*	89.68	10.32	10	8.6	0.26	14.96
	Oltenia	90.48	9.52	10	8.6	0.23	14.08
	De Dăbuleni	89.39	10.61	9.8	8.43	0.24	13.2

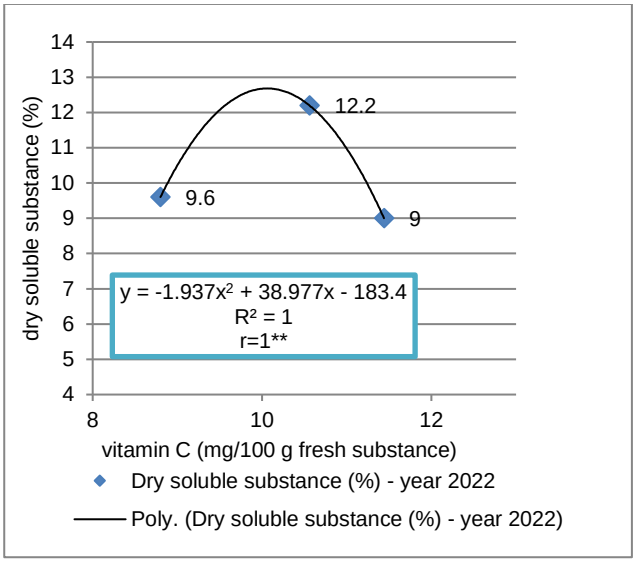

Figure 1. Correlation between vitamin C content and soluble dry matter content (2022)

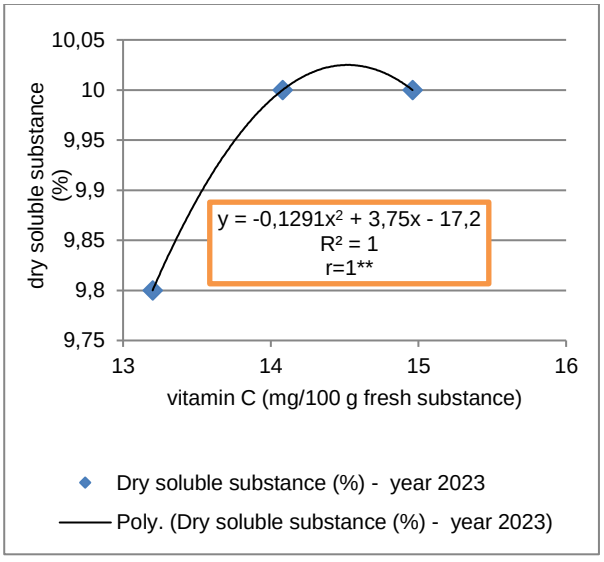

Figure 2. Correlation between vitamin C content and soluble dry matter content (2023)

Between the amount of vitamin C and the content in soluble dry matter, a polynomial correlation was established given by an equation of the second degree, with a distinctly significant correlation factor. In 2022, Vitamin C increased to dry matter values of 10, then began to decrease as soluble dry matter increased (fig. 1), and in 2023, vitamin C increased to dry matter values of 14.5%, after which it started to decrease as soluble dry matter increased (fig 2).

CONCLUSIONS

In the 2 years under study, the watermelon culture endured temperatures of over 40 ºC recorded at the SCDCPN Dăbuleni, the quality of the fruits not being affected.

The highest contents in soluble dry matter (12.2%), total dry matter (14.38%), simple soluble carbohydrates (10.49%), titratable acidity (0.32 g malic acid /100 g fresh substance) were obtained from the *Dulce de Dăbuleni* variety, in 2022.

During the 2 years under study, vitamin C varied between 8.8 mg/100 g fresh substance in the *Dăbuleni* variety, in 2022, and 14.96 mg/100 g fresh substance in the *Dulce de Dăbuleni* variety, in 2023.

The highest water content was recorded in the *Oltenia* variety (91.5%), in 2022.

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