Brazilian Journal of Biology®

ISSN 1519-6984 (Print)
ISSN 1678-4375 (Online)

Original Article

Post-harvest quality of melon accessions subjected to salinity

Qualidade pós-colheita de acessos de melão submetidos a salinidade

F. H. A. Silva[a], P. L. D. Morais[a], M. A. S. Morais[a*], V. R. Gonzalez[a] and N. S Dias[a]

[a] Universidade Federal Rural do Semi-Árido – UFERSA, Departamento de Ciências Agronômicas e Florestais, Laboratório de Fisiologia e Tecnologia Pós-Colheita, Programa de Pós-graduação em Fitotecnia, Mossoró, RN, Brasil

Abstract

The objective was to evaluate the behavior of melon genotypes (*Cucumis melo* L.) in the physical, chemical and biochemical quality of melon fruits as a function of electrical conductivity irrigation water levels (ECw). The experimental design adopted was randomized blocks in a 5 x 3 factorial scheme with five replications. The first factor was represented by five salinity levels (0.5, 1.5, 3.0, 4.5, and 6.0 dS m^{-1}) and the second factor by accessions A35, and A24, and the hybrid Sancho. The physical, chemical and biochemical variables showed a reduction in production, with smaller fruits, with less weight, smaller cavity, with increased pulp thickness for Sancho. Vitamin C and yellow flavonoids increased indicating antioxidant power against ROS. The genotypes showed similar post-harvest behavior, however, the hybrid Sancho stood out over the others, possibly because it is an improved material. Accession A24 presented physiological and biochemical responses that classify it as intolerant.

Keywords: *Cucumis melo* L., genotypes, osmoregulators, antioxidante.

Resumo

Objetivou-se avaliar o comportamento de genótipos de melão (*Cucumis melo* L.) na qualidade física, química e bioquímica de frutos de melão em função da condutividade elétrica de lâminas de irrigação (CEa). O delineamento experimental adotado foi o de blocos casualizados em esquema fatorial 5 x 3 com cinco repetições. O primeiro fator foi representado por cinco níveis de salinidade (0,5, 1,5, 3,0, 4,5 e 6,0 dS m^{-1}) e o segundo fator pelos acessos A35, A24 e o híbrido Sancho. As variáveis físicas, químicas e bioquímicas apresentaram redução na produção, com frutos menores, com menor peso, menor cavidade, com maior espessura de polpa para Sancho. A vitamina C e os flavonoides amarelos aumentaram indicando poder antioxidante contra ROS. Os genótipos apresentaram comportamento pós-colheita semelhante, porém, o híbrido Sancho se destacou dos demais, possivelmente por ser um material melhorado. O acesso A24 apresentou respostas fisiológicas e bioquímicas que o classificam como intolerante.

Palavras-chave: *Cucumis melo* L., genótipos, osmorreguladores, antioxidante.

1. Introduction

The melon tree (*Cucumis melo* L.) is one of the most important vegetables in northeastern Brazil. According to the FAO (Food and Agriculture Organization of the United Nations), in 2020, the world's largest producers of melons were: China, Turkey and India. Brazil occupies the ninth position with approximately 613 thousand tons (FAO, 2020). The Brazilian states that stood out in terms of production were: Rio Grande do Norte with 375,574.00 Kg, followed by Ceará with 75,838.00 Kg and Bahia 65,675.00 Kg (IBGE, 2020).

Abiotic problems have been worrying world producers in recent years. Among the main problems, salinity of the soil and irrigation water is highlighted, triggered by successive irrigations in irrigated agriculture poles (Pereira et al., 2017; Sarabi et al., 2017; Akrami and Arzani, 2019). Salinity causes changes in the reduction of luminosity (L) and chromaticity (C) with an increase in the angular hue (ºH) of the peel and fruit pulp, decrease in total yield, increase in pulp firmness and thickness, reduction of carotenoids total, titratable acidity, soluble solids and total sugars (Akrami et al., 2019; Suárez-Hernández et al., 2019; Lima et al., 2020; Oliveira et al., 2021; Silva et al., 2021).

However, in relation to the action of antioxidants such as total flavonoids, total carotenoids and vitamin C, which work as reactive oxygen species (ROS) dismutators, it seems to be scarce, especially in fruits (Ali and Ismail, 2014; Mallek-Ayadi et al., 2017). Araújo et al. (2016) and Morais et al. (2018b) reports the importance of increasing the list of salinity-tolerant genotypes with the ability to offer high yields. However, to date, there are no resistant/

*e-mail: aparecida8sm@gmail.com
Received: July 2, 2023 – Accepted: March 18, 2024

salinity-tolerant materials on the market, which makes studies possible to provide high-performance commercial materials adapted to cultivation conditions with lower quality water.

Therefore, the objective was to evaluate the behavior of melon accessions in the physical, chemical and biochemical quality of fruits as a function of the electrical conductivity of irrigation water (ECw).

2. Material and Methods

The experiment was conducted in a greenhouse belonging of the Universidade Federal Rural do Semi-árido/UFERSA, in Mossoró, RN, under the geographic coordinates 5º 11' 31" of latitude South and 37° 20' 40" of longitude West, at an altitude of 18 meters (approximately 60 ft). The greenhouse with an arch ceiling, coated with low density polyethylene film (150 µm thick) with sides protected with black screen of 50% of shading. At sowing, two seeds were placed in black polyethylene bags with a capacity of 5 L, which were filled with Golden Mix Type Coconut Fiber® pH: 6.0 ± 0.3, electric conductivity EC: 0.5 dS m^{-1}, density: 85 kg m^{-3}, weight: 31.88 kg, the water retention capacity o (WRC): 500 (w/w). To fill the bags, 25% of their volume was filled with granitic gravel (9.5 to 19mm) adding them to the base, completing the remaining volume 75% with coconut fiber (totaling the volume of 5 L of the bag). After ten days of sowing, the thinning was performed leaving only one plant per bag when it presented the second complete leaf.

For the daily irrigations, the manual irrigation system was adopted, using independent systems for the application of the five salinity levels of the irrigation water, thus avoiding the mixing of water; This method consisted of five fiberglass boxes with a capacity of 350 L with the appropriate amount of saline water, with the main predominant cations $CaCl_2$, NaCl and $MgSO_4$. The application of saline water was initially carried out after the formation of the third complete leaf of the melon until reaching the ideal stage of fruit maturation around 75 DAS (after sowing).

The melon materials used in this experiment were chosen in preliminary tests due to the lack of technical information, mainly regarding the salinity tolerance. In this way, two accessions classified as tolerant (A35) and sensitive (A24) belonging to the Genetic resources and plant breeding studies group of the UFERSA, Mossoró/RN, Brazil, and the commercial hybrid Sancho of Syngenta, which served as a witness. The distilled water used for the preparation of the stock solutions was acquired by the reverse osmosis process, and the fertilizations were carried out according to the methodology proposed by Hoagland and Arnon (1950) using 50% of the nutritional composition.

The water used in the irrigation was the same as domestic water. Before the addition of macronutrients and micronutrients, the cationic balance of the nutrients $CaCl_2$, NaCl and $MgSO_4$ were calibrated for irrigation water with the respective ECw: 0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}.

The plants were conducted vertically, remaining on a single stem. Phytosanitary control was carried out according to the needs of the crop, until the fruit harvest phase. All applications were performed at the doses recommended by the manufacturer. The pollination used was the manual cross in which, soon after the floral opening, the staminate flowers detach from the plants, and quickly separate from their petals that lightly touch their stigmatic surface with the anthers of the male flowers.

The fruits after reaching physiological maturity were collected separately according to their respective treatments, and sent to the Laboratory of Post-Harvest Physiology at UFERSA to proceed with the analysis of the physicochemical qualities of the fruits.

Fresh mass and total production, obtained by means of a semi-analytical scale with results expressed in grams (g), for length (cm) and width (cm) a graduated ruler was used; internal cavity and pulp thickness, a digital caliper was used. The color of the skin and pulp was expressed in L (luminosity – brightness, clarity or reflectance), C* (chroma – color saturation or intensity) and °h (hue angle – hue) (Commission Internacionale de L"Eclaraige) (Minolta 2007), with the aid of a benchtop digital colorimeter (CR-410, Minolta®); fruit and pulp firmness was determined using a Texture Analyzer® texturometer, model TA.XTExpress/TA.XT2icon (Stable Micro Systems Ltd., Surrey, England), expressed in Newton (N).

Titratable acidity by titration, using 1 g of homogenized juice according to Instituto Adolfo Lutz (IAL, 2005); the pH was determined using the pH meter, which was inserted into the homogenized juice; soluble sugars consisted of using the anthrone method proposed by Yemm and Willis (1954); soluble solids determined with the homogenized juice by digital refractometer model PR – 100, Palette, Atago Co, LTD., Japan according to AOAC (2002).

The fraction of total carotenoids was accounted for by the method proposed by Lichtenthaler (1987). Vitamin C content was determined according to the methodology proposed by Strohecker and Henining (1967), with the results expressed in mg of ascorbic acid per 100 g of pulp. Yellow flavonoids were determined according to Francis and Markakis (1989), one gram of pulp was extracted with 95% of 1.5 N ethanol/HCl solution (85:15). The absorbance of the filtrate was measured at 374 nm for total yellow flavonoid content using an absorption coefficient of 76.6 mol cm^{-1}. The results were expressed as mg 100 g^{-1} FW. The absorbances were monitored with a UV-VIS spectrophotometer (model UV-1600 by Pro-Analysis®, Brazil).

The experimental design was randomized blocks in a factorial scheme (5 × 3) with five replications totalling 75 plots. The first factor was represented by treatments with five levels of salinity (0.5, 1.5, 3.0, 4.5 and 6.0 dS m^{-1}) and in the second factor for accesses A35 and A24 and the hybrid Sancho (control). Data were submitted to analysis of variance and when significant between the doses was performed regression analysis. For the melon genotypes the averages were compared by Tukey's test ($p < 0.05$) at a 5% probability level, using the program R x64 3.4.0 software. The graphs were prepared using Sigma Plot software version 12.3.

3. Results and Discussion

The results of the analysis of variance (Table 1) show that the variables fruit mass, fruit length and thickness showed a significant interaction between the melon genotypes and the salinity of the irrigation water used. The other variables showed significance only within one of the factors studied.

For the total mass, it was possible to find an adequate fit for the A35 and Sancho genotypes, $\hat{y}$= -29,464 ECw + 305.67 and $\hat{y}$= -112.5 ECw + 1,195.2, respectively (Figure 1A), whereas for the A24 genotype there was no curve fit, perhaps because it is the most salinity-sensitive genotype. Total production showed no interaction between the factors studied, only within salinity, tending to decrease with increasing doses (Figure 1B). The results of the present work corroborate the literature, in which Pereira et al. (2017), Akrami and Arzani (2019), Akrami et al. (2019) Lima et al. (2020) and others found that increasing irrigation water salinity decreases fruit mass and total fruit production. Possibly, due to the osmotic effect that the salts present in the water cause in the absorption of nutrients by the plant (Mascarenhas et al., 2010).

In relation to firmness, both of the fruit and of the pulp, there was an increase with the increase of the doses of salinity of the irrigation water (Figure 2A and B). An adequate fit was not possible in Figure 2B with $\hat{y}$ = 0.4091ECw + 10.202 and R^2 = 0.55. The linear increase in fruit and pulp firmness (Figures 2A and B), with increasing salinity is an important quality indicator, since fruits with greater firmness are more resistant to mechanical injuries during transport and marketing (Oliveira et al., 2021), in addition to longer shelf life and post-harvest conservation. This result being similar to those observed by Pereira et al. (2017), Morais et al. (2018a) and Oliveira et al. (2021).

In relation to the length, width and thickness of the fruits, linear reductions were observed with increasing ECw of the irrigation water (Figures 3A, B, C and D). An adequate fit in the 3D figure was not possible for genotypes A24 $\hat{y}$ = -3.8386x + 35.97 with R^2 = 0.55 and genotype A35 $\hat{y}$ = -1.8276x + 21.001 with R^2 = 0.51

For this attribute, smaller values of length, width and thickness of the fruits are desired, since these variables indicate the size of the internal cavity of the fruits. The lower this characteristic, the higher the pulp yield,

Table 1. Analysis of variance of the characteristics FM- fruit mass (g); TP- total production (g); FF- fruit firmness (N); PF-pulp firmness (N) L- length (cm); W- width (cm); IC- internal cavity (mm) and PT- pulp thickness (mm) of genotypes A24, A35 and Sancho the of melon (*Cucumis melo* L.) produced in saline conditions (0; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

Source	DF	Means Square							
		FM	TP	FF	PF	L	W	IC	PT
Block	4	3990.07^{ns}	147866.32*	125.37^{ns}	4.18 ^{ns}	3.34 ^{ns}	1.64 ^{ns}	34.96^{ns}	38.95^{ns}
Materials	2	2516819.01**	1064430.67**	20623.50**	13.72 ^{ns}	278.62**	72.89**	317.87**	1406.11**
Salinity	4	369993.13**	1064430.67**	244.00*	22.45**	44.15**	10.79**	163.19*	604.83**
M x S	8	80240.57**	55491.45^{ns}	116.65^{ns}	2.39^{ns}	6.26*	1.66 ^{ns}	97.31^{ns}	127.96**
Error		12889.43	52051.18	94.99	4.92	2.67	1.16	60.64	36.53
Average		514.42	582.69	39.77	11.47	11.88	8.63	40.42	23.23
CV%		22.07	39.15	24.51	19.35	13.77	12.53	19.26	26.02

Materials = genotypes (A24; A35 and Sancho); Salinity = (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}); M= genotypes; S = Salinity doses; DF = Degrees of freedom; ns = not significant; CV = coefficient of variation; **p < 0.01; *p < 0.05.

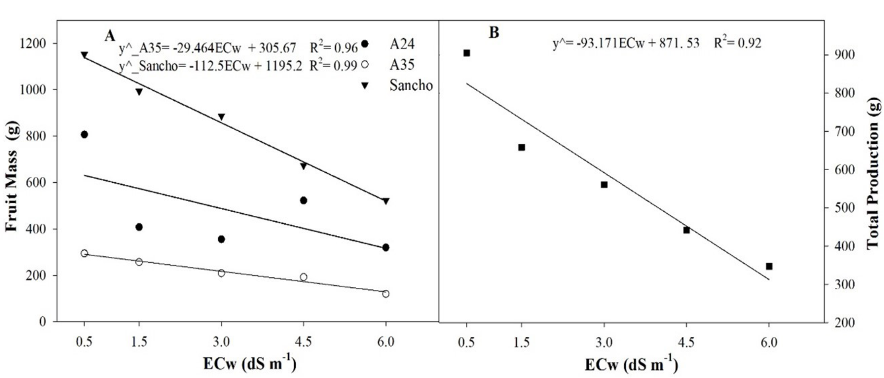

Figure 1. Fruit mass (A) and total production (B) of fruits of genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) in function of the increase of saline doses in the irrigation water (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

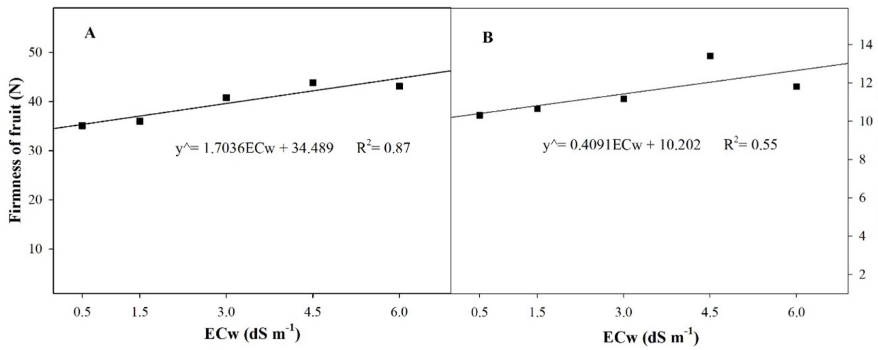

Figure 2. Firmness of fruit (A) and fruit pulp (B) of fruits of genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) in function of the increase of saline doses in the irrigation water (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

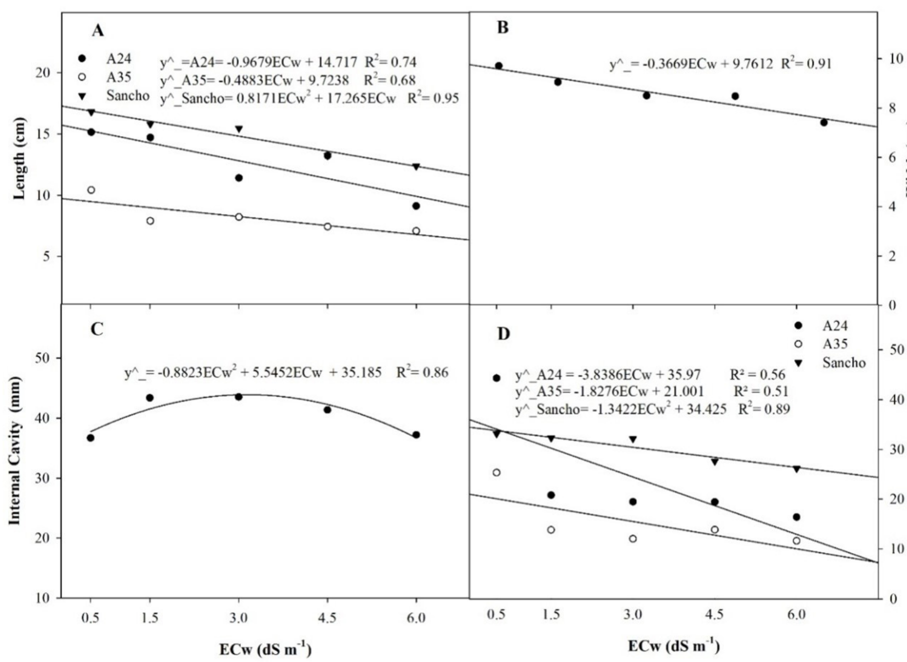

Figure 3. Length (A), width (B), internal cavity (C), pulp thickness (D) of fruits of genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) in function of the increase of saline doses in the irrigation water (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

with tolerance to transport, and these results are similar to those found by Akrami et al. (2019), Dias et al. (2018) and Oliveira et al. (2021).

For the coloring of the fruit skin, the reduction in luminosity (L*) (Figure 4A) may be associated with the degradation, or oxidation, of polyphenols present in the tissue. For Chromaticity (C*), this elevation in the A24 access at a dose of 4.5 dS m^{-1} (Figure 4A) is within the acceptable range for this factor, which is 60. The hue angle increased, possibly due to the color of the genotypes, this being result similar to that found by Suárez-Hernández et al. (2019), who verified an increase in luminosity and chromaticity with a decrease in anglo hue, with an increase in salinity, which shows the oxidizing power of salinity in the appearance marker (color).

The degradation of the luminosity in the pulp of the fruits was evidenced by the decay in the analyzed genotypes, possibly due to the reduction of the chlorophyll content in the pulp, with an increase for the cultivar sancho as the salinity of the irrigation water increases. This reduction in L is accompanied by an increase in C* chromaticity, mainly due to the hue of the white yellowish pulp due to the concentration of yellow flavonoids as the °H angle increases (Figure 4B).

There was a significant interaction between the materials (genotypes) and ECw of irrigation water for the variables vitamin C, total soluble sugars and yellow flavonoids (Table 2). The variables, total soluble solids, hydrogenation potential; titratable acidity showed a significant difference only within an isolated factor.

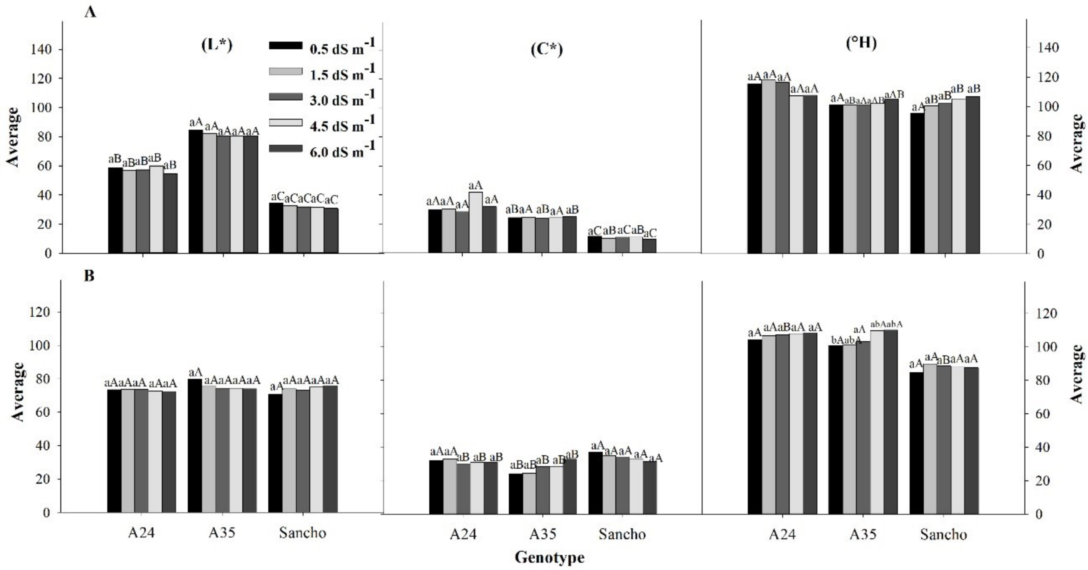

Figure 4. Luminosity (L*), Chroma (C*) and hue angle (°H) of melon bark (A) and fruit pulp (B) of genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) in function of the increase of saline doses in the irrigation water (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}). Lowercase means followed by the same letter between doses, and uppercase means between genotypes do not differ statistically from each other by Tukey's test at 5% probability.

Table 2. Analysis of variance of the characteristics TSS - Total soluble solids in °brix; pH - Hydrogenation potential; TA - Titratable acidity in (%); TS - Total soluble sugars in (%); VTC - Vitamin C in (mg 100 g^{-1}); TC - Total carotenoids in (mg 100 g^{-1}); YF - Yellow flavonoids in (mg 100 g^{-1}) of genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) produced in saline conditions (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

Source	DF	Means Square						
		TSS	pH	TA	TS	VTC	TC	YF
Block	4	0.62^{ns}	0.09^{ns}	0.006^{ns}	0.65^{ns}	1.93*	0.0013^{ns}	4.71**
Materials	2	26.25**	0.69**	0.15**	9.53**	3.89**	0.0014^{ns}	8.56**
Salinity	4	0.98^{ns}	0.12^{ns}	0.009*	1.39^{ns}	6.90**	0.0087**	3.19*
M x S	8	1.18^{ns}	0.07^{ns}	0.013^{ns}	4.00**	0.54^{ns}	0.0017**	6.76**
Error		0.80	0.100	0.002	1.03	0.61	0.0005	0.99
Average		5.20	6.12	0.19	3.79	6.05	0.101	4.44
CV%		17.17	5.18	26.11	26.84	13.00	22.86	22.47

Materials = genotypes (A24; A35 and Sancho); Salinity = (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}); M = genotypes; S = Salinity doses; DF = Degrees of freedom; ns= not significant; CV = coefficient of variation; **$p < 0.01$; *$p < 0.05$.

The titratable acidity was significant only as a function of the ECw of the irrigation water (Figure 5A). Oliveira et al. (2021) also showed that increasing levels of salinity increased titratable acidity. Possibly because salinity has a direct effect on the total titratable acidity of the fruits, since the increase in acidity is related to the nutrition provided to the crops (Prado, 2008). The decrease in sugars for the genotypes Sancho and A35 respectively (Figure 5B) may be due to the sugars that should have been allocated in the fruits, having been used in the osmoregulation process, thus justifying this reduction (Silva et al., 2021), the sugars totals indicate the total amount of sugars in the fruit (sucrose, glucose and fructose).

The decrease in total carotenoids is due to the color of the pulp of the fruits (characteristic of these genotypes) used in this study (Figure 6A). The low content of carotenoids was intensified with the oxidizing effect potentiated by salinity. According to Dumas et al. (2003), a possible explanation for this decrease in carotenoids is that salinity can inhibit or upregulate carotenoid biosynthesis, through the inhibition of genes encoding enzymes related to lycopene and β-carotene. Benmeziane et al. (2018) found a lower amount of this pigment than that found in the present study.

Yellow flavonoids increased linearly (Figure 6B). Melon fruits are rich in phenolic compounds, with flavonoids

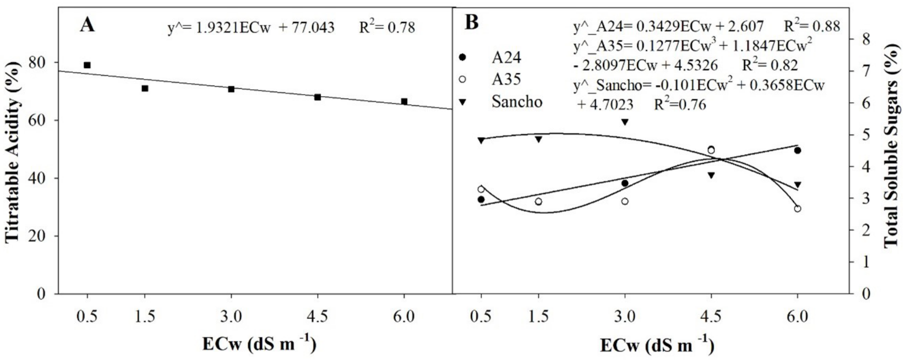

Figure 5. Titratable acidity (A) and total soluble sugars (B) of the fruit of genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) in function of the increase of saline doses in the irrigation water (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

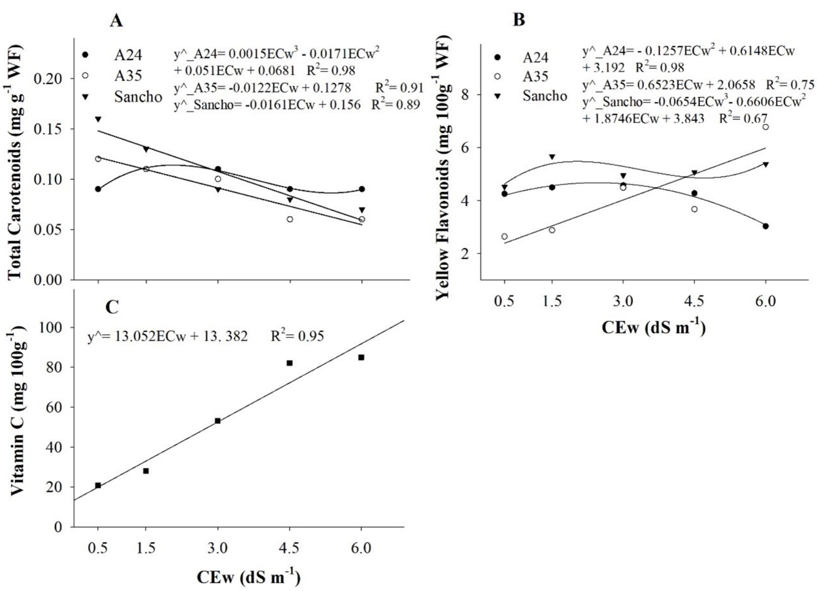

Figure 6. Total carotenoids (A), yellow flavonoids (B) and vitamin C (C) in genotypes A24; A35 and Sancho the of melon (*Cucumis melo* L.) in function of the increase of saline doses in the irrigation water (0.5; 1.5; 3.0; 4.5 and 6.0 dS m^{-1}).

being one of the most representative of this group. There is little information in the literature on the composition of flavonoids in melon pulp. Mallek-ayadi et al. (2017) and Ali and Ismail (2014) found an increase in the concentration of flavonoids in tomato fruits after application of salinity.

Increasing EC doses of irrigation water increased vitamin C with a positive linear effect only between doses (Figure 6C). Oliveira et al. (2021) found an increase in vitamin C levels when submitted to a second dose of salinity. Corroborating the present study, Sousa et al. (2016) observed an increase in vitamin C content in mini watermelon (*Citrullus lanatus*) fruits of cv. Smile with increasing saline concentrations. Vitamin C is widely distributed in plant tissues and is used as a substrate by APX, an important ROS-metabolizing enzyme, therefore, reduced vitamin C significantly reduces cell protection (Anjum et al., 2014).

Despite the increase in pulp and fruit firmness, improvement in antioxidant components, more studies are needed for the development of genotypes that become commercial salinity tolerant. So far, there are no commercial genotypes tolerant to the salinity of irrigation water on the market, which makes it possible for companies and research institutes that work with genetic improvement to commercially develop cultivars that can meet this need.

The results of this study indicate that the salinity from 1.5 dS m^{-1} reduced the production, obtaining smaller fruits (length and width) of smaller mass for all melon accessions studied. Vitamin C and yellow flavonoids increased for the genotypes, indicating antioxidant power against ROS and the accessions studied showed good quality, but the Sancho melon cultivar stood out in the MF, PE and C, of the accessions, possibly because it is an improved material. Accession A24 showed lower AST indicating intolerance to saline solution.

References

AKRAMI, M. and ARZANI, A., 2019. Inheritance of fruit yield and quality in melon (*Cucumis melo* L.) grown under field salinity stress. *Scientific Reports*, vol. 9, no. 1, pp. 7249. http://dx.doi.org/10.1038/s41598-019-43616-6. PMid:31076605.

AKRAMI, M., ARZANI, A. and MAJNOUN, Z., 2019. Leaf ion content, yield and fruit quality of field-grown melon under saline conditions. *Experimental Agriculture*, vol. 55, no. 5, pp. 707-722. http://dx.doi.org/10.1017/S0014479718000303.

ALI, H.E.M. and ISMAIL, G.S.M., 2014. Tomato fruit quality as influenced by salinity and nitric oxide. *Turkish Journal of Botany*, vol. 38, pp. 122-129. http://dx.doi.org/10.3906/bot-1210-44.

ANJUM, N.A., GILL, S.S., GILL, R., HASANUZZAMAN, M., DUARTE, C.A., PEREIRA, E., AHMAD, I., TUTEJA, R. and TUTEJA, N., 2014. Metal/metalloid stress tolerance in plants: role of ascorbate, its redox couple, and associated enzymes. *Protoplasma*, vol. 251, no. 6, pp. 1265-1283. http://dx.doi.org/10.1007/s00709-014-0636-x. PMid:24682425.

ARAUJO, E.B.G., SÁ, F.V.D.S., OLIVEIRA, F.A.D., SOUTO, L.S., PAIVA, E.P.D., SILVA, M.K.D., MESQUITA, E.F. and BRITO, M.E.B., 2016. Crescimento inicial e tolerância de cultivares de meloeiro à salinidade da água. *Revista Ambiente & Água*, vol. 11, no. 2, pp. 462-471. http://dx.doi.org/10.4136/ambi-agua.1726.

ASSOCIATION OF OFFICIAL ANALYTICAL CHEMISTRY – AOAC, 2002. *Official methods of analysis of the AOAC*. 17th ed. Washington: AOAC, 115 p.

BENMEZIANE, F., DJERMOUNE-ARKOUB, L., BOUDRAA, A.T. and BELLAAGOUNE, S., 2018. Physicochemical characteristics and phytochemical content of jam made from melon (*Cucumis melo*). *International Food Research Journal*, vol. 25, pp. 133-141.

DIAS, N.S., MORAIS, P.L.D., SARMENTO, J.D.A., SOUSA NETO, O.N., PALÁCIO, V.S. and FREITAS, J.J.R., 2018. Nutrient solution salinity effect of greenhouse melon (*Cucumis melon* L. cv. Néctar). *Acta Agronomica*, vol. 67, no. 4, pp. 517-524. http://dx.doi.org/10.15446/acag.v67n4.60023.

DUMAS, Y., DADOMO, M., LUCCA, G. and GROLIER, P., 2003. Effects of environmental factors and agricultural techniques on antioxidant content of tomatoes. *Journal of the Science of Food and Agriculture*, vol. 83, no. 5, pp. 369-382. http://dx.doi.org/10.1002/jsfa.1370.

FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS – FAO, 2020 [viewed 18 January 2022]. *Countries by commodity* [online]. Rome: FAO. Available from: https://www.fao.org/faostat/en/#rankings/countries_by_commodity

FRANCIS, F.J. and MARKAKIS, P.C., 1989. Food colorants: anthocyanins. *Critical Reviews in Food Science and Nutrition*, vol. 28, no. 4, pp. 273-314. http://dx.doi.org/10.1080/10408398909527503. PMid:2690857.

HOAGLAND, D.R. and ARNON, D.I., 1950. *The water culture method for growing plants without soils*. California: California Agricultural Experimental Station, 347 p.

INSTITUTO ADOLFO LUTZ – IAL, 2005. *Métodos físico-químicos para análise de alimentos*. 4. ed. São Paulo: IAL, vol. 1, 533 p.

INSTITUTO BRASILEIRO DE GEOGRAFIA E ESTATÍSTICA – IBGE, 2020 [viewed 18 January 2022]. *Produção agrícola: lavoura temporária* [online]. Rio de Janeiro: IBGE. Available from: https://cidades.ibge.gov.br/brasil/rn/pesquisa/14/10346?tipo=ranking&indicador=10347&ano=2020

LICHTENTHALER, H.K., 1987. Chlorophylls and carotenoids: pigments of photosynthetic biomembranes. *Methods in Enzymology*, vol. 148, pp. 350-382. http://dx.doi.org/10.1016/0076-6879(87)48036-1.

LIMA, R.E., FARIAS, L.F.L., FERREIRA, J.F.S., SUAREZ, D.L. and BEZERRA, M.A., 2020. Translocation of photoassimilates in melon vines and fruits under salinity using 13C isotope. *Scientia Horticulturae*, vol. 274, pp. 1-11. http://dx.doi.org/10.1016/j.scienta.2020.109659.

MALLEK-AYADI, S., BAHLOUL, N. and KECHAOU, N., 2017. Characterization, phenolic compounds and functional properties of *Cucumis melo* L. peels. *Food Chemistry*, vol. 221, pp. 1691-1697. http://dx.doi.org/10.1016/j.foodchem.2016.10.117. PMid:27979149.

MASCARENHAS, F.R., MEDEIROS, D.C., MEDEIROS, J.F., DIAS, P.M.S. and SOUZA, M.S.M., 2010. Produção e qualidade de melão gália cultivado sob diferentes níveis de salinidade. *Revista Verde*, vol. 5, no. 5, pp. 171-181.

MINOLTA, C., 2007. *Precise color communication: color control from feeling to instrumentation*. Osaka: MINOLTA Corp.

MORAIS, D.L., AROUCHA, E.M.M., OLIVEIRA, F.A., MEDEIROS, J.F., PAIVA, C.A. and NASCIMENTO, L.V., 2018a. Impact of Salinity on Quality and Post-Harvest Conservation of Gherkin (*Cucumis anguria* L.). *Journal of Agricultural Science (Toronto)*, vol. 10, no. 4, pp. 167-177. http://dx.doi.org/10.5539/jas.v10n4p167.

MORAIS, P.L.D., DIAS, N.S., OLIVEIRA, A.M., SOUSA NETO, O.N., SARMENTO, J.D. and GONZAGA, M.I.S., 2018b. Effects of nutrient solution salinity on the physiological performance of melon cultivated in coconut fiber. *Revista Caatinga*, vol. 31, no. 3, pp. 713-718. http://dx.doi.org/10.1590/1983-21252018v31n321rc.

OLIVEIRA, G.B.S., OLIVEIRA, F.A., SANTOS, S.T., OLIVEIRA, M.K.T., AROUCHA, E.M.M., ALMEIDA, J.G.L., MENEZES, P.V., COSTA, M.J.V., PINTO, F.F.B. and ALVES, F.A.T., 2021. Potassium nutrition as a strategy to mitigate salt stress in melon grown under protected cultivation. *Semina: Ciências Agrárias*, vol. 4, no. 6, pp. 3219-3234. http://dx.doi.org/10.5433/1679-0359.2021v42n6p3219.

PEREIRA, F.A.L., MEDEIROS, J.F., GHEYI, H.R., DIAS, N.S., PRESTON, W. and VASCONCELOS, C.B., 2017. Tolerance of melon cultivars to irrigation water salinity. *Revista Brasileira de Engenharia Agrícola e Ambiental*, vol. 21, no. 12, pp. 846-851. http://dx.doi.org/10.1590/1807-1929/agriambi.v21n12p846-851.

PRADO, R.M., 2008. *Nutrição de plantas*. São Paulo: UNESP, 407 p.

SARABI, B., BOLANDNAZAR, S., GHADERI, N. and GHASHGHAIE, J., 2017. Genotypic differences in physiological and biochemical responses to salinity stress in melon (*Cucumis melo* L.) plants: prospects for selection of salt tolerant landraces. *Plant Physiology and Biochemistry*, v.119, pp. 294-311. http://dx.doi.org/10.1016/j.plaphy.2017.09.006.

SILVA, F.H.A., MORAIS, P.L.D., DIAS, N.S., NUNES, G.H.S., MORAIS, M.B., MELO, M.F. and NASCIMENTO, M.T.A., 2021. Physiological aspects of melon (*Cucumis melo* L.) as a function of salinity. *Journal of Plant Growth Regulation*, vol. 40, no. 3, pp. 1298-1314. http://dx.doi.org/10.1007/s00344-020-10190-5.

SOUSA, A.B.O., DUARTE, S.N., SOUSA NETO, O.N., SOUZA, A.C.M., SAMPAIO, P.R.F. and DIAS, C.T.S., 2016. Production and quality of mini watermelon cv. Smile irrigated with saline water. *Revista Brasileira de Engenharia Agrícola e Ambiental*, vol. 20, no. 10, pp. 897-902. http://dx.doi.org/10.1590/1807-1929/agriambi.v20n10p897-902.

STROHECKER, R. and HENINING, H.M., 1967. *Análisis de vitaminas: métodos comprobrados*. Madrid: Paz Montalvo, 42 p.

SUÁREZ-HERNÁNDEZ, Á.M., VÁZQUEZ-ANGULO, J.C., GRIMALDO-JUÁREZ, O., DURAN, C.C., GONZÁLEZ-MENDOZA, D., BAZANTE-GONZÁLEZ, I. and MENDOZA-GÓMEZ, A., 2019. Production and quality of grafted watermelon in saline soil. *Horticultura Brasileira*, vol. 37, no. 2, pp. 215-220. http://dx.doi.org/10.1590/s0102-053620190213.

YEMM, E.W. and WILLIS, A.J., 1954. The estimation of carbohydrates in plant extracts by anthrone. *The Biochemical Journal*, vol. 57, no. 3, pp. 508-514. http://dx.doi.org/10.1042/bj0570508. PMid:13181867.