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Yield, physiology and quality of yellow melon grown with biofertilizer[1]

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ABSTRACT

An efficient organic cultivation can be a viable strategy to enhance the sustainability of the melon production chain. This study aimed to assess the physiological and productive responses, as well as the post-harvest quality, of melon fruits, as a function of biofertilizer doses. The experiment followed a randomized blocks design, in a split-plot arrangement, with four replications. The treatments included six biofertilizer doses (0, 1, 2, 3, 4 and 5 L plant^{-1}) as subplots and two melon hybrids (AC 154 and Royal Amália) as plots. The use of 3 L plant^{-1} cycle^{-1} of the biofertilizer increased the sugar content in the leaf tissue, improved the photosynthetic efficiency, enhanced the biochemical variables and provided higher yields, in addition to improving the fruit post-harvest quality of the tested hybrids.

KEYWORDS: *Cucumis melo* L., organic cultivation, fruit post-harvest quality.

RESUMO

Produtividade, fisiologia e qualidade de melão amarelo cultivado com biofertilizante

O cultivo orgânico eficiente pode ser uma estratégia viável para aumentar a sustentabilidade da cadeia produtiva do meloeiro. Objetivou-se avaliar as respostas fisiológicas e produtivas, bem como a qualidade pós-colheita, de frutos de meloeiro, em função de doses de biofertilizante. O delineamento experimental foi em blocos casualizados, com parcelas subdivididas, e quatro repetições. Os tratamentos consistiram de seis doses de biofertilizante (0; 1; 2; 3; 4; e 5 L planta^{-1}) como subparcelas e dois híbridos de meloeiro (AC 154 e Royal Amália) como parcelas. O uso de 3 L planta^{-1} ciclo^{-1} do biofertilizante proporcionou aumento na quantidade de açúcares no tecido foliar, na eficiência fotossintética, nas variáveis bioquímicas e na produtividade, além de melhorar a qualidade pós-colheita dos frutos dos híbridos testados.

PALAVRAS-CHAVE: *Cucumis melo* L., cultivo orgânico, qualidade pós-colheita de frutos.

INTRODUCTION

Melon cultivation requires a significant amount of chemical fertilizers, particularly potassium (K), nitrogen (N) and phosphorus (P), posing negative environmental impacts such as increased greenhouse gas emissions and contamination risks, and increasing water and carbon footprints in its production chain (Santos et al. 2018a). Allied with that, the intensive use of mineral fertilizers in irrigation areas of the Brazilian semiarid region has also led to higher production costs and soil degradation (Silva et al. 2016). To address these issues, there is a need for more sustainable production systems and alternative nutrient sources. Therefore, biofertilizers have been suggested as a potential solution to reduce reliance on synthetic inputs in melon cultivation.

According to Mahmud et al. (2021), biofertilizers can promote plant growth and soil health, even under abiotic stress conditions, through the production of phytohormones and N fixation, as well as solubilization and mobilization of nutrients such as P, K and zinc (Zn), reducing chemical fertilizer inputs and hence risks of salinization and environmental contamination.

Previous researches have demonstrated positive outcomes when using biofertilizers in melon cultivation. For instance, Santos et al. (2014) reported that aerobic fermentation mixed biofertilizer resulted in a yield of 32.62 t ha^{-1} for cantaloupe melon at a dose of 1.08 L plant^{-1} week^{-1}, while anaerobic

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fermentation bovine biofertilizer yielded 25.87 t ha^{-1}. These authors also observed an increase in pulp thickness, when compared to mineral fertilizers at the dose of 1.41 L plant^{-1} week^{-1}. In a study by Batista et al. (2019), investigating the initial growth of Gold Mine melon in the semiarid region of the Bahia state (Brazil), different doses of biofertilizers exhibited a significant impact on main stem elongation, number of leaves and leaf area.

However, there is a lack of information on the physiological and post-harvest quality effects of biofertilizers on yellow melon, particularly under semiarid conditions. This gap is especially notable when considering promising hybrids suitable for organic production systems. Therefore, this study aimed to assess the physiological responses, yield and post-harvest quality of melon hybrids grown with different biofertilizer doses in the Brazilian semiarid region.

MATERIAL AND METHODS

The experiment was conducted at the Embrapa Semiárido, in Petrolina, Pernambuco state, Brazil (9º8'8.9''S, 40º18'33.6''W and altitude of 365.5 m), from October to December 2019. According to the Köppen & Geiger classification, the local climate is BSwh', standing for a semiarid Caatinga climate, with average annual rainfall of 465.71 mm and average air temperature of 26.6 ºC (Alvares et al. 2013). During the experimental period, October showed the highest reference evapotranspiration (ETo) value (6.62 mm day^{-1}), with mean maximum, average and minimum air temperatures of 22.09, 28.40 and 35.57 ºC, respectively (Figure 1). The highest air temperature values were recorded in November and December, reaching 36.07 and 35.75 ºC, respectively.

The treatments were arranged in a split-plot design, and the experiment was conducted in a complete randomized blocks design, with four replications. The main plots consisted of two melon varieties [AC 154 (yellow hybrid, export type, with medium elliptical longitudinal section, thick and uniform white flesh) and Royal Amália (yellow hybrid, honeydew type, with orange flesh, uniform and crispy)], while the subplots consisted of six biofertilizer doses (0, 1, 2, 3, 4 and 5 L plant^{-1}), totaling 48 experimental plots, with each subplot consisting of six plants.

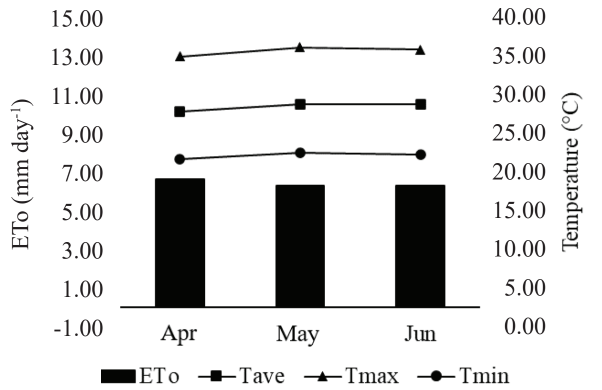


Figure 1. Monthly means of maximum (T_{max}), average (T_{ave}) and minimum (T_{min}) temperatures, and reference evapotranspiration (ETo) during the cultivation of two melon hybrids subjected to biofertilizer doses (Petrolina, Pernambuco state, Brazil, 2019).

The planting rows were spaced 2.0 m apart and plants within rows 0.3 m apart, totaling 3.6 m² per plot and 201.6 m² of total area, with 115.2 m² as the useful area. Seeds were sown in polystyrene trays (October 02, 2019) filled with Maxfertil™ commercial substrate (85 % of bark and pinus compost, 10 % of vermiculite and 5 % of carbonized husk - rice and pinus - with NPK additives). One seed was placed per cell at a depth of about 2/3 of the seed size, and irrigation was performed twice a day to maintain the substrate moisture for root development. After 7 days of sowing (October 09, 2019), the seedlings were transplanted to the final growing area, planting two seedlings per hole when they had developed a true leaf. Thinning was performed when the plants reached 4 to 5 true leaves, selecting the most vigorous plant.

The soil tillage involved plowing and harrowing using a disk harrow, followed by furrowing for planting beds using a furrower. Fertilization was conducted at the planting stage and during the crop growth (Cavalcanti 1998). The fertilizer sources included castor cake (120 kg ha^{-1}), Yoorin Master™ phosphate (30 kg ha^{-1}), Ekosil™ (30 kg ha^{-1}), Commax Algas™ and magnesium sulfate.

The soil in the experimental area is classified as Argissolo Vermelho Amarelo distrófico plíntico (Santos et al. 2018b) or Acrisol (FAO 2015), and its chemical characteristics at the 0-0.2 m depth layer are shown in Table 1.

To prepare the biofertilizer, 50 kg of earthworm castings, 25 kg of castor bean meal, 10 kg of Yoorin Master™, 5 kg of sugarcane molasses, 300 g of DBR

Table 1. Soil chemical characteristics at the 0-0.2 m depth layer.

pH (H_2O)	EC mS cm^{-1}	Ca	Mg	K	Na	Al	H + Al	CEC	BS	P	OM
		cmol$_c$ dm^{-3}							mg dm^{-3}		
6.2	0.51	2.7	1.3	0.64	0.14	0	0.07	5.5	86.9	106.93	0

pH: hydrogen potential; EC: electrical conductivity of the saturation extract; Ca: calcium; Mg: magnesium; K: potassium; Na: sodium; Al: aluminum (extraction in KCl 1 M); H + Al: potential acidity; CEC: cation exchange capacity; BS: base saturation; P: available phosphorus extracted by Mehlich-1; OM: organic matter.

Probiotic® and 20 kg of MB-4™ organic biofertilizer were used. The products were mixed and diluted in 1,000 L of untreated water to avoid a chlorine treatment that could harm the microorganisms present in the mixture. The solution was then aerated using an automated aerator for 10 min at intervals of 1 hour. After preparation, the solution was filtered and a sample was taken for chemical characterization (Table 2).

For conservation of the product characteristics, the biofertilizer solution was stored for a maximum period of approximately 30 days. As the first solution approached completion, a second solution was prepared in parallel, allowing 8 days for nutrient maturation and release (Oliveira et al. 2022).

Irrigation was performed using a drip system with emitters spaced at 0.30 m, with a watering interval of 2 days. The application doses were calculated based on the crop evapotranspiration (ETc). The crop coefficients (Kc) used to determine the ETc were initial (0.35), vegetative (0.70), fruiting (1.00) and maturation (0.80) (Embrapa 2008). The reference evapotranspiration values (ETo) were provided by the meteorological station installed at the Embrapa Semiárido experimental field.

Phytosanitary treatments included the use of products such as Nat ZB™, Agree™, sulfocalcic solution and Primecur™, applied via spraying as needed. The biofertilizer doses were applied weekly through irrigation water starting from 12 days after transplanting (DAT). The biofertilizer solution was filtered and injected into the irrigation system using PVC tubes (manifolds) based on the pressure difference.

At 20 and 40 DAT, corresponding to the flowering and fruiting stages, respectively, the following physiological variables were evaluated: photosynthesis (μmol CO_2 m^{-2} s^{-1}), stomatal conductance (mmol H_2O m^{-2} s^{-1}), transpiration (H_2O m^{-2} s^{-1}) and leaf temperature (ºC), using a portable gas exchange analyzer (IRGA - Model LI-6400 XT), as well as chlorophyll a, b and total contents by a chlorophyll index meter (ClorofiLOG CFL 1030). Samples of the third fully expanded leaf were collected from the apex of the plant to determine the total soluble sugars and reducing sugars contents. The plant material was wrapped in aluminum foil and stored in a refrigerated container with ice. Afterwards, the leaf samples were macerated, soaked in phosphate buffer solution (pH 7.0) and centrifuged to obtain the supernatant for the total soluble sugars determination (Yemm & Willis 1954), and quantification of reducing sugars using the dinitrosalicylic acid method (Miller 1959).

At the end of the experiment, the fruits were counted and weighed to determine the average fruit weight, extrapolating the values to an area of 1 ha to obtain the average yield. Two representative fruits, in terms of color and size, were selected from each plot for post-harvest quality evaluation, characterizing them for pulp firmness (N) using a penetrometer, fruit length (cm) and width (cm) using a graduated ruler, total soluble sugars (ºBrix) using a handheld refractometer (Pocketpal-1 model), pH using a digital pH meter, and total titratable acidity by titration with NaOH.

The data were subjected to analysis of variance. When treatment effects were observed, the hybrid

Table 2. Chemical characterization of the biofertilizer.

pH (H_2O)	EC dS m^{-1}	N	P	K	Ca	Mg	S	Cu	Mn	Zn	Fe
		g L^{-1}						mg L^{-1}			
6.1	4.3	0.6	50.0	0.9	3.4	0.6	0.02	1.1	11.7	16.3	68.3

pH: hydrogen potential; EC: electrical conductivity; N: nitrogen by the Kjeldahl method; P: phosphorus; K: potassium; Ca: calcium; Mg: magnesium; S: sulphur; Cu: copper; Mn: manganese; Zn: zinc; Fe: iron by plasma atomic emission spectrometry.

means were compared using the Tukey test at 5 % of significance ($p < 0.05$). The effect of biofertilizer doses was evaluated using regression analysis, testing linear and quadratic models. The equations were chosen based on the F-test of regression analysis ($p < 0.05$) and coefficient of determination (R^2), with the lowest residual mean square. The physiological variables were not compared over time, so each collection date was evaluated separately. Statistical analyses were performed using the Sisvar software, version 5.7 (Ferreira 2011).

RESULTS AND DISCUSSION

Regarding chlorophyll synthesis in melon leaves, the statistical analysis demonstrated a significant difference only for the biofertilizer doses, but not between the AC 154 and Royal Amália hybrids. During the flowering stage, a significant and positive effect of the biofertilizer doses on the chlorophyll a content was observed (Figure 2A), reaching a maximum of 17.84 mg m^{-2} at the dose of 2.85 L plant^{-1}. For the chlorophyll b content (Figure 2B), the maximum values were 7.58 and 7.22 mg m^{-2} for the average of the AC 154 and Royal Amália hybrids, corresponding to an estimated dose of 2.69 L plant^{-1}. Likewise, the maximum observed total chlorophyll contents (Figure 2C) were 25.97 and 24.96 mg m^{-2}, achieved at an estimated dose of 2.97 and 2.67 L plant^{-1}. Overall, the Royal hybrid exhibited a more pronounced response in the synthesis of chlorophyll b and total chlorophyll at extreme doses.

In the fruiting stage, the contents of chlorophyll a (Figure 2D), b (Figure 2E) and total (Figure 2F) exhibited estimated maximum values of 8.15, 9.01 and 19.38 mg m^{-2}, respectively, for the studied hybrids, at the doses of 3.04, 2.55 and 2.92 L plant^{-1}.

The observed chlorophyll values were lower than expected for the phenological stages of yellow melon (Batista 2019). This result may be associated with the fact that the biofertilizer serves as a nutrient source for the soil, including N, which has a considerable influence on increasing chlorophyll levels in plants (Anicésio et al. 2018). Additionally, the organic matter present in the biofertilizer acts as a cementing agent among soil particles, improving its physical attributes and increasing the cation exchange capacity, thereby enhancing nutrient availability (Alencar et al. 2015). The soil microbiota is also benefited from using biofertilizers (Du et al. 2022), as it increases the conversion of complex organic matter into simpler compounds that can be readily absorbed by plants (Yadav & Sarkar 2019).

It is worth noting that doses higher than 3 L plant^{-1} resulted in a reduction in the chlorophyll levels. Considering the electrical conductivity of the biofertilizer, the increased doses raised the soil solution salinity to stress levels for the crop. Sarabi &

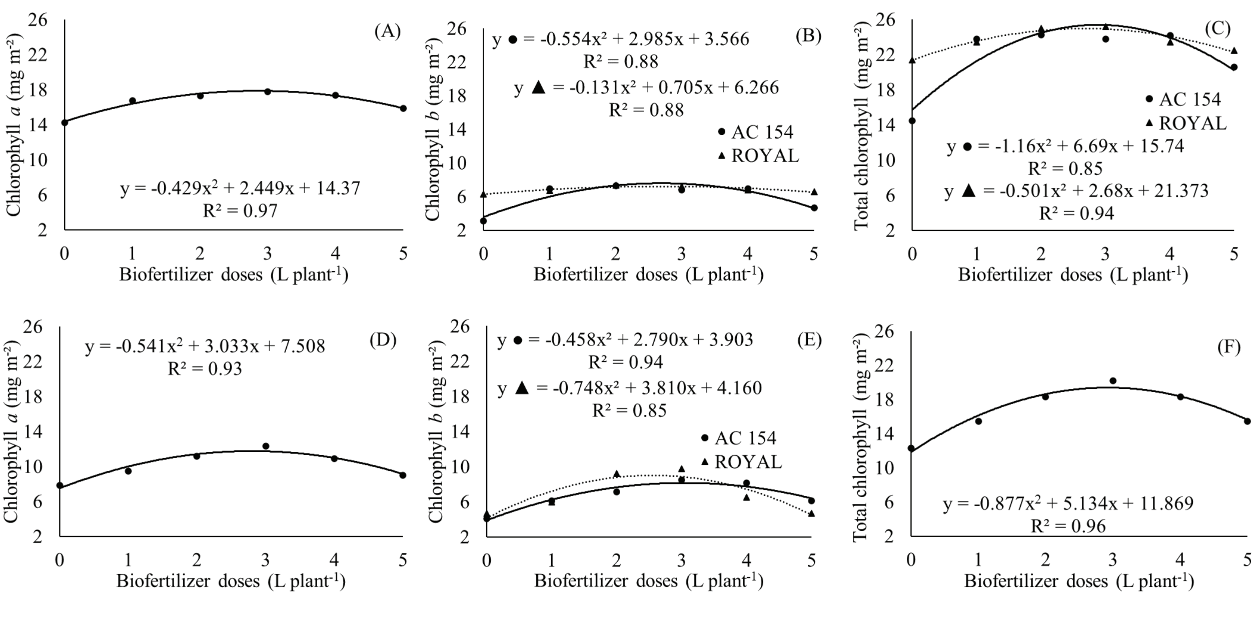


Figure 2. Contents of chlorophyll a, b and total during the flowering (A, B and C) and fruiting (D, E and F) stages of two melon hybrids grown under biofertilizer doses.

Ghashghaie (2022) reported that salt stress reduces the chlorophyll content and net photosynthetic rate in melon genotypes. Mendonça et al. (2010) stated that salt stress leads to an increase in the enzyme chlorophyllase, which enhances pigment degradation.

Batista et al. (2019) found chlorophyll a and b values of 30 and 10 mg m^{-2}, respectively, in leaves of the Gold Mine melon cultivar. Lima et al. (2020) reported chlorophyll a and b values of 35 and 15 mg m^{-2}, respectively, for the Pele de Sapo melon. The lower values observed in the present study may be attributed to differences between the cultivars used.

Concerning parameters related to plant gas exchange at flowering (Figures 3A-D), the hybrids responded differently to the biofertilizer application only in terms of leaf transpiration (Figure 3C) at extreme doses. The adjusted quadratic regression equations estimated the transpiration to be 5.29 and 5.28 mmol of H_2O m^{-2} s^{-1} at the doses of 2.54 and 2.68 L plant^{-1} for the AC 154 and Royal hybrids, respectively.

Regarding photosynthesis (Figure 3A), the maximum rate was 29.55 µmol of CO_2 m^{-2} s^{-1}, with the dose of 2.51 L plant^{-1}. The adjusted equations for the other variables also exhibited a quadratic behavior. Only the leaf temperature decreased with increasing biofertilizer doses, reaching a minimum value of 28.32 ºC for the dose of 2.39 L plant^{-1}. This decrease is likely due to an increased gas exchange, which cools the leaf blade and transfers heat to the atmosphere (Gonçalves et al. 2010). The maximum stomatal conductance (Figure 3B) of 0.26 mol of H_2O m^{-2} s^{-1} was obtained with an application of 2.7 L plant^{-1} of biofertilizer.

During the fruiting stage, there was an interaction between hybrids and biofertilizer doses for the variables photosynthesis and transpiration (Figures 4A and 4C). The photosynthesis reached maximum values of 20.37 and 25.73 µmol of CO_2 m^{-2} s^{-1} at the doses of 2.50 and 1.56 L plant^{-1}, respectively, while the transpiration reached maximum rates of 4.37 and 4.30 mmol of H_2O m^{-2} s^{-1} at the doses of 2.81 and 1.89 L plant^{-1} for the AC 154 and Royal hybrids, respectively. On the other hand, the maximum values for stomatal conductance and leaf temperature (Figure 4B) were 0.19 µmol of CO_2 m^{-2} s^{-1} and 30.4 ºC, respectively, obtained at the doses of 3.13 and 2.91 L plant^{-1}.

The dose range of 2.50 to 3.00 L plant^{-1} of biofertilizer yielded the best results for leaf chlorophyll content. These results may increase yield indices in hybrids, since chlorophyll plays a vital role in photosynthesis (Taiz & Zeiger 2017).

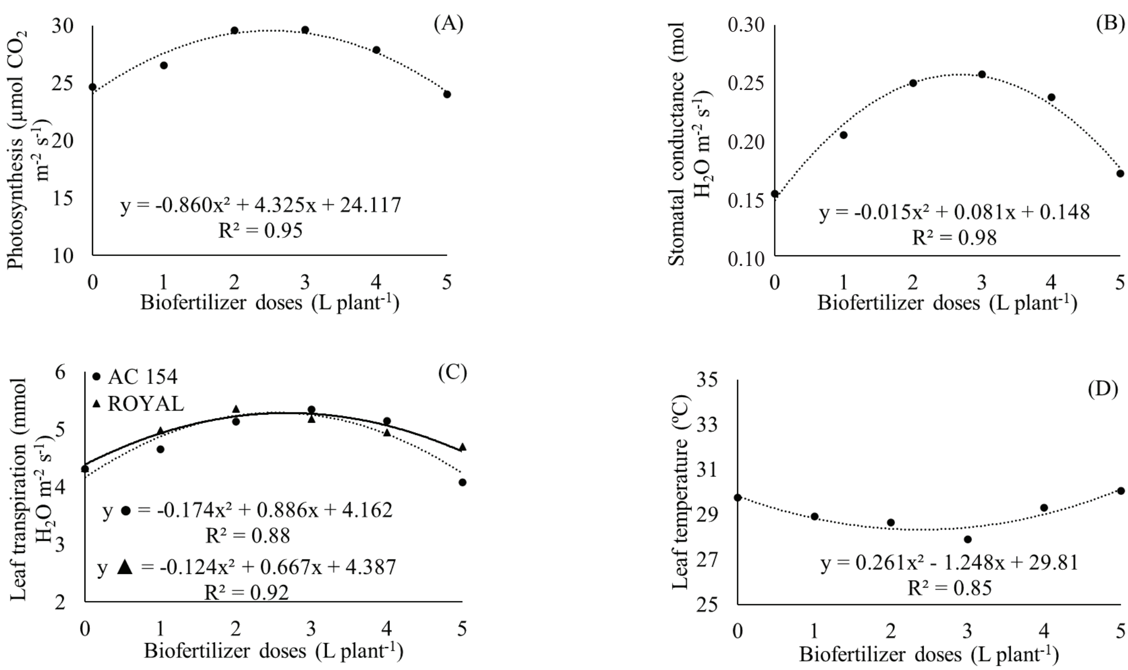


Figure 3. Photosynthesis (A), stomatal conductance (B), leaf transpiration (C) and leaf temperature (D) during the flowering stage of two melon hybrids grown under biofertilizer doses.

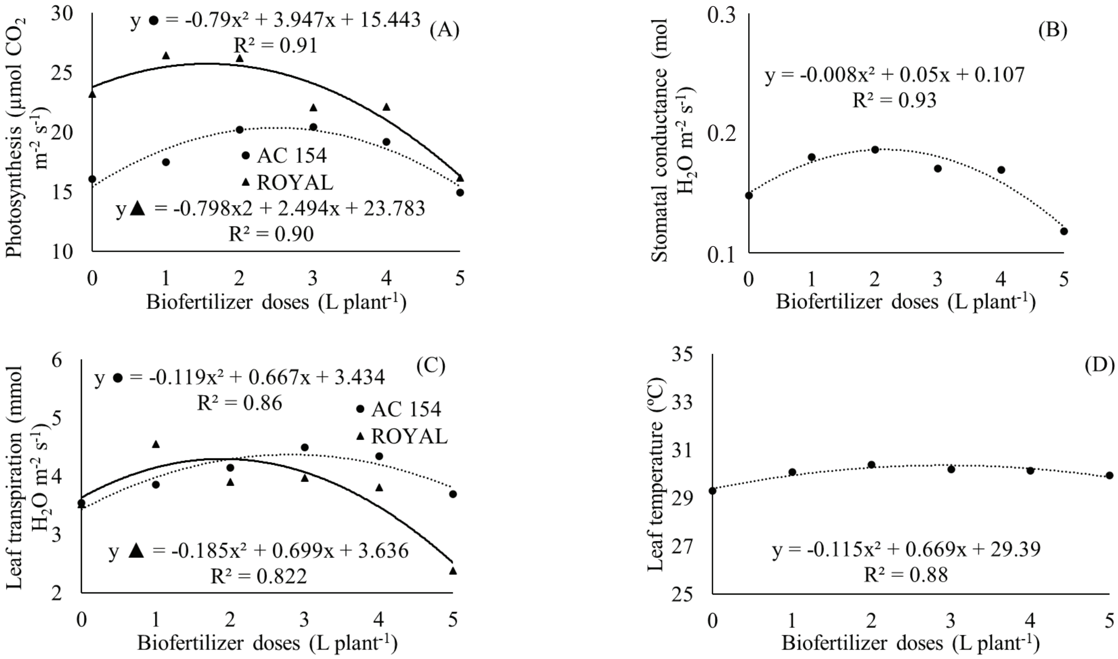


Figure 4. Photosynthesis (A), stomatal conductance (B), leaf transpiration (C) and leaf temperature (D) during the fruiting stage of two melon hybrids grown under biofertilizer doses.

These authors also highlighted that chlorophyll is crucial in capturing solar energy and transferring it to photosystem reaction centers to be used in the Calvin cycle, wherein CO_2 is converted into organic matter.

The nutrients in the biofertilizer, such as N and Mg, may have influenced the physiological responses observed. This is because these elements are constituents of chlorophyll, which has a direct relationship with the transfer of photochemical energy in the photosystem reaction centers (Mesquita et al. 2015). Additionally, Mg acts as a cofactor in photosynthesis-related enzymes and organic compound synthesis, while P is required for converting light energy into chemical energy (ATP) during photosynthesis (Taiz & Zeiger 2017).

In general, a decrease in gas exchange was observed with doses above 3 L plant^{-1}. This concentration may have led to an increase in the electric conductivity of the applied solution, inducing stomatal closure (Thales et al. 2013). Biofertilizer benefits on melon physiological characteristics were also reported by Viana et al. (2013), who observed increased rates of photosynthesis, stomatal conductance and transpiration for the Mirage cultivar under biofertilizer doses and types.

The total soluble sugars increased up to a certain value of the applied biofertilizer doses (Figures 5A and 5B), fitting a quadratic regression model. During flowering, the hybrids showed a significant difference in the response curve, with maximum estimated levels of 5.46 and 4.83 mg g^{-1} for the doses of 1.88 and 3.00 L plant^{-1}, respectively, for the AC 154 and Royal hybrids. In the fruiting stage (Figure 5B), there was no difference between the hybrids, with a maximum content of 5.73 mg g^{-1} obtained with the dose of 2.11 L plant^{-1}.

In both the flowering and fruiting stages, the accumulation capacity of reducing sugars (Figures 5C and 5D), in response to biofertilizer doses, differed between the melon hybrids, with AC 154 standing out. The adjusted regression equations for the flowering stage estimated maximum levels of 1.53 and 1.11 mg g^{-1} for doses of 2.33 and 2.92 L plant^{-1}, respectively, for the AC 154 and Royal hybrids. In this case, AC 154 was more efficient in sugar accumulation, achieving higher levels with a lower biofertilizer dose. In the fruiting stage (Figure 5C), the Royal hybrid was more efficient, with peak points of 1.04 and 1.48 mg g^{-1} for the doses of 2.62 and 2.61 L plant^{-1} of biofertilizer, respectively, for the AC 154 and Royal hybrids. This difference in efficiency between hybrids and evaluation stages may be associated with their adaptability to climate, as the ambient temperature decreased over the cultivation period.

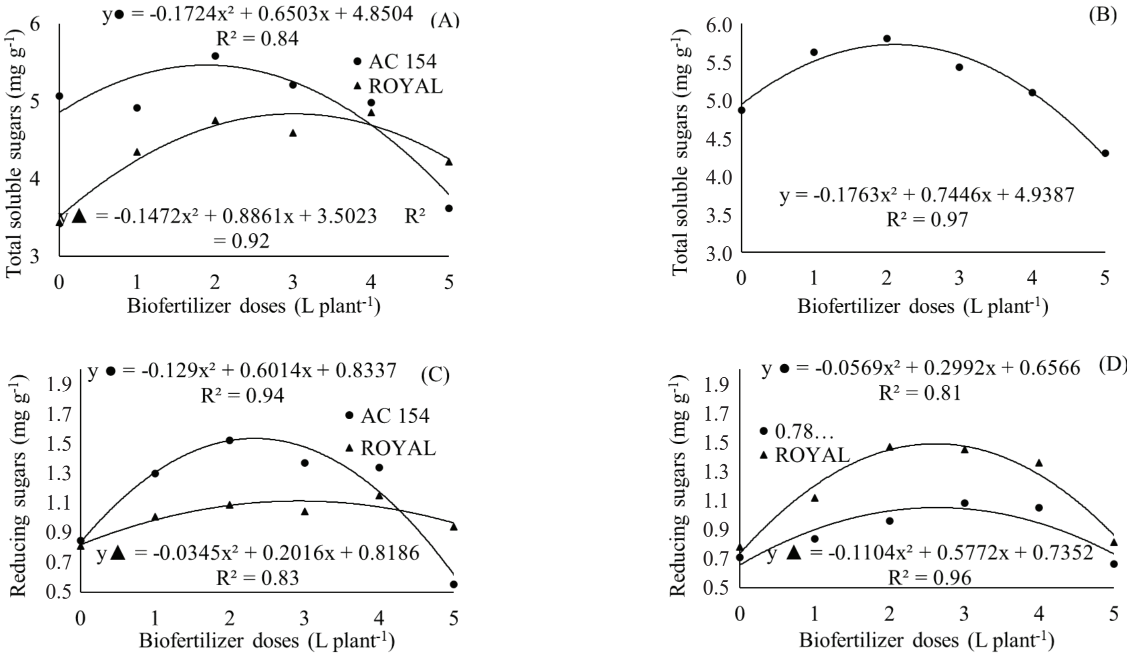


Figure 5. Total soluble sugars (A and B) and reducing sugars (C and D) in the leaf tissue of melon hybrids, as a function of biofertilizer doses and flowering (A and C) and fruiting (B and D) stages.

Considering that the increase in photosynthetic production contributes to carbohydrate accumulation (Sarker & Rahin 2018), the maximum sugar content in leaf tissue was provided by a dose close to the one that resulted in a higher photosynthesis, reinforcing the direct relationship between these variables. This result is consistent with the findings of Ferreira (2016), who reported an increase in the levels of reducing sugars and total soluble sugars in leaves of yellow melon, hybrid F1 10/00, when cultivated using a biostimulant.

The reducing sugars and total soluble sugars contents observed in this study were slightly higher than those found by Mesquita et al. (2021) for Crimson Sweet Select watermelon. These authors also used biofertilizers and evaluated reducing sugars and total soluble sugars at 25 and 40 days after the transplantation (DAT), and reported values close to 0.9 and 0.8 mg g^{-1} for reducing sugars and 1.00 mg g^{-1} for total soluble sugars, respectively, for both the analyzed dates.

Regarding post-harvest fruit quality, the variables average fruit weight, fruit length, pulp thickness, total soluble sugars and titratable acidity were influenced by the biofertilizer doses and melon hybrids individually. On the other hand, the variables fruit width, pulp firmness and pH showed significant differences only between the melon hybrids.

Table 3 illustrates the comparison between the AC 154 and Royal Amália hybrids. The AC 154 hybrid exhibited a higher average fruit weight, fruit length, fruit width and pulp thickness, with averages of 1.11 kg, 14.25 cm, 12.03 cm and 3.41 cm, respectively. However, the average fruit weight of AC 154 fell below the standard for the cultivar, which is 2.40 kg (Embrapa 2017). On the other hand, the Royal Amália hybrid had an average weight of 1.05 kg, which is close to the recommended value of 1.1 kg for this variety (East-West Seed 2023). Additionally, the Royal Amália hybrid outperformed the AC 154 in terms of pulp firmness, total soluble

Table 3. Average post-harvest characteristics of fruits of two melon hybrids under biofertilizer doses.

Characteristic	AC 154	Royal Amália
Fruit average weight (kg)	1.11 a*	1.05 b
Fruit length (cm)	14.25 a	12.35 b
Fruit width (cm)	12.03 a	11.41 b
Pulp thickness (cm)	3.41 a	3.07 b
Total soluble sugars (ºBrix)	9.05 b	13.31 a
Titratable acidity	0.09 b	0.10 a
pH	6.33 b	6.65 a

* Means followed by the same letter in the row do not differ from each other by the Tukey test at 5 % of significance.

sugars, titratable acidity and pH, with averages of 24.0 N, 13.31 ºBrix, 0.10 and 6.65, respectively.

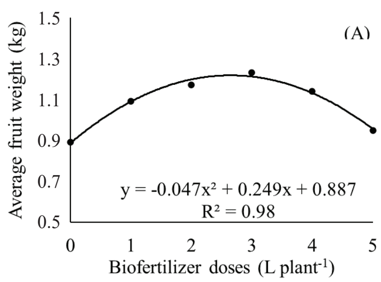
Pulp pH is essential in assessing fruit quality. The findings of the present study showed a low acidity for the two hybrids studied, which is under the classification proposed by Azeredo & Brito (2004). Therefore, the treatments promoted fruits of superior quality, since a low acidity makes them less susceptible to microbial development, which is directly related to the fruit post-harvest shelf life (Azeredo & Brito 2004).

Based on the mathematical models in Figures 6A, 6B, 6D, 6E and 6F, the parameters average fruit weight, pulp thickness, total soluble sugars, fruit length and titratable acidity reached their maximum values at 1.22 kg, 3.49 cm, 12.07 ºBrix, 14.09 cm and 0.11 %, respectively. These optimal values were achieved when applying biofertilizer doses of 2.65, 2.69, 2.57, 2.85 and 2.91 L plant^{-1}, respectively.

According to Carmo et al. (2017), the total soluble sugars contents found for the two hybrids studied (Table 3) and the estimated values for the biofertilizer doses (Figure 6D) are within the recommended range for marketable fruits, making them suitable for export to the European continent, where it ranges from 9 to 12 ºBrix.

The melon yield (Figure 6C) exhibited a quadratic response to biofertilizer doses, reaching a maximum yield of 32 t ha^{-1} with the dose of 2.57 L plant^{-1}. Santos et al. (2014) obtained comparable results of 32.62 t ha^{-1} with a dose of 1.08 L plant^{-1} week^{-1} of mixed biofertilizer (cattle manure + Anyi tile-like gray chicken manure + water) using the Mirage melon cultivar in the Brazilian northeastern semiarid region. Although a similar yield was achieved in this study, a larger amount of biofertilizer was required. The use of biofertilizer led to a significant increase of 72.97 % in the yellow melon yield, when compared to the treatment without biofertilizer, enhancing the profitability and fertilizer efficiency, as observed in other studies (Silva et al. 2016, Batista et al. 2019, Santos et al. 2019).

The pulp firmness exhibited a significant interaction between biofertilizer doses and hybrids, with the AC 154 hybrid showing higher values than the Royal Amália hybrid. AC 154 reached its maximum firmness with the highest biofertilizer dose. According to Tomaz et al. (2009), the ideal pulp firmness for melon commercialization should be equal to or greater than 22 N. This requirement was



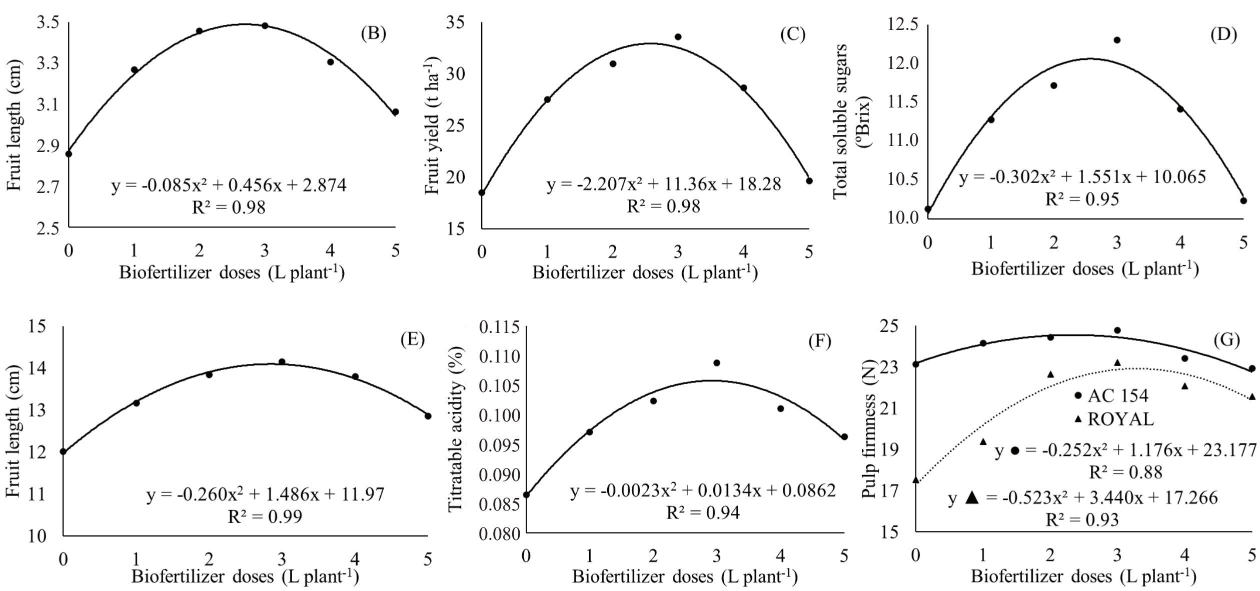


Figure 6. Average fruit weight (A), pulp thickness (B), fruit yield (C), total soluble sugars (D), fruit length (E), titratable acidity (F) and pulp firmness (G) of two melon hybrids under biofertilizer doses.

met by both the AC 154 and Royal Amália hybrids, with values of 24.55 and 22.61 N, respectively, for the doses of 2.33 and 3.19 L plant^{-1} (Figure 6G). This result is important for melon cultivation efficiency, as firmness is a crucial factor in post-harvest handling, where firmer fruits are more resistant to mechanical injuries during transportation and commercialization, providing a longer shelf-life (Chaves et al. 2014).

The physiological and production findings of the present study are supported by Benicasa (2003), who stated that the photosynthetic production accounts for approximately 90 % of the plant dry matter. A greater amount of vegetative material and assimilates enables the plants to achieve their maximum yield potential, both quantitatively and qualitatively (Van Bueren & Struik 2017).

CONCLUSION

Applying 2.5 to 3 L plant^{-1} cycle^{-1} of the biofertilizer (earthworm castings, castor bean meal, Yoorin Master™, sugarcane molasses, DBR Probiotic® and MB-4™) enhances the photosynthetic efficiency, biochemical parameters and yield, and improves the post-harvest quality of the AC 154 and Royal Amália melon hybrids.

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