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Scientific Article

Morphology of melon grown with fish farming effluent and cattle manure

Morfologia do meloeiro cultivado com efluente de piscicultura e esterco bovino

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ABSTRACT - Water scarcity is a significant challenge faced in semi-arid regions, especially concerning agriculture. Therefore, alternatives for utilizing available water resources of inferior quality and adding organic matter to the soil are fundamental strategies to address this challenge. Considering this, the objective was to investigate the use of fish farming effluent and cattle manure in the production of melon seedlings of the Cantaloupe variety, specifically the Hales Best Jumbo cultivar. The experiment was conducted in a greenhouse, using a completely randomized design with a 5 x 5 factorial scheme. The treatments consisted of five proportions of cattle manure (0%, 5%, 10%, 15%, and 20%) combined with five dilutions of fish farming effluent (FFE) in public-supply water (PSW): D1 - 0% FFE; D2 - 15% FFE and 85% PSW; D3 - 30% FFE and 70% PSW; D4 - 45% FFE and 55% PSW; D5 - 60% FFE and 40% PSW, with six repetitions, totaling 150 experimental units. The results indicate that using substrate containing 20% cattle manure, irrigated with the D3 dilution (30% fish farming effluent and 70% public-supply water), promoted benefits for morphological variables of melon. The reuse of fish farming effluent, with electrical conductivity up to 1.75 dS m^{-1}, is an alternative for reutilization and favors the growth and biomass production of Cantaloupe melon, Hales Best Jumbo cultivar.

Keywords: *Cucumis melo* L. Salt stress. Organic matter. Reuse.

RESUMO - A escassez hídrica é um grande desafio enfrentado nas regiões semiáridas, especialmente, no que diz respeito à agricultura. Assim, alternativas para o uso de águas disponíveis que têm qualidade inferior, bem como a adição de matéria orgânica no solo, são estratégias fundamentais para enfrentar esse desafio. Diante disso, objetivou-se investigar o uso de efluente da piscicultura e esterco bovino na produção de mudas de meloeiro da variedade Cantaloupe, cultivar Hales Best Jumbo. Realizou-se o experimento em casa de vegetação, com delineamento inteiramente casualizado, em esquema fatorial 5 x 5, cujos tratamentos foram compostos de cinco proporções de esterco bovino - E (0%; 5%; 10%; 15% e 20%) e cinco diluições do efluente de piscicultura (EP) em água de abastecimento público (AA): D1 - 0% EP; D2 - 15% EP e 85% AA; D3 - 30% EP e 70% AA; D4 - 45% EP e 55% AA; D5 - 60% EP e 40% AA, com 6 repetições, totalizando 150 unidades experimentais. Os resultados indicam que a utilização do substrato contendo 20% de esterco bovino, irrigado com a diluição D3 (30% de efluente de piscicultura e 70% de água de abastecimento) proporcionou benefícios no desempenho das variáveis de crescimento e fitomassa do meloeiro. O reúso de efluente da piscicultura, apresentando condutividade elétrica até 1,75 dS m^{-1}, é uma alternativa de reaproveitamento e favorece o crescimento e a produção de fitomassa de meloeiro Cantaloupe da cultivar Hales Best Jumbo.

Palavras-chave: *Cucumis melo* L. Estresse salino. Matéria orgânica. Reúso.

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INTRODUCTION

World production of melon (*Cucumis melo* L.) was estimated at 28.558 million tons, with a harvested area of approximately 1.062 million hectares, resulting in an average yield of 26.89 t ha^{-1} (FAO, 2022). In Brazil, its production predominates in the Northeast region, with the states of Bahia, Ceará and Rio Grande do Norte being the main melon producers, with more than 80% of the cultivated area, and the production of the last two states is mostly destined for export (KIST et al., 2022).

In the semi-arid region, average annual rainfall data range from 250 to 600 mm, with irregular spatial and temporal distribution, with average temperature of 27 ºC and average evapotranspiration of 3000 mm (BEZERRA et al., 2020). However, the availability of good quality water for agricultural production is considerably reduced, given the edaphoclimatic characteristics of the region.

Irrigation water quality directly influences the production and development of seedlings, being a determining factor for agricultural activities (SOUZA et al., 2019). Under conditions of water scarcity, mixing and/or alternating the application of fresh water and water with higher salt concentrations can be employed in irrigation to make use of water available in the region, aiming at reducing the salinization to which the plant is subjected; however, this strategy must be adequate to guarantee sustainable agriculture (HASSANLI; EBRAHIMIAN, 2016).

Melon is considered moderately sensitive to salinity, having irrigation water salinity threshold of 2.0 dS m^{-1} and soil saturation extract salinity threshold of 3.0 dS m^{-1} (AYERS; WESTCOT, 1999). Excess salts in irrigation water cause several adverse effects on soil and plants, mainly reducing the osmotic potential of the soil solution, leading to lower water availability to plants, and increasing the osmotic potential, nutritional imbalance due to the high ion concentration and toxicity by specific ions such as sodium and chloride, resulting in reduced plant growth (ANDRADE et al., 2019). Fish farming effluents can serve as an alternative source for irrigation of agricultural crops, ensuring water saving in production (DANTAS et al., 2019), in addition to providing nutrients; however, they generally contain a high concentration of salts, which can limit their reuse in the agricultural exploitation of sensitive crops (SOUZA et al., 2019).

Among the factors that can favor agricultural exploitation is the use of organic residues that serve as a source of nutrients and organic matter for plants (FARIAS et al., 2019), improving the chemical, physical and biological properties of the soil, increasing plant germination and growth rates (COSTA et al., 2020). The use of cattle manure in the formulation of substrate for seedling production is a strategy, mainly for the use of organic solid waste in agriculture, being low cost and accessible to small rural producers. Cattle manure improves the physical and chemical properties of substrates, favoring crop growth and biomass production (HOSEINI et al., 2021; YANG; ZHANG, 2022).

In this context, the production of plants with quality and vigor, adequate growth and stand homogeneity promotes better uniformity of crops, contributing to high yield in the field. Therefore, the objective was to evaluate the morphology of melon of the Cantaloupe variety, Hales Best Jumbo cultivar, produced with fish farming effluent and cattle manure.

MATERIAL AND METHODS

The experiment was carried out from May to June 2022, in a greenhouse covered with diffuser plastic and 50% shade net, located in the Department of Agricultural and Forestry Sciences of the Federal Rural University of the Semi-Arid Region - UFERSA, in Mossoró, Rio Grande do Norte, Brazil, located at the geographic coordinates 5º 11’ S and 37º 20’ W at an altitude of 18 m.

According to Köppen’s climate classification, the local climate is BSwh’ (hot and dry), with rainy season in summer delaying until autumn. It has an average annual temperature of around 27.0 °C, average relative humidity of 68.9% and irregular rainfall with average of 673.9 mm (DINIZ; PEREIRA, 2015). The maximum and minimum temperature and relative humidity data recorded inside the greenhouse during the experiment are presented in Figure 1.

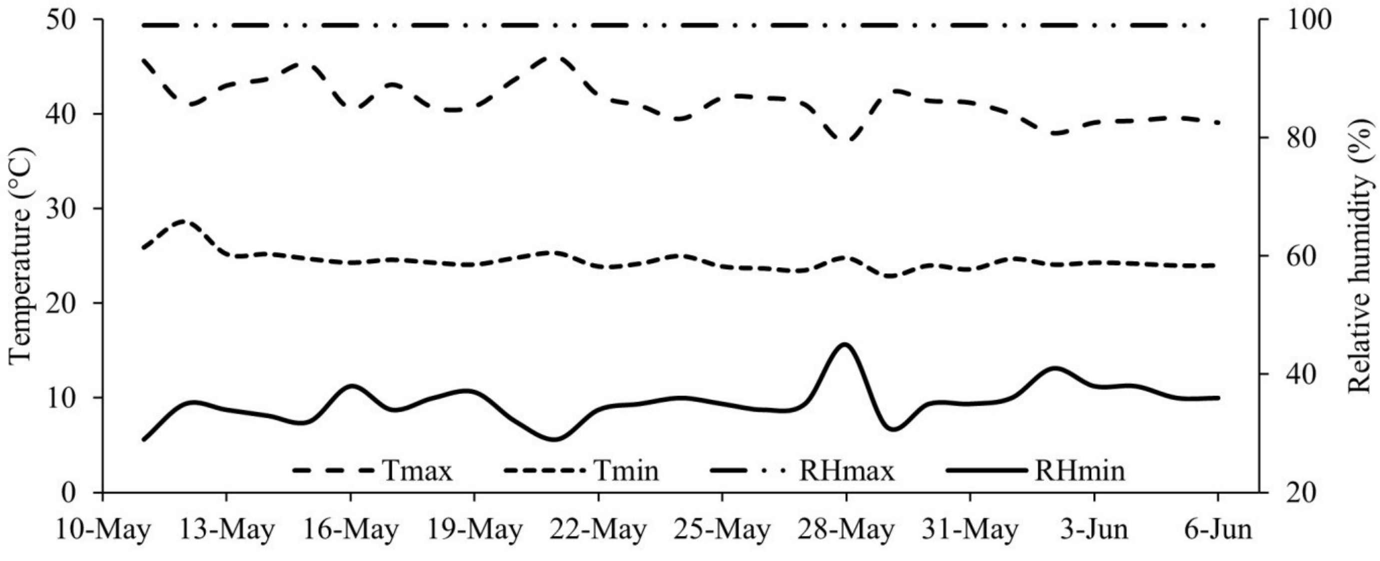

Figure 1. Maximum and minimum temperature (ºC) and relative humidity (%) in the greenhouse during the experimental period 2022. Mossoró, RN, Brazil.

The experimental design used was completely randomized, in a 5 x 5 factorial scheme, with 6 replicates, totaling 150 experimental units. The factors were composed of five proportions of cattle manure (CM) (0%; 5%; 10%; 15% and 20%) and five dilutions of fish farming effluent (FFE) in public-supply water (PSW): D1 - 0% FFE; D2 - 15% FFE and 85% PSW; D3 - 30% FFE and 70% PSW; D4 - 45% FFE and 55% PSW; D5 - 60% FFE and 40% PSW.

Fish farming effluent was collected in the Aquaculture sector of UFERSA, and cattle manure was provided by the seedling production sector of the Agricultural Sciences Center of UFERSA. Cantaloupe melon seeds, Hales Best Jumbo cultivar, were purchased. The cantalupensis group and the chosen cultivar represent noble melons, of great economic importance, produced for export.

Table 1 describes the physical-chemical characteristics of the public-supply water and fish farming effluent (RICHARDS, 1954).

After diluting the fish farming effluent in public-supply water, the hydrogen potential (pH) and electrical conductivity (EC) at 25 °C were measured using a digital pH meter (Instrutherm® PH-5000) and a benchtop conductivity meter (Tecnal®, TEC-4MP), respectively (Table 2).

Table 1. Physical-chemical characteristics of the public-supply water (PSW) and fish farming effluent (FFE) used in the experiment.

Identification	pH	EC	K^+	Na^+	Ca^{2+}	Mg^{2+}	CL^-	CO_3^{2-}	HCO_3^-	SAR
	H_2O	dS m^{-1}	mmol$_c$ L^{-1}							(mmol$_c$ L^{-1})$^{0.5}$
PSW	7.90	0.58	0.36	4.15	0.80	1.10	4.00	0.00	5.50	4.30
FFE	7.50	4.11	0.71	16.65	16.90	9.70	22.60	0.00	5.80	4.60

SAR - Sodium adsorption ratio.

Table 2. Hydrogen potential (pH) and electrical conductivity (EC) of the dilutions between fish farming effluent and public-supply water.

Dilutions of effluent	pH	EC (dS m^{-1})
D1	7.90	0.58
D2	7.80	1.19
D3	7.70	1.75
D4	7.60	2.30
D5	7.60	2.57

Dilutions of fish farming effluent (FFE) in public-supply water (PSW): D1 - 0% FFE; D2 - 15% FFE and 85% PSW; D3 - 30% FFE and 70% PSW; D4 - 45% FFE and 55% PSW; D5 - 60% FFE and 40% PSW.

The soil was collected in the surface layer (0-20 cm) and subsequently sieved through a 10-mm-mesh sieve to compose the substrate for the melon seedling bags. Chemical analysis is presented in Table 3, according to the methodology described in the Soil Analysis Methods Manual (EMBRAPA, 1997). The soil came from the UFERSA's teaching garden, East campus of Mossoró, RN. It is classified as *Argissolo Vermelho-Amarelo Eutrófico Abrupto* (Ultisol), with sand textural class (88% sand, 10% silt and 2% clay) (EMBRAPA, 2013).

Table 3. Chemical characterization of the soil (0-20 cm) and cattle manure used in the experiment.

	pH	ECse	N	OM	P	K^+	Na^+	Ca^{2+}	Mg^{2+}	Al^{3+}	H+Al	SB	CEC	V	m	ESP
	H_2O	dS m^{-1}	-----g kg^{-1}----		---------mg dm^{-3}---------			-------------------cmol$_c$ dm^{-3}-------------------						%		
Soil	7.70	0.06	0.49	8.80	123.8	104.3	15.3	2.8	1.2	0.0	0.0	4.33	4.33	100	0	2
Manure	7.70	1.96	2.66	51.06	421.0	1983.1	430.6	6.2	2.9	0.0	0.0	16.04	16.04	100	0	12

The substrate was composed of a mixture (v/v) of soil and cattle manure. Three seeds were sown per plastic bag (2.5 dm^3), and 2.0 dm^3 of substrate was used in each bag. The dimensions of the substrate were approximately 10 cm in diameter and 25 cm in depth. Until the 10th day after sowing (DAS), the seedlings were irrigated only with public-supply water, aiming for germination and emergence without the adverse effect of the salinity of the fish farming effluent. Irrigation of melon seedlings with the dilutions was carried out for 16 days, until 26 DAS. At 10 DAS, thinning was performed, leaving only the most vigorous seedling per bag. Irrigations were carried out once a day, applying the same volume to all plants, which varied and increased according to the growth and water needs of the plants, and irrigation was sufficient to maintain substrate moisture close to the maximum water retention capacity of the soil.

The variables analyzed were: number of leaves per plant (NL), plant height (PH), root length (RL), total leaf area (TLA), stem diameter (SD), shoot fresh mass (SFM), root fresh mass (RFM), shoot dry mass (SDM), root dry mass (RDM), total fresh mass (TFM), total dry mass (TDM), and the data were used to calculate the Dickson Quality Index (DQI).

At 26 DAS, treatment effects were evaluated according to each variable: number of leaves per plant (NL), determined by counting fully open leaves; plant height (PH), obtained by measuring the height of the aerial part in centimeters, from the collar to the apical bud of the main branch, using a graduated ruler; root length (RL), obtained by measuring the distance from the collar to the apex of the main root, using a graduated ruler with values in centimeters; total leaf area (TLA), determined as a function of leaf width (Equation 1), according to Nascimento et al. (2002), by calculating the individual area for each leaf and then summing the values to obtain the total leaf area.

$$LA = 0.826\ W^{1.89} \quad (1)$$

where: LA = Leaf area (cm^2); W = Leaf width (cm).

Stem diameter (SD) was measured at 2 cm above ground level, using a digital caliper, with values expressed in millimeters; masses were expressed in grams (g) and obtained by weighing on a precision analytical balance with two decimal places: shoot fresh mass (SFM) and root fresh mass (RFM), determined by weighing the shoots and roots, respectively; shoot dry mass (SDM) and root dry mass

(RDM), determined after drying the material in a forced circulation oven at 65 °C. Total fresh mass (TFM) was obtained by adding SFM and RFM values, and total dry mass (TDM) was obtained by adding SDM and RDM values. These data were then used to calculate the Dickson quality index (DICKSON; LEAF; HOSNER, 1960), according to Equation 2:

$$DQI = \frac{TDM}{\frac{PH}{SD} + \frac{SDM}{RDM}} \quad (2)$$

where: DQI = Dickson quality index; TDM = Total dry mass (g); PH = Plant height (cm); SD = Stem diameter (mm); SDM = Shoot dry mass (g); RDM = Root dry mass (g).

The data were subjected to analysis of variance using the F test ($p<0.05$); in significant cases, regression analysis was applied to the cattle manure factor and Tukey test was applied to the fish farming effluent factor, using the computer program SISVAR® (FERREIRA, 2019).

RESULTS AND DISCUSSION

There were significant effects of the interaction between the factors proportions of cattle manure and dilutions of fish farming effluent on total leaf area ($p<0.01$) and stem diameter ($p<0.05$) (Table 4). There were significant effects of the cattle manure factor on number of leaves, plant height, total leaf area and stem diameter ($p<0.01$) and root length ($p<0.05$) of melon seedlings (Table 4). For the individual factor fish farming effluent, significant effects were observed on plant height and total leaf area ($p<0.01$) and root length and stem diameter ($p<0.05$) (Table 4).

Table 4. Summary of analysis of variance and test of means for number of leaves (NL), plant height (PH), root length (RL), total leaf area (TLA) and stem diameter (SD) of melon seedlings grown with cattle manure and fish farming effluent, at 26 DAS.

Sources of variation	DF	Mean square				
		NL	PH	RL	TLA	SD
Manure (M)	4	10.67**	367.75**	54.20*	64665.59**	6.65**
Linear regression	1	42.56**	1429.47**	169.50**	256696.83**	25.82**
Quadratic regression	1	0.00^{ns}	31.52^{ns}	10.91^{ns}	33.82^{ns}	0.28^{ns}
Effluent (E)	4	0.68^{ns}	54.35**	45.19*	4517.71**	0.37*
M x E	16	0.39^{ns}	20.25^{ns}	16.65^{ns}	2483.45**	0.26*
Residual	125	0.33	12.20	17.30	796.05	0.15
CV (%)	-	12.86	21.06	14.71	18.09	7.55
Treatments		Mean ± Standard error				
		NL	PH (cm)	RL (cm)	TLA (cm^2)	SD (mm)
D1		4.53 ± 0.14 a	16.01 ± 0.76 ab	29.79 ± 0.81 a	150.74 ± 9.22 b	4.90 ± 0.12 b
D2		4.73 ± 0.15 a	17.71 ± 0.85 a	27.76 ± 0.82 ab	155.63 ± 8.42 ab	5.06 ± 0.09 ab
D3		4.50 ± 0.16 a	17.90 ± 1.20 a	26.57 ± 0.66 b	174.87 ± 12.11 a	5.20 ± 0.13 a
D4		4.37 ± 0.12a	16.70 ± 0.83 ab	29.03 ± 0.85 ab	157.35 ± 9.53 ab	5.11 ± 0.09 ab
D5		4.37 ± 0.14 a	14.61 ± 0.62 b	28.23 ± 0.76 ab	141.29 ± 8.00 b	5.12 ± 0.08 ab

**, * and ^{ns} = Significant at 1% probability level, significant at 5% probability level and not significant, respectively, according to the F test. Means followed by the same letters in the column do not differ by Tukey test at 5% probability level. Dilutions of fish farming effluent (FFE) in public-supply water (PSW): D1 - 0% FFE; D2 - 15% FFE and 85% PSW; D3 - 30% FFE and 70% PSW; D4 - 45% FFE and 55% PSW; D5 - 60% FFE and 40% PSW.

The number of leaves per plant (Figure 2A) and plant height (Figure 2B) were described by increasing linear regression equations as the manure proportions increased. According to the regression equation, higher NL and PH values were observed in melon plants grown with 20% cattle manure, with average values of 5 leaves per plant and 20.95 cm, respectively. A linear decreasing behavior was observed for root length (Figure 2C), as the doses of cattle manure increased. Despite this trend, the difference in melon root length under the manure proportions of 0% (29.78 cm) and 20% (26.77 cm) was only 3.01 cm. This behavior may have been caused by the restriction of root growth due to the 25 cm depth of the substrate in the plastic bags, preventing full root development in the treatments.

When analyzing the dilutions of fish farming effluent in the production of seedlings, the lowest value of plant height was obtained with the highest dilution, D5 (14.61 cm), but dilutions D2 and D3 led to the highest values (17.71 and 17.90 cm), respectively, not statistically differing from each other. For RL, the highest value (29.79 cm) was observed when fish farming effluent was not used (D1) and the lowest value (26.57 cm) was obtained when D3 was used in irrigation. The other treatments (D2, D4 and D5) did not differ from each other (Table 4).

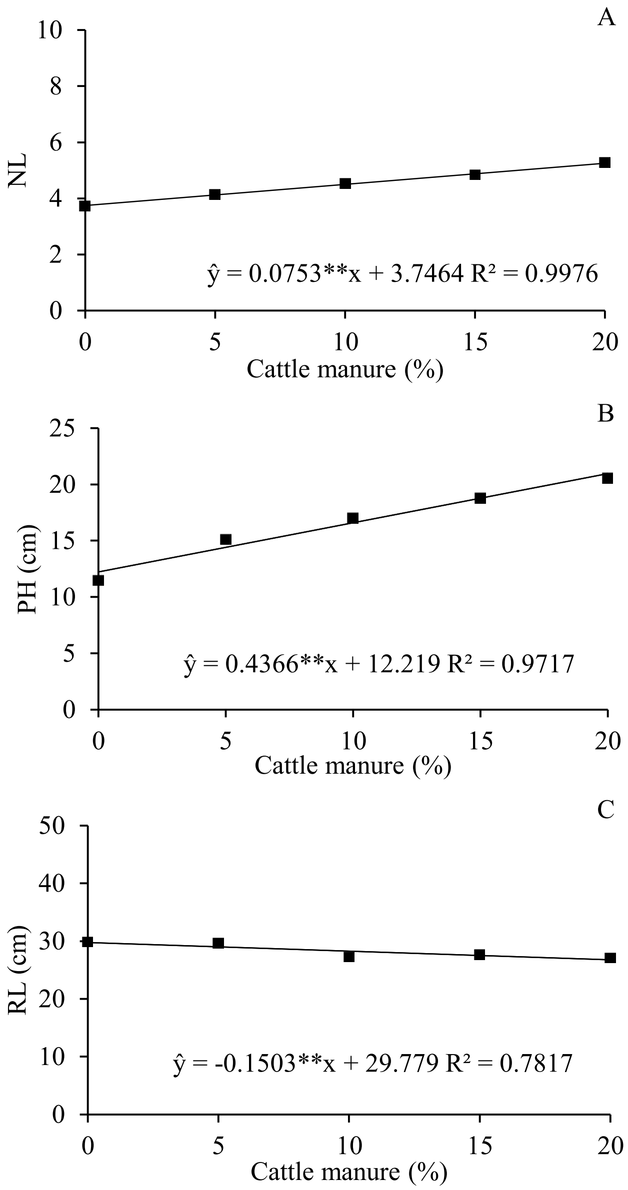

Figure 2. Number of leaves (NL), plant height (PH) and root length (RL) of 'Cantaloupe' melon seedlings grown with cattle manure and fish farming effluent, at 26 DAS.

TLA and NL per plant showed similar behavior; as the number of leaves increased, so did the total leaf area. Determining leaf area is of fundamental importance, as leaves are related to several processes such as evapotranspiration, radiation interception and CO_2 fixation (HERNANDEZ-SANTANA et al., 2017). Plants with larger leaf area tend to have more efficient photosynthetic rates, which promote greater light assimilation, photosynthesis and dry matter accumulation, hence favoring greater plant production (ALBANO et al., 2017).

The stem diameter of melon seedlings, subjected to different proportions of cattle manure and dilutions of fish farming effluent, was significantly affected by the interaction ($p<0.05$), being described by increasing linear regressions. The highest SD value (6.04 mm) was observed in the combination of D3 (EC = 1.75 dS m^{-1}) with the use of 20% cattle manure in the seedling substrate (Figure 3B). This result for SD occurred because the electrical conductivity of 1.75 dS m^{-1} is lower than the salinity threshold of the melon crop, as it is considered moderately sensitive to salinity and has an irrigation water salinity threshold of 2.0 dS m^{-1} (AYERS; WESTCOT, 1999). However, Araújo et al. (2016) found that Cantaloupe melon seedlings, Hales Best Jumbo cultivar, can be irrigated using water with electrical conductivity of up to 2.4 dS m^{-1}, without compromising their growth and quality.

Plants that have a larger stem diameter have a greater tendency to survive, as well as a greater capacity for formation and growth of new roots (TAIZ et al., 2017). However, this behavior is observed up to the EC of 1.75 dS m^{-1}, which led to an increase in growth variables, except for RL, since the plants either employed saline regulation to prevent the excessive salt levels of the substrate from reaching the protoplasm or were able to tolerate the toxic effects and osmotic disturbances associated with the increase in salt concentration in the protoplasm (SILVA et al., 2022).

Aged cattle manure has potential in the production of melon seedlings, due to its high nutrient content (SILVA JÚNIOR et al., 2018). This accumulation is possibly related to the results observed in total leaf area (Figure 3A) and stem diameter (Figure 3B). Another inference that can be made, due to the better development of seedlings with the greater proportion of cattle manure, is related to the improvements in the physical properties of the soil, when organic matter is added, which causes a decrease in bulk density, better aeration, greater porosity and greater water retention capacity.

There was a significant effect for the interaction between cattle manure and fish farming effluent for the variables shoot fresh mass (SFM), root fresh mass (RFM), root dry mass (RDM), total fresh mass (TFM), total dry mass (TDM) and Dickson quality index (DQI) ($p<0.01$) and shoot dry mass (SDM) ($p<0.05$) in melon seedlings (Table 5).

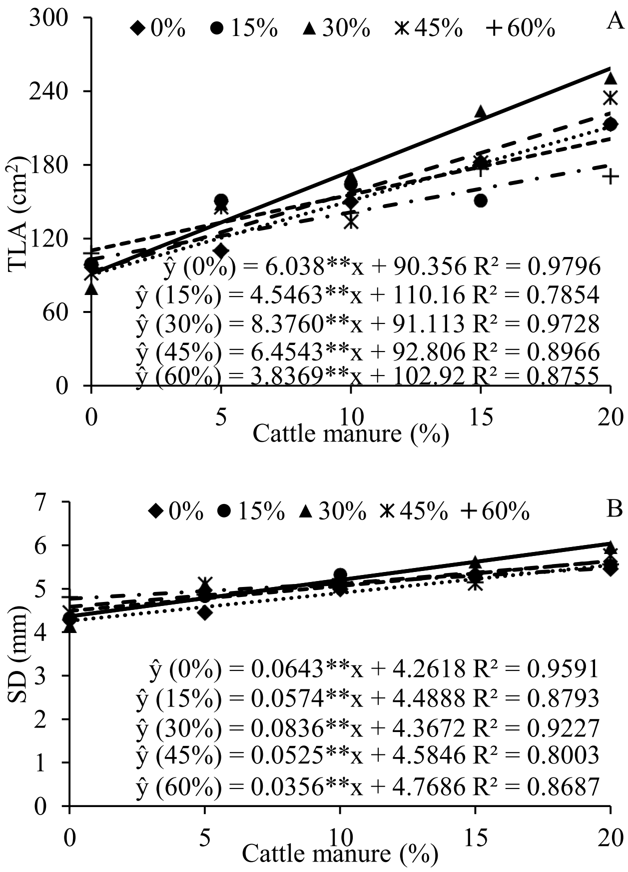

Figure 3. Total leaf area (TLA) and stem diameter (SD) of 'Cantaloupe' melon seedlings as a function of the interaction between cattle manure and fish farming effluent dilutions, at 26 DAS.

Table 5. Summary of analysis of variance and test of means for shoot fresh mass (SFM), root fresh mass (RFM), shoot dry mass (SDM), root dry mass (RDM), total fresh mass (TFM), total dry mass (TDM) and Dickson quality index (DQI) of melon seedlings grown with cattle manure and fish farming effluent, at 26 DAS.

Sources of variation	DF	Mean square						
		SFM	RFM	SDM	RDM	TFM	TDM	DQI
Manure (M)	4	372.21**	39.78**	3.51**	0.57**	641.61**	6.75**	0.09**
Linear Reg.	1	1477.41**	141.91**	13.77**	1.85**	2535.08**	25.72**	0.28**
Quadratic Reg.	1	1.21^{ns}	14.23**	0.20*	0.39**	7.14ns	1.17**	0.06*
Effluent (E)	4	18.55**	5.45*	0.27**	0.26**	37.44**	0.95**	0.02*
M x E	16	7.87**	6.10**	0.09*	0.17**	20.89**	0.35**	0.02**
Residual	125	3.56	1.78	0.05	0.05	7.66	0.15	0.01
CV (%)	-	17.75	24.64	19.02	33.79	17.24	21.48	26.48

**, * and ^{ns} = Significant at 1% probability level, significant at 5% probability level and not significant, respectively, according to the F test. Means followed by the same letters in the column do not differ by Tukey test at 5% probability level.

The SFM and SDM of melon seedlings, subjected to doses of cattle manure and fish farming effluent, were described by increasing linear regressions (Figures 4A and 4C). For both variables, the greatest biomass accumulations were observed when using the highest dose of cattle manure (20%) and D3. For SFM production, using substrate with the highest proportion of cattle manure (20%) led to a reduction as irrigation water salinity increased, when compared to D3 (17.24 g) and D5 (12.76 g), corresponding to a 25.99% decrease in biomass.

For SDM, there was a decrease under D3 (1.82 g) and D5 (1.36 g), corresponding to 25.66%. Such decrease was possibly due to the increase in electrical conductivity, which restricted the absorption of water and nutrients, resulting in a reduction in plant biomass (SOUSA et al., 2018).

For all dilutions of the effluent, except D5, RFM was described by the increasing linear regression model; under D5 there was a significant effect ($p<0.05$), with fit of a quadratic polynomial model. Seedlings grown with the substrate containing 20% cattle manure and irrigated with D2 obtained the highest RFM value (8.24 g), while the lowest value was obtained with the substrate containing 0% cattle manure and under D5 (EC = 2.57 dS m^{-1}) (Figure 4B).

RDM showed a significant effect ($p<0.05$) only when the effluent dilutions D2 and D3 were used. For both, an increasing linear regression model was fitted, and the highest RDM value obtained was 1.12 g, under 20% cattle manure and D2 (Figure 4D). Therefore, the increase in irrigation water salinity, above EC = 1.19 dS m^{-1}, caused an adverse effect on root dry mass production.

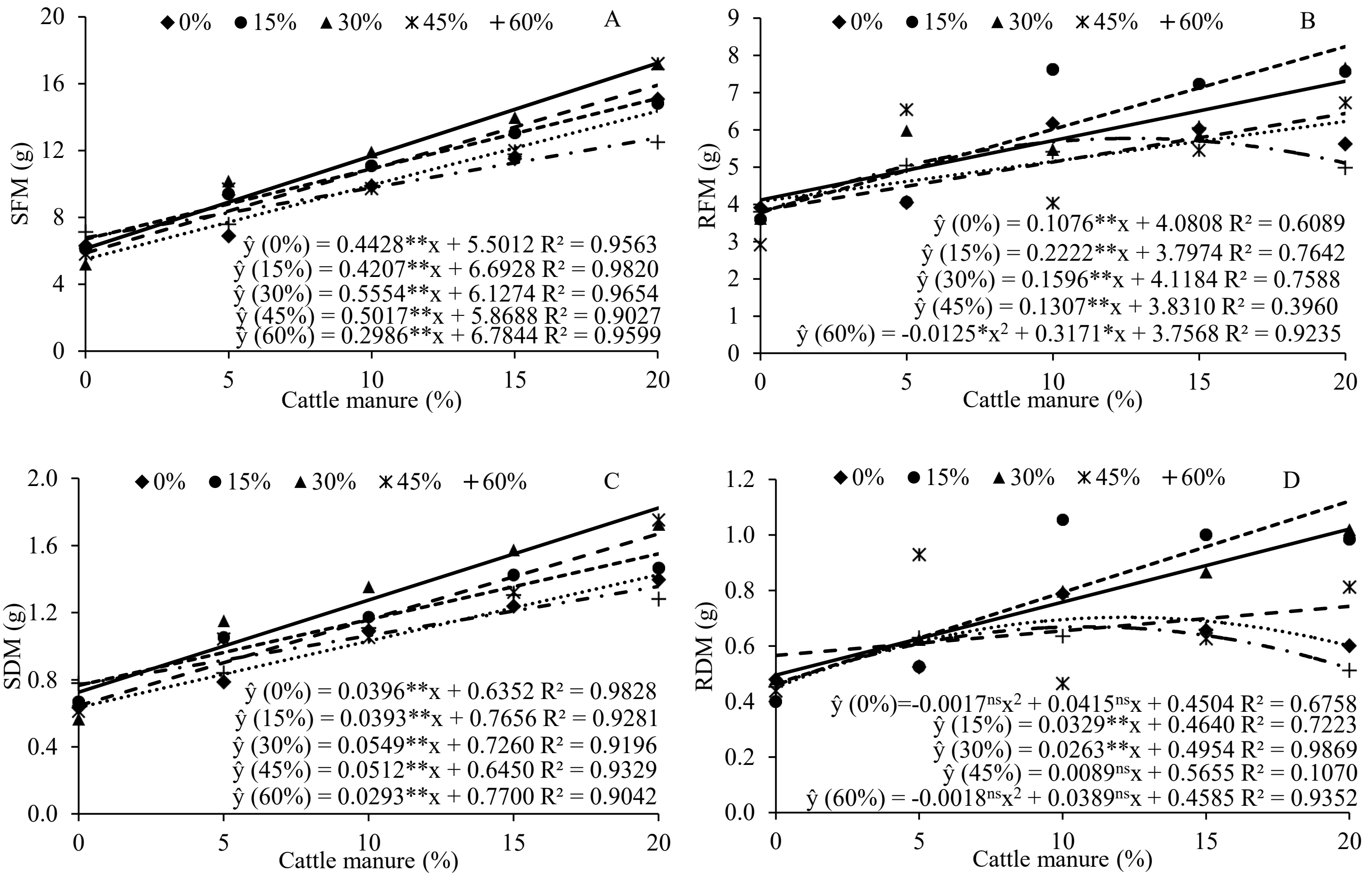

Figure 4. Shoot fresh mass (SFM), root fresh mass (RFM), shoot dry mass (SDM) and root dry mass (RDM) of 'Cantaloupe' melon seedlings as a function of the interaction between cattle manure and fish farming effluent dilutions, at 26 DAS.

Total fresh mass (TFM), total dry mass (TDM) and Dickson quality index (DQI) were described by increasing linear regressions; however, a quadratic polynomial model had the best fit to DQI data under D4 (Figures 5A, 5B and 5C). For TFM and TDM, the highest values were observed at the highest dose of cattle manure (20%).

For TFM, as the dilutions of fish farming effluent increased, there was a reduction of 2.10 g when comparing D1 (20.59 g) and D5 (18.49 g) (Figure 5A). For TDM, there was a reduction of 0.21 g in the same comparison, between D1 (2.0 g) and D5 (1.79 g), which may be related to the amount of salts present in the fish farming effluent (Figure 5B). The greater the amount of salts in the solution, the greater the restriction of water and nutrient absorption (COMETTI; FURLANI; GENUNCIO, 2018).

DQI data were described by an increasing linear regression model with the increase in the proportion of cattle manure (Figure 5C). DQI is an indicator of seedling quality, considering plant height, stem diameter and shoot and root biomass (CRUZ; PAIVA; GUERRERO, 2006); it is considered an index of sturdiness and balance in the biomass distribution of seedlings (ROS et al., 2018). Cantaloupe melon seedlings, Hales Best Jumbo cultivar, had DQI above 0.24 for all treatments evaluated, that is, above the ideal value of 0.20 suggested by Hunt (1990). According to Pelloso et al. (2020), well-formed seedlings have higher DQI values, as the higher the value of this index, the better the quality of the seedling for transplanting and, consequently, the better the agronomic performance.

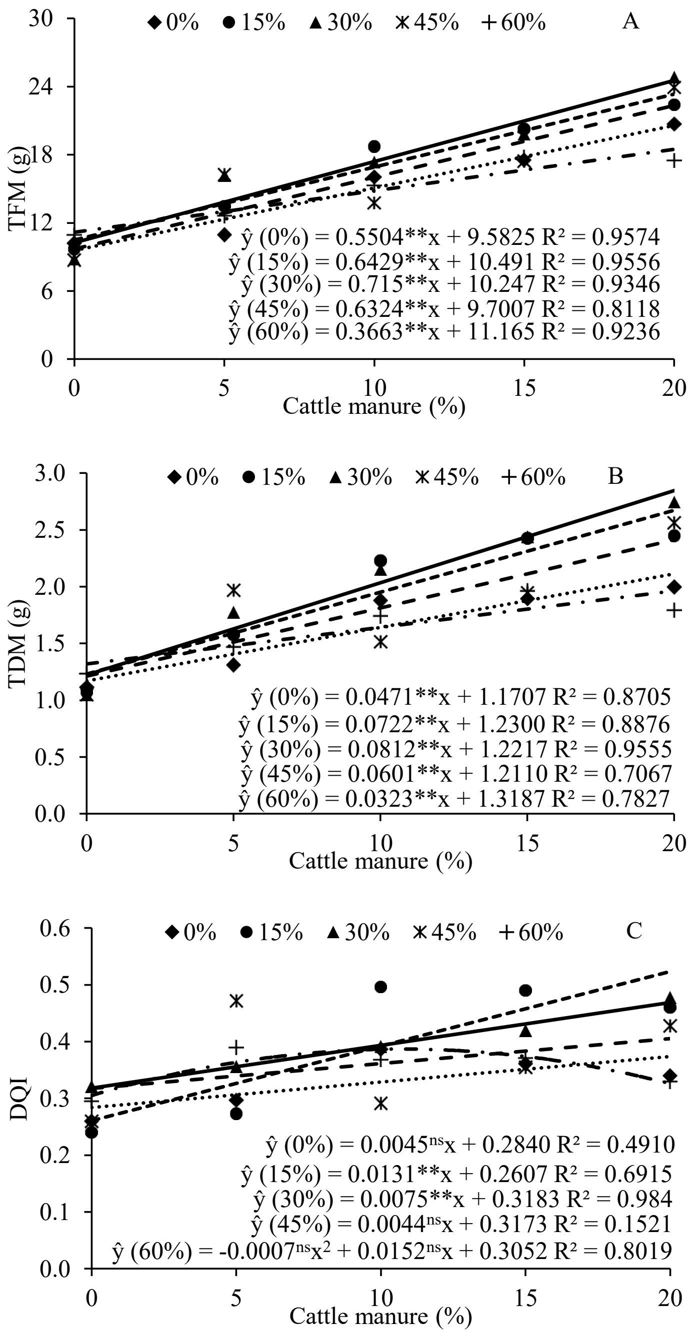

Figure 5. Total fresh mass (TFM), total dry mass (TDM) and Dickson quality index (DQI) of ‘Cantaloupe’ melon seedlings as a function of the interaction between cattle manure and fish farming effluent dilutions, at 26 DAS.

CONCLUSION

Using substrate with 20% cattle manure irrigated with D3 dilution, 30% fish farming effluent and 70% public-supply water, favored the performance of the morphological variables of ‘Cantaloupe’ melon seedlings, Hales Best Jumbo cultivar. The reuse of fish farming effluent, with electrical conductivity of up to 1.75 dS m^{-1}, is an alternative and favors the growth and biomass production of melon seedlings of the Hales Best Jumbo cultivar.

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