

Full Length Research Paper

Saline water and organic matter in the development and quality of *Licania rigida* Benth. seedlings

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***Licania rigida* Benth. (oiticica)** is a native species from the Northeastern Brazil. In this sense, the aim of this study is to evaluate the effects of irrigation with saline water and organic matter on the growth and quality of oiticica seedlings. The experiments were laid out in randomized complete block using a 5 × 2 factorial design related to electrical conductivity of irrigation water at 0.5, 1.5, 3.0, 4.5 and 6.0 dS m⁻¹ in a substrate with and without organic castor bean compost (*Ricinus communis*) and soil in a volume ratio of 0:1 and 1:1 v/v. Growth in height, stem diameter, leaf number, leaf area, chlorophyll *a* and *b* and total chlorophyll indices, shoot and root dry matter and Dickson Quality Index were evaluated. The increase in water salinity inhibited biometric growth, seedlings production of root and shoot biomass, chlorophyll content and Dickson Quality Index. Increase in water salinity, except for root biomass, inhibited biometric growth, shoot biomass accumulation, chlorophyll *a*, *b* and total, chlorophyll indexes and quality index of oiticica seedlings. In the results, although the Dickson Quality Index did not decrease with increasing water salinity and did not vary among treatments with and without organic compost, the transplanting of seedlings in the field was found to be suitable.

Key words: Salinity, organic compost, oiticica.

INTRODUCTION

Oiticica (*Licania rigida* Benth.), which belongs to the “*Chrysobalanaceae* family”, is an oilseed from Brazil. It is disseminated through the riparian forests of the Caatinga region of Sertão, Seridó, Brazilian Northeast Agreste and

Ceará, as well as through the basins of Piauí, Ceará, Rio Grande do Norte and Paraíba (Beltrão and Oliveira, 2007). This oleaginous species adapts to the water deficit of the soil possibly because of its deep root system, and

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this ensures its green coloring throughout the year. Its production coincides with the driest period of the year in the semi-arid region of Paraíba (Diniz Neto et al., 2014). Among its uses, the most significant is the use of its seed oil as raw material in the siccativ paint industry and soap factories (Maia, 2004). However, it also has medicinal properties (Roque and Loiola, 2013).

Its importance as a raw material in the production of oil and soap clearly stands out. This highlights the need to evaluate the behavior of oiticica in relation to water salinity as an alternative to the semi-arid producer (Diniz Neto et al., 2014). Although the use of saline water in irrigation is considered as an alternative in the productive system due to the scarcity of water in quantity and quality, there are serious risks of adding salts to the soil at impairing levels for productive areas and plants (Matos et al., 2013).

Due to water scarcity, the use of saline water in agriculture relies on the adoption of technological or chemical and organic methods (or both simultaneously) to reduce the degenerative effects of the salinity on the soil and plants (Cavalcante et al., 2007; Mesquita et al., 2015). Organic matter is considered as important, as measured by Silva et al. (2008) for guava (*Psidium guava*) and Souza et al. (2014) for noni (*Morinda citrifolia*) plants irrigated with non-saline water and water with increasing salinity, ranging from 0.3 to 8 dS m⁻¹. Organic inputs from plants and animals increase water retention capacity, soil aggregation and reduce soil density (Mgbeze and Abu, 2010). They also act in the soil's chemical improvement, by providing an increase in nutrient concentrations (Nóbrega et al., 2008), and in soil's microbiological improvement by increasing the population and the fauna diversity of saline soils and saline-sodic soils (Ndubuisinnaji et al., 2011; Sall et al., 2015).

Among organic material sources, there are organic compounds produced by the fermentation of plant part mixture with bovine manure, or manure from other types of flock, which may or may not contain other mineral components (Primo et al., 2010). In this sense, according to Cha-um and Kirdmanee (2011), the organic compost from castor beans in soils degraded by salts stimulates growth, biomass production and physiological efficiency of plants in saline environments. Changes in metabolism induced by salinity are the result of plants' physiological responses such as: Stimulus to growth, photosynthetic capacity, and accumulation of chlorophyll (Souto et al., 2015).

Given the above, the aim of this study was to evaluate the effects of irrigation with saline water and organic matter on the growth and quality of oiticica seedlings.

MATERIALS AND METHODS

The experiment was conducted between February and May 2014 in a screened greenhouse at the Humanities, Social and Agricultural

Center of the Federal University of Paraíba, Bananeiras, Paraíba state.

Initially, the composting windrow was prepared with vegetative parts of castor bean plants (stem, branches and leaves), crushed and placed at a height of 20 cm, interspersed with cattle manure in 5 cm thick layers. The piles were 1 m wide, 1.5 m high and 5 m long. The material was turned over every two weeks and temperatures were taken with a thermometer with a range of up to 150°C. At 80 days after piling, the material showed a uniformed color and particle size, suitable for the preparation of the substrate.

The experimental design was completely randomized with five replications and two plants per plot in a 5 × 2 factorial design related to irrigation water salinity levels at 0.5, 1.5, 3.0, 4.5 and 6.0 dS m⁻¹ in the presence and absence of castor bean organic compost + material from layers 20 to 40 cm, with lower content of organic matter. The soil was classified, following the criteria of the Brazilian System of Soil Classification (SiBCS) (EMBRAPA, 2013), as Dystrophic Yellow Latosol in volume proportions of 0:1 and 1:1 v/v. The soil and the organic compost were characterized chemically according to methodologies suggested by the Brazilian Agricultural Research Corporation (EMBRAPA) (Donagema et al., 2011). The results are shown in Table 1.

Oiticica seeds were obtained from plants from the municipality of Catolé do Rocha, Catolé do Rocha microregion and Alto Sertão Paraíba mesoregion. Then the shells were manually eliminated with a knife and the seeds were placed in paper bags until sowing.

The experimental units were 20 × 30 cm black polyethylene bags, with a maximum volume of 3 dm³ of substrate. It contained two seeds per treatment. The first emergence occurred between 20 and 30 days after sowing. Thinning was performed at 10 days after emergence, and the most vital plant of each experimental unit was excluded.

Saline preparation of saline solution was done by adding 1.5 dS m⁻¹ non-iodized sodium chloride to 92%

The preparation of saline water from 1.5 dS m⁻¹ was done by adding non-iodized sodium chloride with 92% purity to obtain the desired conductivity. The solution was measured with a digital portable CD 860 conductivity meter.

At 60 days after the first emergence of seedlings, the growth in plant height was measured from the base of the plant to the end of the main stem with a graduated ruler. The stem diameter was measured at the base of the plant, 2 cm from the soil, with a digital caliper. The leaves were then counted after previous measurements of leaf number, leaf area, shoot dry matter, root dry matter (both were summed to obtain total dry matter), chlorophyll *a* and *b* and total chlorophyll content. The Dickson Quality Index was calculated for oiticica seedlings.

The oiticica seedlings were collected, and then the shoot and root were separated. They were packed in paper bags and placed in a circulation air oven at 65°C until they were constantly dried. Then, samples were weighed on an analytical balance to obtain shoot and root dry matter and subsequently the Dickson Quality Index (DQI). This index is a balanced formula including the relations among morphological characteristics, such as total dry matter (TDM), shoot dry matter (SDM), root dry matter (RDM), plant height (PHe) and stem diameter (SD) (DICKSON et al., 1960) using the equation:

$$DQI = \frac{TDM}{\left(\frac{PHe}{SD}\right) + \left(\frac{SDM}{RDM}\right)}$$

The results were submitted for variance analysis by F test. Means of soil with and without organic compost were compared by F test, which is conclusive to values between two factors, and means for electrical conductivity of irrigation water were calculated by regression using the t test with the statistical software ASSISTAT version 7.7 beta (Silva and Azevedo, 2002).

Table 1. Chemical characterization of the soil at the layer 20-40 cm and of the castor bean compost used to prepare the substrate for oiticica seedlings.

Sources	Chemical attributes											
	*pH	P	K ⁺	Na ⁺	H ⁺ Al ³⁺	Al ³⁺	Ca ²⁺	Mg ²⁺	BS	CEC	V	OM
		mg dm ⁻¹				cmol _c dm ⁻³					%	g kg ⁻¹
Soil	5.7	19.1	0.23	0.1	0.2	0.0	4.4	0.4	5.1	5.3	96.9	10.4
COC	8.2	921.0	12.3	1.5	0.8	0.0	14.1	4.2	-	-	-	259

* = pH in water; COC = castor bean organic compost; BS = base sum (Ca²⁺ + Mg²⁺ + K⁺); CTC = cation exchange capacity [BS + (H⁺ + Al³⁺)]; V = saturation by exchangeable bases (BS/CTC)100; OM = Organic matter.

RESULTS AND DISCUSSION

Although the interaction between salinity and organic castor bean compost did not show significant effects on any of the variables (Table 2), the sources of variation significantly interfered with growth in height, stem diameter, leaf emergence and leaf area of oiticica seedlings. This interaction situation contradicted the findings of Cavalcante et al. (2007), who recorded significant effects for the interaction of irrigation water salinity x organic matter levels on the growth and production of yellow passion fruit. However, the result is in accordance with the findings of Silva et al. (2008), Diniz et al. (2014) and Souza et al. (2014); they concluded that the isolated effects of irrigation water salinity inhibit and organic matter stimulates the growth of guava (*P. guajava*), oiticica (*L. rigida*) and noni (*M. citrifolia*) during the formation of seedlings.

The growth in the height of oiticica seedlings reduced along with the electrical conductivity of irrigation water. However, in the same situation, it increased in the substrate with organic compost in comparison to the treatment without the organic input (Figure 1). The increase in the salt concentration of water inhibited linearly at a 1.023 cm level per unit increase of electrical conductivity. Growth in height promoted a 22.6% loss among plants irrigated with a higher and lower salt content water, and 4.11% per unit increase of irrigation water salinity (Figure 1A). According to these results, salt stress generally affects plant growth (including oiticica), by reducing the CO₂ fixation, thus reducing the rate of plant cell division and elongation (Freire et al., 2010).

As for the effects of the organic compost, when the value of the plants with organic input was compared to the value of those without (Figure 1B), there was an increase of 23.7% in the value of the plants with organic input. This is a result of the inhibition of aggression by organic compost salts to seedlings. This increase indicated that the organic input mitigates the adverse effects of salinity through benefits to physical properties by increasing the pore space (Mellek et al., 2010), to chemical properties by improving fertility (Bendouali et al., 2013), and to biological properties by increasing the population and the microbial diversity of soil (Sall et al., 2015; Ndubuisinnaji

et al., 2011) thus, mitigating the degenerative actions of salts on plants. In this sense, organic inputs, according to Brahma Prakash and Sahu (2012), mitigate the negative effects of salinity on plants by releasing humic substances in the medium, which reduce the osmotic pressure inside roots, keeping the superiority of the total potential energy of soil water, and providing the uptake of nutrients by plants.

Similar to the decrease in height, the growth in stem diameter was also affected by the increase in the electrical conductivity of irrigation water and stimulated by the addition of the castor bean organic compost (Figure 2). The decreases were from 4.17 to 4.08, 3.93, 3.80 and 3.57 mm in plants irrigated with water at 0.5, 1.5, 3.0, 4.5 and 6.0 dS m⁻¹, respectively, inducing a loss of 14.4% among plants treated with water at 6.0 and 0.5 dS m⁻¹, and 2.62% increase in each unit of saline water irrigation (Figure 2A). Contrary to what was obtained in seedling in saline water, when compared on the other hand, the stem diameter of the seedling treated with organic compost exceeded the stem of the seedling not treated by 18.3% (Figure 2B).

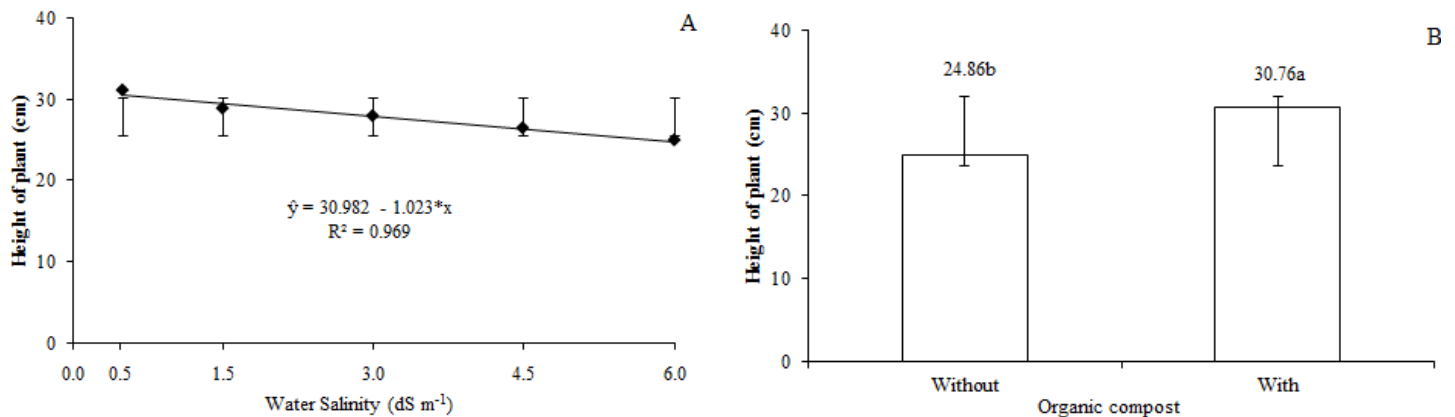
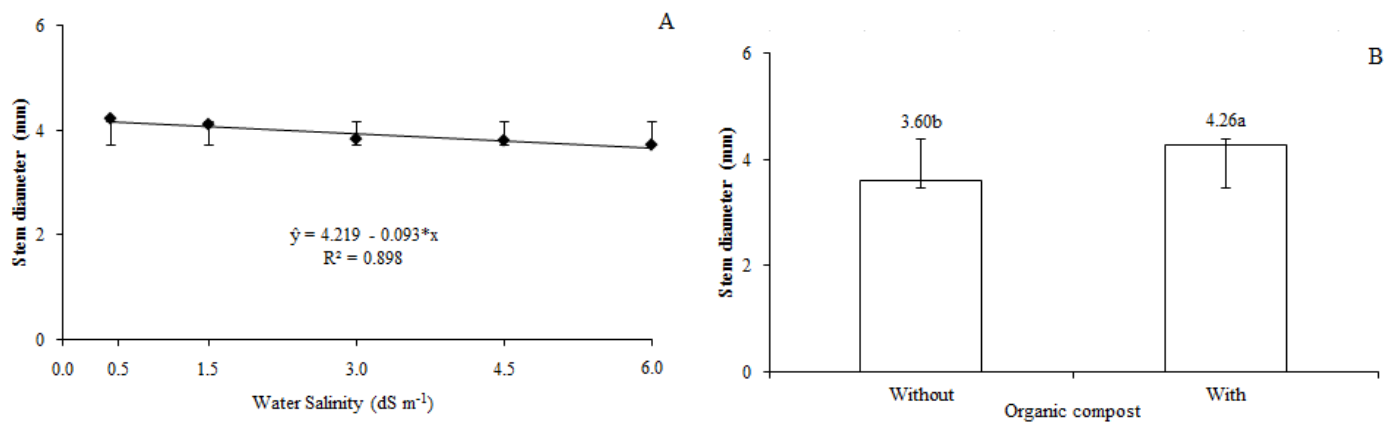
The increase in diameter growth of oiticica seedlings in soil with organic compost in a saline environment is a response to the physical improvement of the substrate and to the stimulating action of organic proteins and solutes which work by inhibiting the negative action of salinity and stimulating the growth of plants. This is also verified by Silva et al. (2008) and Mesquita et al. (2015), for guava (*Psidium guajava*) and neem plants (*Azadirachta indica*) respectively, using irrigation with saline water in a substrate with solid and liquid cattle manure.

The saline water hindered, while the addition of the organic compost to the substrate increased leaf production of oiticica seedlings respectively (Figure 3). The linear decrease was 0.199 leaf per unit increase of water salinity, with a loss of 18.21% among seedlings irrigated with water at 6.0 and 0.5 dS m⁻¹, corresponding to 3.31% for each unit increase in water salt content (Figure 3A). As for the organic compost in substrate, there was a 12.24% increase in the number of leaves of seedlings with organic compost in comparison to those without it in the substrate (Figure 3B). It may have

Table 2. Summary of the analysis of variance for plant growth in height (PHe), stem diameter (SD), leaf number (LN) and leaf area (LA) of oiticica seedlings (*L. rigida*) irrigated with saline water and organic castor bean compost.

SOV	df	Mean square			
		PHe	SD	LN	LA
Blocks	4	1.44*	0.11 ^{ns}	0.37 ^{ns}	38.57 ^{ns}
Salinity (S)	4	53.22*	0.48*	2.02*	476.12**
COC proportions (P)	1	435.13**	5.41**	6.48*	2,596.75**
<u>S x P</u>	4	58.96 ^{ns}	0.21 ^{ns}	1.68 ^{ns}	42.43 ^{ns}
Error	36	23.95	0.22	0.94	45.21
Total	49	-	-	-	-
Linear Reg.	1	172.92*	1.53*	5.76*	1,787.01**
Quadratic Reg.	1	18.94 ^{ns}	0.24 ^{ns}	0.71 ^{ns}	53.11 ^{ns}
CV (%)	-	17.60	11.94	17.53	11.09

COC = castor bean organic compost; CV = Coefficient of variation; ^{ns} = not significant by Tukey test; * and ** = significant at 5 and 1% probability, respectively.

**Figure 1.** Height of oiticica seedlings in saline water with (A) Soil with organic compost and (B) Soil without organic compost.**Figure 2.** Stem diameter of oiticica seedlings in saline water (A) in soil with and (B) in soil without organic compost.

caused chemical (Nóbrega et al., 2008) and microbiological improvement by increasing the population

and the fauna diversity of the soil (Ndubuisinnaji et al., 2011).

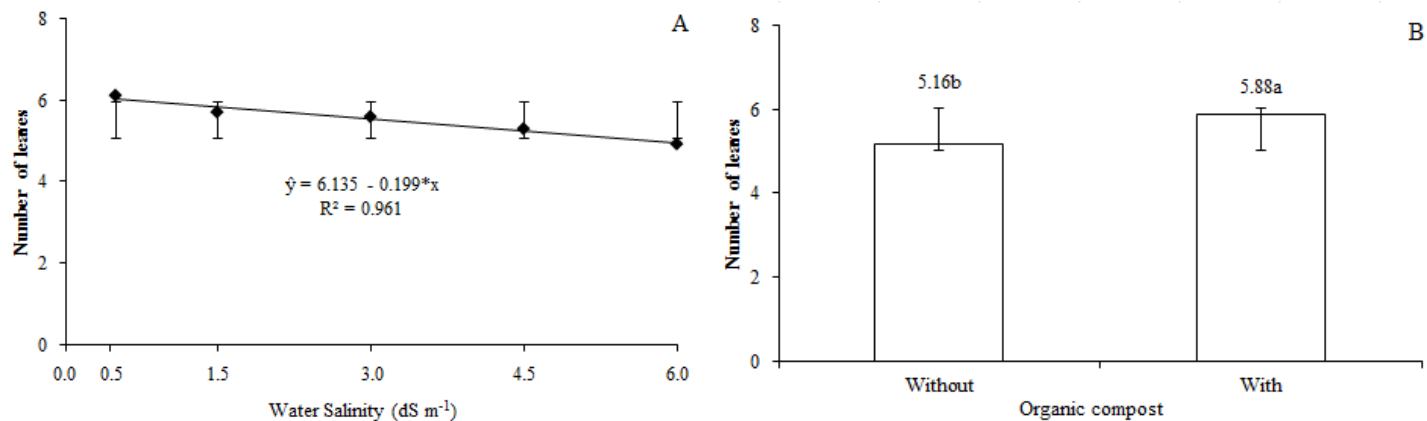


Figure 3. Comparison of leaf numbers of oiticica leaves in saline water which are in (A) soil with organic compost and (B) soil without organic compost.

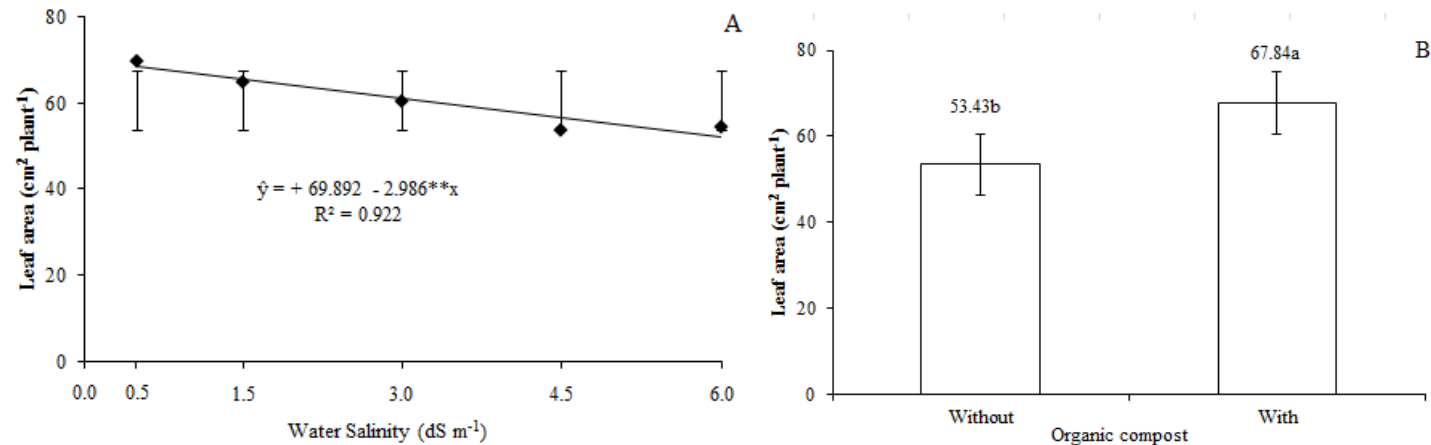


Figure 4. Leaf area of oiticica seedlings in saline water in (A) soil with organic compost and (B) without organic compost.

The effects of water salinity and organic compost on leaf area were similar to those recorded for growth in height, stem diameter and number of leaves emitted, in which the increase in water salinity inhibited and the addition of organic compost increased the leaf area of seedlings (Figure 4B). The reduction was 2.986 cm² per unit increase in the electrical conductivity of irrigation water, with a 24.05% loss among plants irrigated with water at 6.0 and 0.5 dS m⁻¹ (Figure 4A), and 4.37% per unit increase in electrical conductivity.

The salt stress caused by water loss is reflected in the loss of leaf expansion and consequently in the absorption of water and nutrients by plants, as found by Centeno et al. (2012) and Diniz et al. (2013). When evaluating water consumption in castor bean (*Ricinus communis*) and neem (*Azadirachta indica*) plants; which were irrigated with high saline water under stress conditions, according to Marschner (2012), the water has a concentration of salts so high that it causes nutritional imbalance. As in

other variables, the organic compound also caused a 26.97% increase in leaf area compared to plants in the substrate without the organic input (Figure 4B).

Similar results were found by Souza et al. (2014), who also reported an increase in leaf area of noni plants in a substrate with organic matter in a saline environment. The reduction of leaf area, according to Sucre and Suárez (2011), may be an adaptive mechanism or an osmotic adjustment of plants grown under saline conditions. They also reported that there is transpiration in these conditions: The absorption of Na⁺ and Cl⁻ and its translocation through the xylem keep the tissues more hydrated and exert a diluting action of salts.

The interaction between saline water and organic compost, as recorded for growth in height, stem diameter, number of leaves and leaf area, were not statistically influenced by the chlorophyll process, shoot and root biomass production and quality of oiticica seedlings (Table 3).

Table 3. Summary of analysis of variance for chlorophyll *a* (Cla), chlorophyll *b* (Clb), total chlorophyll index (Clt), shoot dry matter (SDM), root dry matter (RDM) and Dickson Quality Index (DQI) of oiticica seedlings (*L. rigida*) in saline water and proportions of castor bean organic compost.

SOV	df	Mean square					
		Cla	Clb	Clt	SDM	RDM	DQI
Blocks	4	3.27 ^{ns}	0.29 ^{ns}	4.12 ^{ns}	2.06 ^{ns}	0.45 ^{ns}	0.44 ^{ns}
Salinity (S)	4	165.18**	7.41**	231.05**	10.97**	0.51 ^{ns}	1.99**
COC Proportions (P)	1	1,332.31**	16.70**	1,661.18**	25.92**	22.45**	0.06 ^{ns}
S × P	4	9.61 ^{ns}	0.48 ^{ns}	10.36 ^{ns}	1.07 ^{ns}	0.46 ^{ns}	0.22 ^{ns}
Error	36	7.59	0.58	6.05	2.16	0.50	0.35
Total	49	-	-	-	-	-	-
Linear Reg.	1	568.82**	21.16**	816.24**	36.00**	0.02 ^{ns}	6.39**
Quadratic Reg.	1	91.05**	0.31 ^{ns}	99.96**	1.03 ^{ns}	0.64 ^{ns}	0.08
CV (%)	-	12.27	11.99	8.54	21.68	22.48	14.27

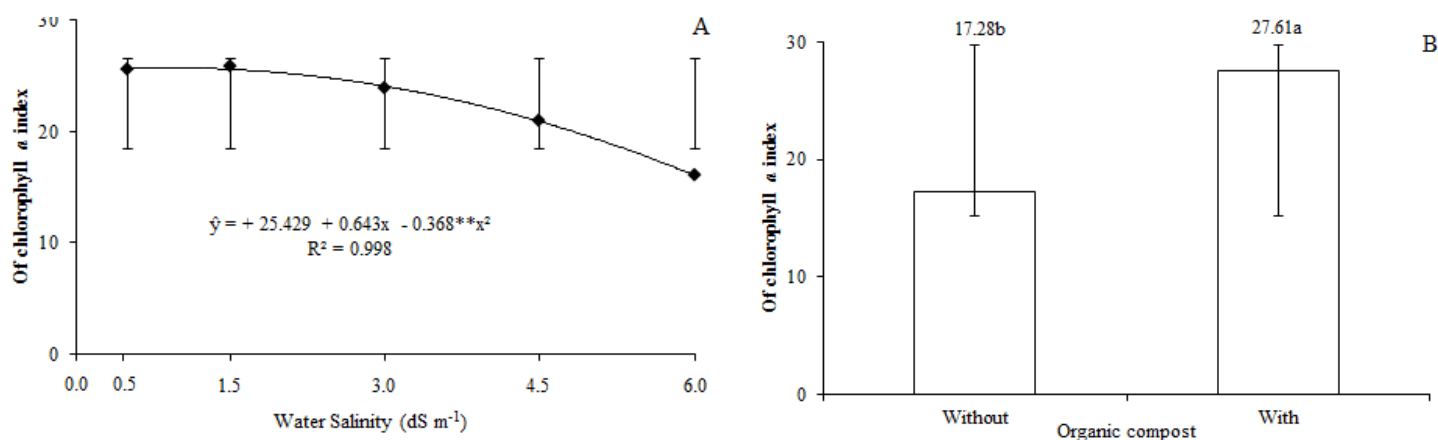


Figure 5. Chlorophyll *a* index of oiticica seedlings in saline water in (A) soil with organic compost and (B) soil without organic compost.

The highest estimated index of chlorophyll *a* was 25.71, referring to the estimated maximum water electric conductivity at 0.8 dS m⁻¹, but the irrigation with saline water above that level (1.5, 3.0, 4.5 and 6.0 dS m⁻¹) hindered the production of chlorophyll *a* in oiticica by 0.54, 6.46, 18.83 and 37.61% (Figure 5A). Going by these results, salinity changes the metabolism and physiology of plants, with negative effects on the photosynthetic capacity and chlorophyll *a* accumulation. This is in agreement with those obtained in the study of Freire et al. (2014) and Souto et al. (2015) for yellow passion fruits and noni plants, respectively, which were irrigated with saline water.

Cattle manure unlike saline water, stimulates the production of chlorophyll *a*. This statement is based on a superiority of 59.79% more chlorophyll *a* in the leaves of plants from treatments with the organic compost in relation to soil without such organic input (Figure 5B). The organic input may have provided the release of liquid or solid humic substances to the substrate. This

decreased the osmotic potential difference of the substrate, promoting the release of compounds such as humic acids, which stimulate the osmotic adjustment of plants growing in a saline environment (Brahmaprakash and Sahu, 2012).

The increase in water salinity was linearly inhibited at a level of 0.373 per unit increase in the electrical conductivity of water. Chlorophyll *b* index decreased from 7.35 to 5.29, inducing a 28.03% loss among plants irrigated with water at 0.5 and 6.0 dS m⁻¹, and 5.11% per unit increase in saline water irrigation (Figure 6A). The behavior of data are compatible with Scalon et al. (2003), who concluded that water or soil salt stress hinders the activity of chlorophyll *b*. According to the authors, this chlorophyll pigment captures energy from other wave lengths and transfers it to the chlorophyll *a*, which uses it in photosynthesis photochemical reactions. This function can be inhibited by salinity. This on the other hand, contradicts Bezerra et al. (2013), who established that the chlorophyll content in *Parkinsonia aculeata* plants

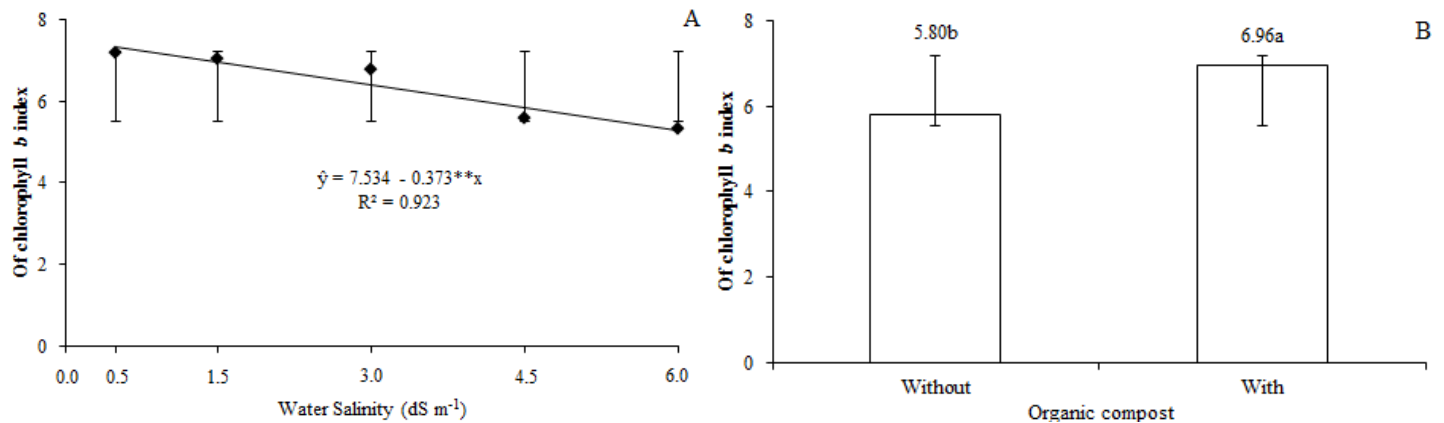


Figure 6. Chlorophyll *b* index of oiticica seedlings in saline water with (A) soil with organic compost and (B) soil without organic compost.

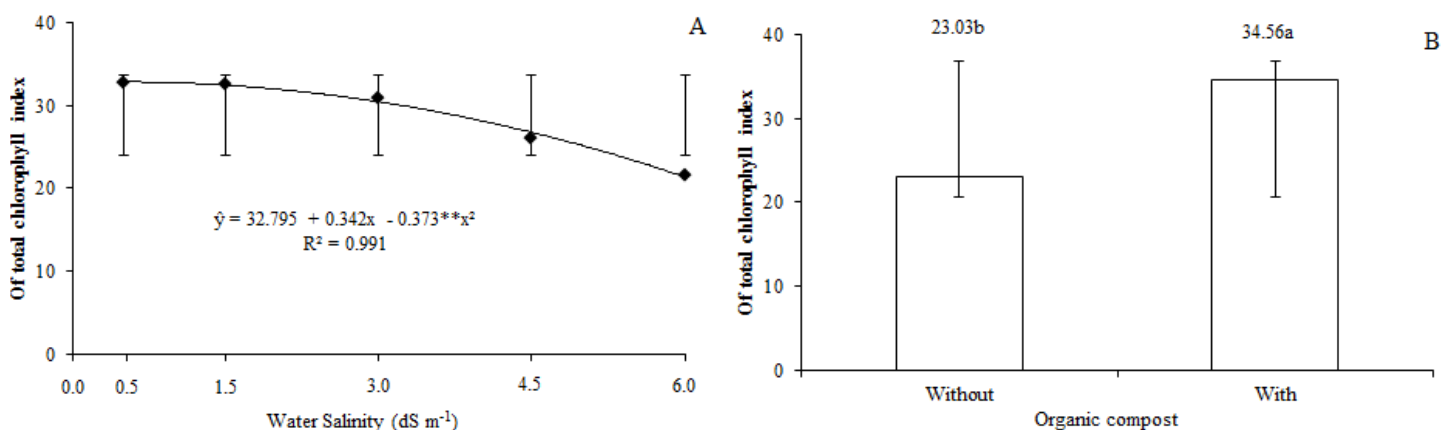


Figure 7. Total chlorophyll index of oiticica seedlings in saline water with (A) in soil with organic compost and (B) in soil without organic compost.

was not reduced under salt stress. Cattle manure provided a 20% increase in the chlorophyll *b* contents of oiticica seedlings (Figure 6B) which is lower when compared to its effect on chlorophyll *a*.

The effects of saline water and cattle manure on chlorophyll *a* and *b* are transferred to total chlorophyll, which is the sum of both. Thus, the increase in the electrical conductivity of the irrigation water decreased the total chlorophyll index of oiticica plants from 32.87 to 32.44, 30.46, 26.78 and 21.42. There was a record of 1.22, 7.33, 18.53 and 34.83% losses among oiticica seedlings irrigated with water at 1.5, 3.0, 4.5 and 6.0 dS m⁻¹, respectively, in comparison with plants irrigated with low-saline water (Figure 7A). Thus, the addition of the organic compost, similar to chlorophyll *a* and *b*, increased the total chlorophyll index of plants compared to plants in the substrate without organic compost (Figure 7B).

Chlorophyll absorbs *quanta* of light incident on leaves. This function is hindered when plants such as oiticica seedlings are subjected to salt stress, and this hindrance

results in photosynthetic deficiency. Similar results were reported by Mendonça et al. (2010), Silva et al. (2011), Matos et al. (2013), Freire et al. (2014), Souza et al. (2014) and Souto et al. (2015) for eucalyptus (*Eucalyptus* spp.), jatropha (*Jatropha curcas*), passion fruit and noni seedlings under irrigation with saline water.

Root dry matter accumulation of the seedlings was the only variable that did not respond to the effects of water salinity (Table 3). The data did not fit any regression model but corresponded with the average value of 3.13 g plant⁻¹ (Figure 8A). This behavior differs from that of the vast majority of food and non-food plants classified as sensitive, moderately sensitive and moderately tolerant to water or soil salt stress (Ayers and Westcot, 1999).

These plants presented a hindered growth and yield potential due to either the increase in the salt content of the irrigation water, or of other recorded variables.

The decrease in growth was as low as 54.47% in seedlings without organic compost (Figure 8B).

The increase in water electrical conductivity did not

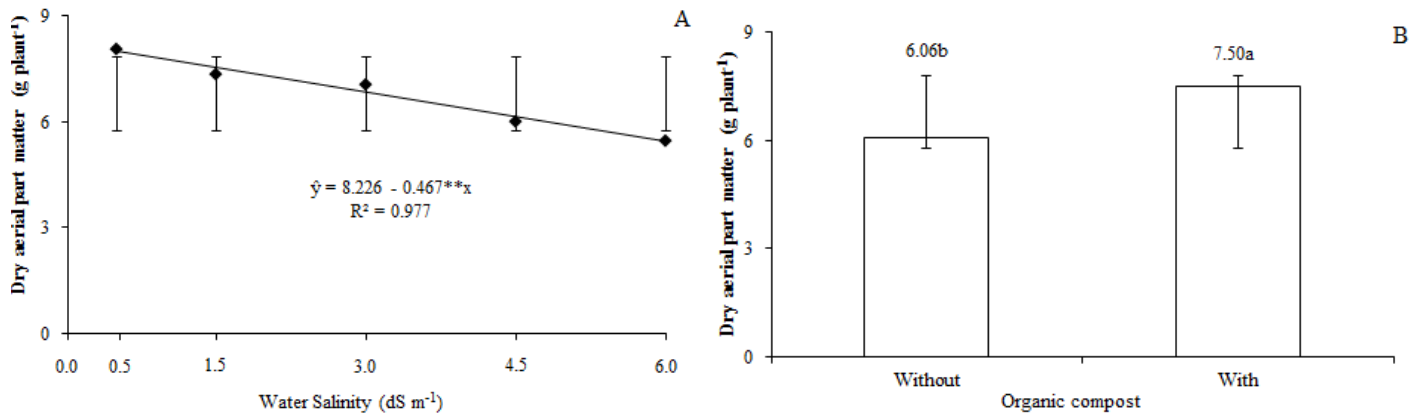


Figure 8. Root dry matter of oiticica seedlings in saline water in (A) soil with organic compost and (B) soil without organic compost.

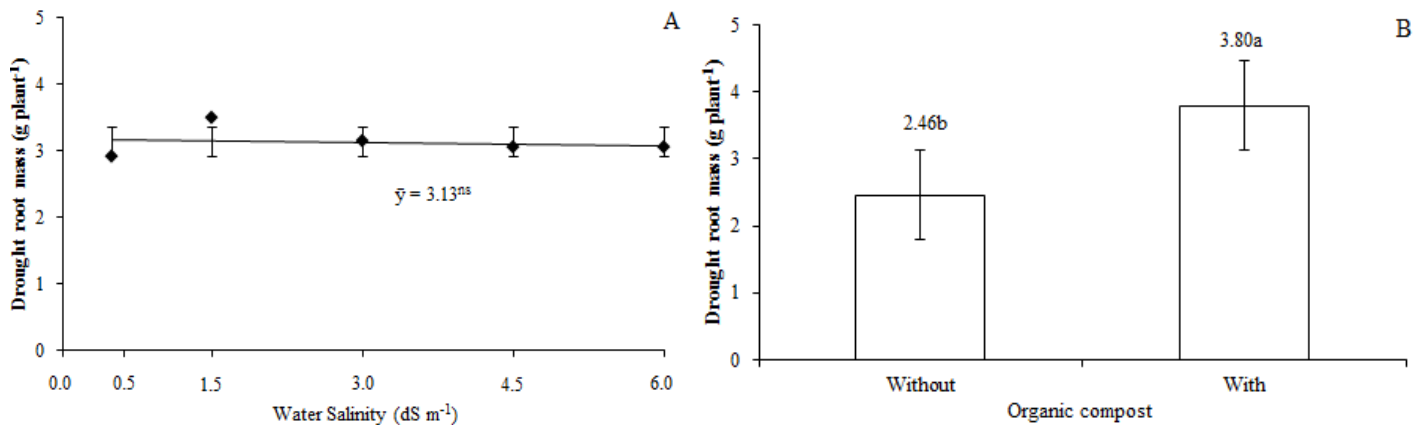


Figure 9. Shoot dry matter of oiticica seedlings in saline water in (A) soil with organic compost and (B) soil without organic compost.

affect root dry matter accumulation, but inhibited the production of shoot dry matter of seedlings from 7.98 to 5.42 g plant⁻¹. This resulted in a 32.08% loss in seedlings irrigated with water with the highest salt content and 5.83% loss in seedlings irrigated with water with the lowest salt content, per unit increase in the salt concentration (Figure 9A). A similar situation was recorded for the organic compost, with up to 23.76% biomass accumulated in the shoots of seedlings compared to those developed in treatments without the organic input (Figure 9B). This increase is a response to the positive action of the organic compost which provides an increase in biomass and physiological efficiency of plants grown in saline environments (Cha-Um and Kirdmanee, 2011).

When the quality of the seedlings were evaluated by DQI, it was observed that increase in the salt content of the irrigation water consequently resulted in loss of electrical conductivity up to 0.196 per unit. According to the values in Figure 10A, the DQI decreased in the

following order: 4.65, 4.46, 4.16, 3.87 and 3.57, with relative losses of 4.09, 10.54, 16.77 and 23.22% caused by water at 1.5, 3.0, 4.5 and 6.0 dS m⁻¹ in comparison to plants irrigated with low-salinity water (0.5 dS m⁻¹). If the indexes 3.57 and 4.65 are compared, there is a 23.22% loss among plants irrigated with water at 6.0 and 0.5 dS m⁻¹, which is equivalent to a loss of 4.22% for each unit increase in the electrical conductivity of irrigation water. The organic compost was the only variable that did not decrease with the increase in salinity. The quality index of the seedlings was, among all, the variable that did not increase with the addition of organic input to the substrate (Figure 10B).

The DQI of oiticica seedlings suffered a decrease from 4.65 to 3.57 with increase in water salinity, but no difference was observed between those treated with and without organic compound. The average was between 4.11 and 4.18, and they were suitable to be transplanted to the field (Hunt, 1990)

DQI values above 0.2 are suitable for the production of

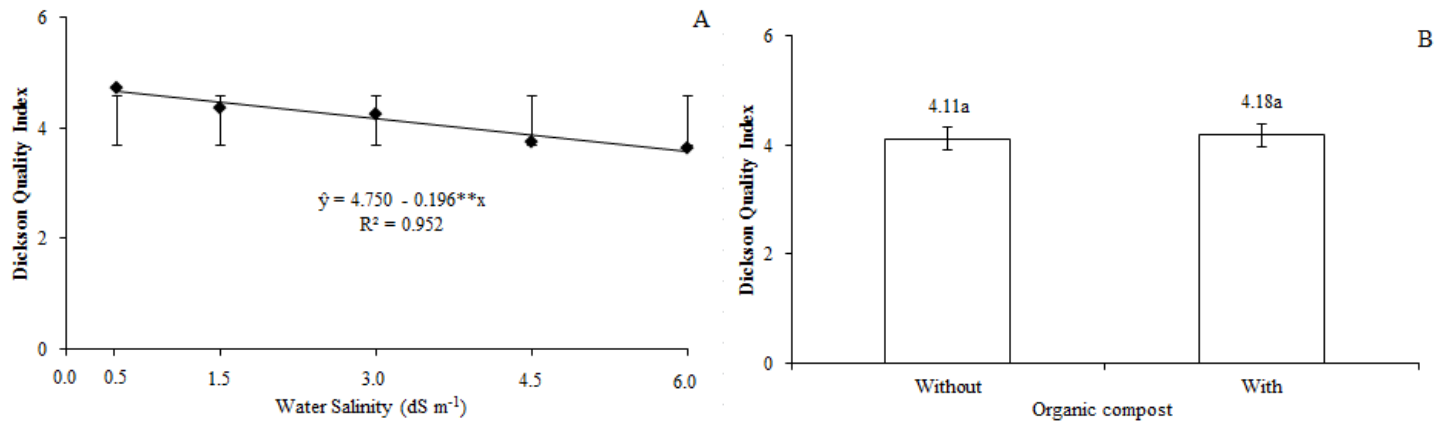


Figure 10. Dickson quality index of oiticica seedlings in saline water in (A) soil with organic compost and (B) soil without organic compost.

seedlings and despite its decrease with increasing water salt content; the equivalence of DQI values in the presence and absence of organic matter signifies the tolerance of this species to salts during the phase of seedling formation or the early growth of plants. Diniz Neto et al. (2014) also recognized that the change caused by the addition of biofertilizer; and irrigation with saline water of different salt levels was not significant on the oiticica seedlings.

Growth inhibitions, chlorophyll index, production of shoot dry matter and quality index of seedlings are responses to the depressive action of water salinity in physiological processes. These physiological processes include: The opening and closing of stomata, carbon dioxide fixation, activity of chlorophyll and photosynthetic efficiency. This was stated by Taiz and Zeiger (2013) for plants in general and Souza et al. (2014, 2015) for noni plants. On the other hand, the increases in the variables are due to the high fertility potential of the organic compost provided by phosphorus, potassium, calcium and magnesium (Table 1). The increase is also due to the beneficial action of organic inputs which results in the physical improvement of the soil for the growth of the root system, as discussed by Mgbeze and Abu (2010) and Benbouali et al. (2013); and also the improvement in soil biological activity (Cha-Um and Kirdmanee, 2011).

Conclusion

The increase in water salinity inhibited biometric growth (except for root biomass), chlorophyll indexes, shoot dry matter and Dickson quality index of oiticica seedlings. The organic compost, except for the Dickson Quality Index, stimulated biometric growth; chlorophyll indexes and formation of shoot and root dry matter of seedlings. The quality index of seedlings did not decrease with the increase in salinity and did not vary with or without treatment with organic compost. The seedlings were also

observed to be suitable to be transplanted to the field.

Conflict of Interests

The authors have not declared any conflict of interests.

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