CHAPTER 3

AGRONOMIC PERFORMANCE OF *RAPHANUS SATIVUS* L. CULTIVATED IN DENSE FERRALSOLS FERTILIZED WITH ORGANIC COMPOST

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ABSTRACT: The use of organic fertilizers in agriculture has been increasing and necessary in order not only to offer plants balanced nutrition but also to reuse organic solid waste that could be disposed of inappropriately in the environment. Thus, the objective of this work was to evaluate the agronomic indicators of the *R. sativus* according to different doses of organic compost in two growing seasons (autumn and spring) in the conditions of the Coastal Tablelands of Brazil. We carried out the experiment in the experimental area at the Federal University of Recôncavo da Bahia (UFRB) from June to July (rainy season) and from October to November (dry season), in both periods arranged in randomized blocks, consisting of five doses of organic compost (0, 5, 10, 15 and 20 t ha^{-1}). Thirty days after sowing, we evaluated: chlorophyll a, b, and total (in the rainy season only), plant height, number of leaves per plant, root diameter, dry and fresh mass of the aerial part and total, and mass and dry and fresh matter of tuberous root. The organic compost stimulated the growth and development of the *R. sativus* in the two growing seasons. The best agronomic performance of *R. sativus* was obtained with doses of 15.07 and 20 t ha^{-1} in the dry and rainy seasons, respectively.

KEYWORDS: organic agriculture; organic fertilizers; sustainability; radish.

DESEMPENHO AGRONÔMICO DE *RAPHANUS SATIVUS* L. CULTIVADO EM FERRALSOLS DENSOS ADUBADOS COM COMPOSTO ORGÂNICO

RESUMO: O uso de fertilizantes orgânicos na agricultura vem sendo crescente e necessário, não só para oferecer às plantas uma nutrição balanceada, mas também para reaproveitar resíduos sólidos orgânicos que poderiam ser descartados de forma inadequada no meio ambiente. Assim, o objetivo deste trabalho foi avaliar os indicadores agronômicos de R. sativus em função de diferentes doses de composto orgânico em duas épocas de cultivo (outono e primavera) nas condições dos Tabuleiros Costeiros do Brasil. O experimento foi realizado na área experimental da Universidade Federal do Recôncavo da Bahia (UFRB) nos períodos de junho a julho (período chuvoso) e de outubro a novembro (período seco), em ambos os períodos dispostos em blocos casualizados, constituídos por cinco doses. de composto orgânico (0, 5, 10, 15 e 20 t ha^{-1}). Trinta dias após a semeadura foram avaliados: clorofila a, b e total (somente no período chuvoso), altura das plantas, número de folhas por planta, diâmetro da raiz, massa seca e fresca da parte aérea e total, e massa e massa seca. e matéria fresca de raiz tuberosa. O composto orgânico estimulou o crescimento e desenvolvimento de R. sativus nas duas safras. O melhor desempenho agronômico de R. sativus foi obtido com doses de 15,07 e 20 t ha^{-1} nos períodos seco e chuvoso, respectivamente.
PALAVRAS-CHAVE: agricultura orgânica; fertilizantes orgânicos; sustentabilidade; rabanete.

INTRODUCTION

The growing concern for the environment and the search for increasingly healthy eating habits are changing the consumption pattern of the world population. Thus, conservationist and agroecological practices to produce vegetables have become increasingly frequent (He et al., 2022; Liang et al., 2022; Paracchini et al., 2023; Testani et al., 2023). Agroecological practices, adopted mainly by family farming, have enabled farmers to add greater value to products, ensuring increased profitability. In addition, the replacement of chemical fertilization by organic fertilizers produced within the property has reduced production costs.

In agroecological crops, organic fertilization is one of the viable alternatives to supply the nutrient demand for vegetables. It can be done through several sources, such as animal manure, biofertilizers, composting, and green manure, favoring biological fixation of nitrogen (Dias et al., 2020; Nunes, et al., 2020; Jena, 2022; Paes et al., 2022). Regardless of the form of organic fertilization used, they promote, in addition to improvements in soil chemical attributes, physical and biological attributes (Kathayat and Rawat 2019; Gouveia *et al*. 2020). The importance of using organic fertilization to improve crop yields is well established; however, studies demonstrating adequate doses are still scarce since we have a very large diversity of species with different nutritional requirements (Manzoor *et al*. 2021).

The organic compost from composting is an important source of organic fertilizer for agriculture and the environment. Besides being a source of nutrients, it comes from various residues, which could contaminate the environment if discarded inappropriately (Islam *et al*. 2011). As it comes from different types of residues, the compound can present different fertility levels, which justify studies to define adequate doses for application in different agricultures (Becker *et al*. 2010). Due to the great diversity of components used for the production of organic compounds, Brazil established specific legislation for the classification of organic fertilizers, taking into account the raw material used, and the chemical and microbiological constitution (ABNT NBR10004/2004).

R. sativus, for example, is a crop that is responsive to organic fertilization since, in addition to providing nutrients, organic fertilization improves the physical quality of soils, favoring the development of tuberous roots (Nishio 2017). Silva *et al*. (2017), analyzing the agronomic performance of *R. sativus* fertilized with *Calotropis procera* (Ait.) R. Br. in two growing seasons, found that the best agronomic performance was obtained via green fertilization with 15.6 t ha^{-1}. Ferreira *et al*. (2011), when carrying out the organic cultivation of *R. sativus* in a no-tillage system with mulch and living roofs, obtained a positive result in conventional soil preparation with a linear response to the doses of compost.

R. sativus production is estimated at 9000 t ha^{-1}, being grown in greater quantities in Brazil's South and Southeast regions due to more favorable climatic characteristics (IBGE, 2017). Because it is a food with a high energy value and contains minerals such as phosphorus, iron, calcium, manganese, nicotinic acid and vitamins such as B1, B2 and C (Lopes 2008), the consumption of *R. sativus* has numerous benefits to human health, such as a diuretic effect, stimulating digestive functions, detoxifying the liver, and antibiotic due to its spicy substances (Minami *et al*. 1998). As it has several benefits to human health, it is of fundamental importance to expand *R. sativus* planting in other regions of the country.

In the Coastal Tablelands of Brazil, the presence of soils with dense horizons has hampered the production of several crops because, in dry conditions, it limits plants root development, reducing the absorption of water and nutrients, and in wet conditions, it can reduce the concentration of oxygen (Pereira, 2023). Given this, organic fertilization by promoting improvements in the soil's physical, chemical and biological properties can favor the greater development of plants, especially those whose commercial part is the root, such as the *R. sativus* crop.

In this context, studies on *R. sativus* cultivation in Coastal Tablelands are necessary to expand cultivation in the region. We hypothesize that there is an optimal dose of organic compost produced from tree pruning, goat and cattle manure (3:1:1) that favors the development and production of the *R. sativus* crop. Given the above, the objective of this work was to evaluate the agronomic indicators of *R. sativus* according to different doses of organic compost in two growing seasons (autumn and spring) in dense Ferrasols of Coastal Tablelands in Brazil.

MATERIAL AND METHODS

We carried out the experiment in two growing seasons: rainy season (autumn - June to July 2019) and dry season (spring - October to November 2019) at the Experimental Farm of Vegetal Production of the Center for Agricultural Environmental and Biological Sciences of the Federal University of Recôncavo da Bahia (UFRB), located in the municipality of Cruz das Almas-BA, with geographic coordinates 12º40'19" S latitude and 39º06'23" W longitude. The climate of the region, according to the Köppen-Geiger classification, is Aw to Am, that is, a hot and humid climate, with an average annual rainfall of 1,200 mm, an average annual temperature of 24.2 °C and relative humidity of approximately 82%, with the wettest quarter occurring in the months of May-June-July (Almeida, 1999). The meteorological data of a historical series of 20 years are presented in Figures 1 and 2, which were obtained from a conventional meteorological station, belonging to the National Institute of Meteorology (INMET) and located near the study area.

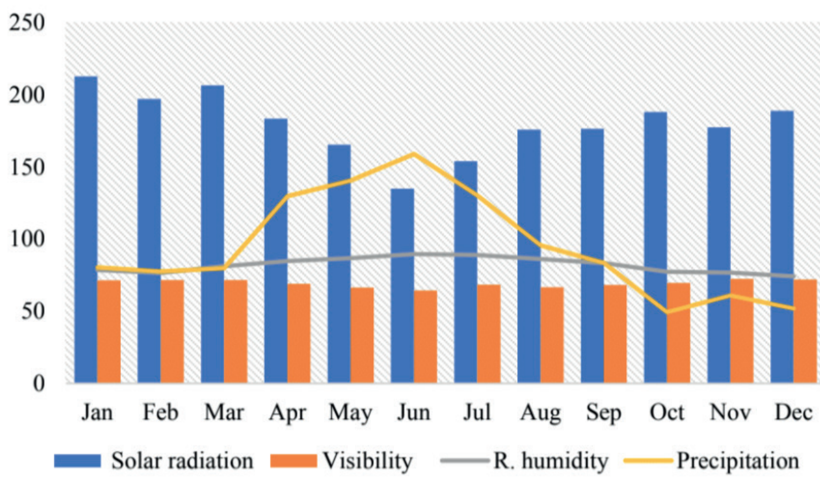

Figure 1. Solar radiation (h), visibility (h), relative humidity and average monthly precipitation of a 20-year historical series in the municipality of Cruz das Almas-BA.

We conducted the *R. sativus* planting in the first growing season (rainy period) from June 6 to July 6, 2019 (30 days of the cycle). We carried out the second planting (dry period) from October 13 to November 15, 2019 (30 days of the cycle) under rainfed conditions.

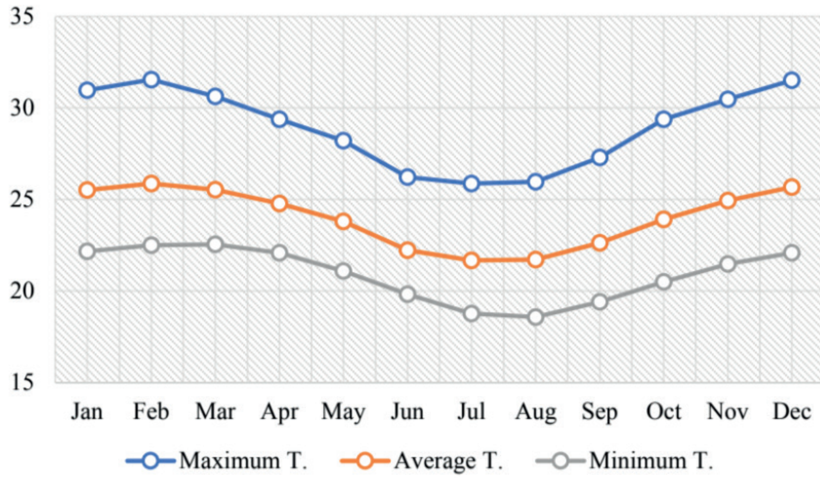

Figure 2. Maximum, average and minimum temperature (°C) of a historical series of 20 years in the Municipality of Cruz das Almas-BA.

Before initiating the experiment, we collected chemically characterized soil samples. The soils of the study area were classified as dense Ferralsols. The organic compost used in the experiment was produced at UFRB from the compost pile formed from tree pruning, cattle and goat manure in a ratio of 3:1:1. Soil chemical characterization indicated: pH (H_2O): 5.2; pH (CaCl): 4.5; P: 11.2 mg dm^{-3}; K^+: 74 mg dm^{-3}; Ca^{2+}: 0.8 $cmol_c$ dm^{-3}; Mg^{2+}: 0.4 $cmol_c$ dm^{-3}; Al^{3+}: 0.3 $cmol_c$ dm^{-3}; Potential acidity: 2.6 $cmol_c$ dm^{-3}; Sum of bases: 1.4 $cmol_c$ dm^{-3}; T: 4 cmol dm^{-3}; base saturation: 35%; OM: < 14.4 g kg^{-1}.

Chemical attributes of the compost were described on a wet basis (Moreira, 2018) and are presented in Table 1. According to NBR 10.004 (ANNT, 2004), the organic compound used was classified as Class II A Waste – Non-inert.

PARAMETERS	HUMYD BASED	NUTRIENT CONTENT APPLIED IN EACH DOSE (kg ha^{-1})			
		5	10	15	20
pH (H2O)	7.0	-	-	-	-
pH ($CaCl_2$ 0.01 M)	6.4	-	-	-	-
Density (Organic Residue)	1.00 g cm^{-3}	-	-	-	-
Humidity (Organic Residue) 60 - 65°C	12.03 %	-	-	-	-
Humidity (Organic Residue) 110°C	0.69 %	-	-	-	-
Total Organic Matter (Combustion)	10.64%	-	-	-	-
Organic Carbon	5.27 %	-	-	-	-
Total Mineral Residue (R.M.T.)	76.64 %	-	-	-	-
Mineral Residue (R.M.)	5.76 %	-	-	-	-
Insoluble Mineral Residue (R.M.I.)	70.88 %	-	-	-	-
Total Nitrogen	0.62 %	31	62	93	124
Phosphorus (P_2O_5)	0.20 %	10	20	30	40
Potassium (K_2O)	0.22 %	11	22	33	44
Calcium (Ca)	0.50 %	25	50	75	100
Magnesium (Mg)	0.11 %	5.5	11	16.5	22
Sulfur (S)	0.02 %	1	2	3	4
C/N ratio	9	-	-	-	-
Copper (Cu)	13 mg kg^{-1}	0.06	0.13	0.19	0.26
Manganese (Mn)	112 mg kg^{-1}	0.56	1.12	1.68	2.24
Zin (Zn)	31 mg kg^{-1}	0.15	0.31	0.465	0.62
Boron (B)	206 mg kg^{-1}	1.03	2.06	3.09	4.12
Sodium (Na)	725 mg kg^{-1}	3.62	7.25	10.87	14.49

* pH in 0.01 M $CaCl_2$; Total Organic Matter and Mineral Residue from Muffle Combustion; Potassium (K_2O), calcium (Ca), magnesium (Mg) by atomic absorption spectrophotometer, extracted with HC 1+1 l; Total nitrogen, sulfuric digestion (Kjeldahl); Carbon by dichromate oxidation followed by titration; Phosphorus (P_2O_5): Extraction with HCl 1+1, determination by spectrophotometer (reading at 430 nm wavelength) using the vanadomolybdic solution method; Sulfur (S) Gravimetric of barium sulfate; Manganese (Mn), Cuprum (Cu), Zinc (Zn), Sodium (Na) by atomic absorption spectrophotometer extracted with HCl 1+1. Boron (B) by spectrophotometer with monosodium Azomethine H.

Table 1. Physical and chemical characterization of the organic compost

The experimental design used in both experiments was in randomized blocks, with five treatments and four replications. The treatments consisted of five doses of organic compost: 0, 5, 10, 15, and 20 t ha^{-1}. Plots represented the experimental units with dimensions of 1.6 m × 5.0 m, covering an area of 160 m^2.

The *R. sativus* cultigen used was the 'Crimson Gigante', recommended for the conditions of the Northeast of Brazil, in the spacing of 0.40 cm with 1.0 m between rows, totaling 20 plants per plot. Soil preparation of each experimental area consisted of plowing and harrowing. Then, we lifted the seedbeds manually, using hoes.

We incorporated the organic compost into the soil's 0-0.20 m layer in the experimental plots according to each treatment. 10 days after applying the organic compost, we carried out direct sowing at a depth of two cm, placing five seeds per hole. 10 days after planting, thinning occurred, leaving only one plant. During the conduction of the experiment, manual hoeing was performed whenever necessary.

After 30 days of sowing in the respective planting seasons, we carried out the harvest and evaluated the following characteristics in 10 useful plants selected in each plot: indices of chlorophyll a, b, and total (CLA, CLB and CLT), using an electronic chlorophyll meter (chlorofiLOG CFL 1030) by Falker (only in the first rainy season); plant height (ALP), obtained by measuring with a ruler from the ground level to the tip of the highest leaf; number of leaves (NF) per plant, determined by directly counting the number of leaves greater than three cm in length, starting from the basal leaves until the last open leaf; diameter of the tuberous roots (DR), determined using a digital caliper and expressed in cm; mass of fresh matter of tuberous roots (*m*MFR) by weighing on a commercial digital scale; dry matter mass of tuberous roots (*m*MSR) and aerial part (*m*MSPA), determined after drying in an oven with forced air circulation, with temperature regulated at 65 ºC, until reaching constant weight, and expressed in g plant^{-1}. The total dry matter mass (*m*MST) was obtained by the sum of the dry matter mass of the tuberous roots and the aerial part.

We initially submitted the data to joint analysis of variance using the F test at 5% to verify the effect of the growing seasons, and, if significant, the splitting was performed for each season. Within each growing season, we performed regression analysis to verify the effect of compost doses on *R. sativus* development, using the "R" statistical software (R development core team, 2021), especially the ExpDes package (Ferreira *et al*. 2013).

RESULTS

The joint analysis of variance showed an interaction between the growing seasons and the doses of organic compost used (Table 2).

		ALP	Dr	NF	MSPA	MSR	MST	MFR
	GL				QM			
Doses	4	214.99**	77.85**	10.41**	20.22**	20.46*	80.95**	1701.81**
Seasons	1	221.68**	2549.27**	12.76**	115.04**	134.38**	498.10**	3678.55**
Doses/seasons	4	116.31**	51.26**	5.92**	8.30**	10.28**	36.67**	132.73**
Seasons/blocks	6	2.99^{ns}	3.44^{ns}	0.16^{ns}	0.11^{ns}	0.19^{ns}	0.43^{ns}	1.39^{ns}
residuals	24	1.52	1.69	0.09	1.18	0.14	0.32	2.76

Table 2. Summary of joint analysis of variance.

Through the joint analysis of variance, it was possible to verify that the development of *R. sativus* plants was different in the two growing seasons, and in the dry season, the plants have higher averaged for most of the variables studied, except NF, which was higher in the rainy season (Table 3).

Growing Season	ALP	DR	NF	MSPA	MSR	MST	MFR
	cm plant^{-1}	mm plant^{-1}	Un	----------------------- g plant^{-1} --------------------			
Rainy	13.93 b	2.64 b	6.56 a	1.03 b	0.91 b	1.95 b	20.84 b
Dry	18.64 a	18.60 a	5.43 b	4.42 a	4.58 a	9.00 a	40.02 a

Table 3. Mean values of the variables studied in each growing season.

The evaluations of the chlorophyll contents of the plants were measured only in the rainy season. For chlorophyll a, the estimated dose of 12.61 t ha^{-1} of the organic compost resulted in a maximum index of 30.25 (Figure 3a). As for chlorophyll b, the behavior was the opposite of chlorophyll *a*, with higher averages at the dose of 20 t ha^{-1} (Figure 3b). For total chlorophyll, the effect of increasing doses of organic compost showed a positive linear behavior, with an increase of 51.29%, compared to the treatment without application of organic compost (Figure 3c).

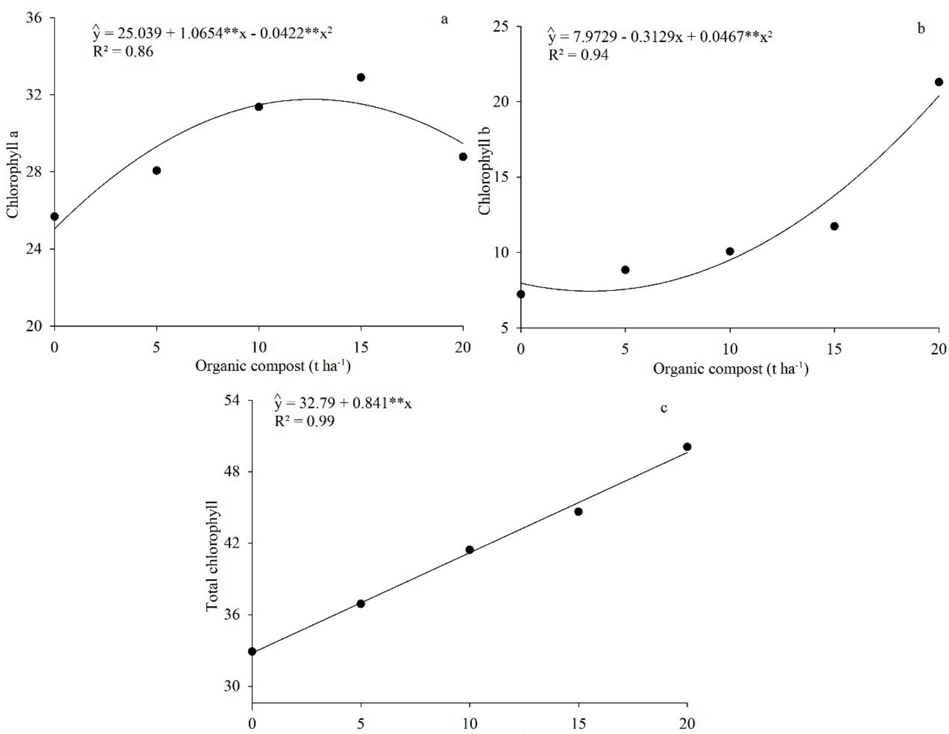

Figure 3. Chlorophyll a (a), b (b) and total (c) in radish plants (*Raphanus sativus* L.), according to doses of organic compost.

The doses of organic compost influenced the agronomic characteristics of the *R. sativus* for most of the variables studied in the two growing seasons ($p<0.01$ and $p<0.05$). For ALP during the rainy season, there was a quadratic behavior, with higher averages at the dose of 12.49 t ha^{-1} of organic compost, with an increase of 76% compared to the treatment without application of organic compost (Figure 4a). In the dry period, the doses of organic compost provided a linear increase for ALP, with an increase of 293% compared to the treatment without the application of organic compost (Figure 4a).

The doses of organic compost did not influence the DR of *R. sativus* plants in the dry period (Figure 4b). In the rainy season, the increase in DR was linear according to the doses of organic compost, with an increase of 9% compared to the treatment without application of organic compost (Figure 4b).

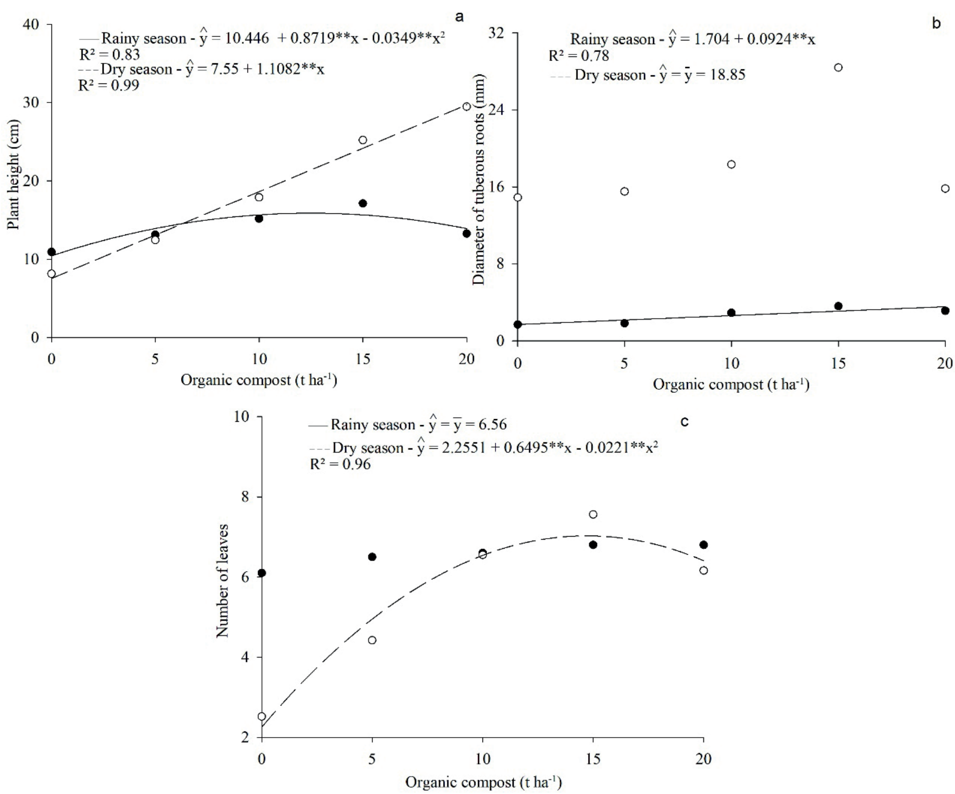

Figure 4. Plant height (a), diameter of tuberous roots (b) and number of leaves (c) of *R. sativus* according to the doses of organic compost grown in the rainy and dry seasons.

The increase in the doses of organic compost did not influence the NF of *R. sativus* plants in the rainy season (Figure 4c). In the dry period, the supply of organic compost doses increased the NF, with higher averages (7.03 leaves plant^{-1}) at the dose of 14.64 t ha^{-1} of organic compost, providing an increase of 212% without application of the organic compost (Figure 4c).

In the rainy season, the highest yields of mMSPA (1.55 g plant^{-1}) and mMST (2.96 g plant^{-1}) were obtained with the application of 20 t ha^{-1} of organic compost (Figures 5a and 5c). The use of organic compost allowed an increase of 443% and 474% in mMSPA and mMST, respectively, compared to the treatment without organic compost. In the dry period, mMSPA showed the highest average (6.41 g) with the application of 17.91 t ha^{-1} of organic compost. For mMST, the highest production (12.88 g plant^{-1}) was achieved by applying 16.23 t ha^{-1} of organic compost. These values represented an increase of 780% and 838% in the variables when the organic compost was applied, compared to the treatment without the application of the organic compost (Figures 5a and 5c).

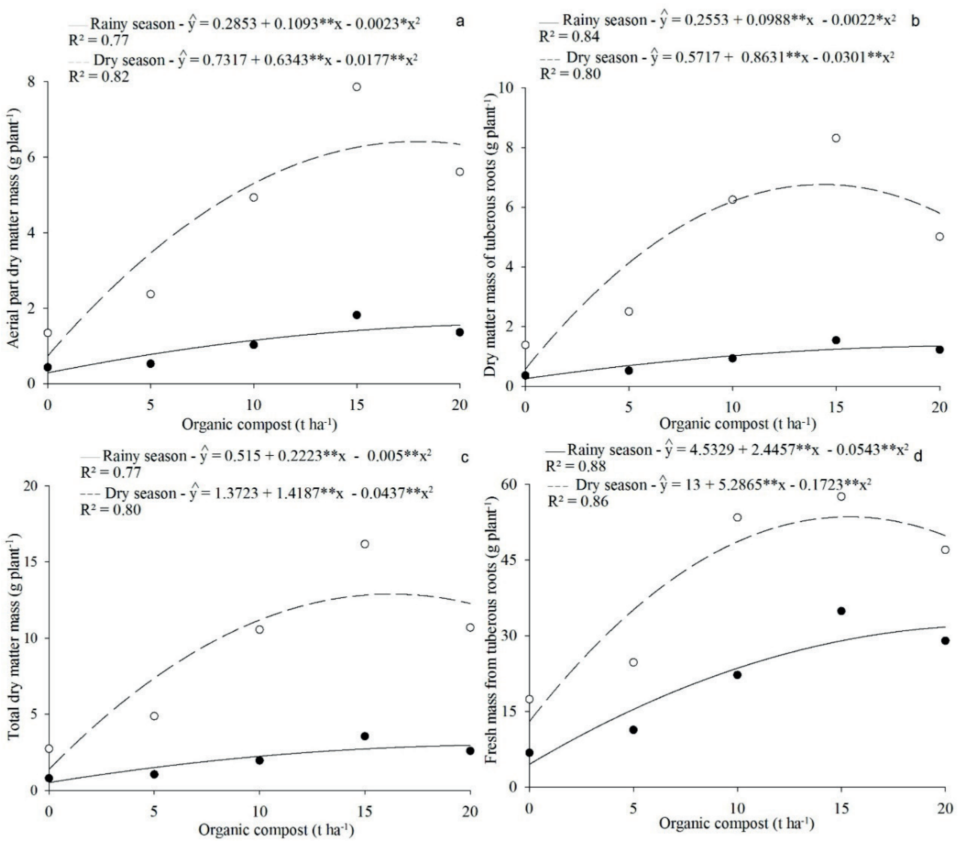

Figure 5. Production of aerial part dry matter (a), tuberous root (b), total (c) and tuberous root fresh matter (d) of *R. sativus* plants, according to doses of organic compounds, cultivated in the rainy and dry seasons.

For the *m*MSR values, from the cultivation in the rainy season, it was possible to obtain the production of 1.35 g plant^{-1}, with the application of 20 t ha^{-1} of the organic compost, resulting in an increase of 429% compared to the treatment without application of the organic compost. The cultivation in the dry period showed the highest production of *m*MSR (6.76 g plant^{-1}) at the dose of 14.33 t ha^{-1} of organic compost, with an increase of 1082% compared to the treatment without application of organic compost (Figure 5b).

For the production of *m*MFR in the first (rainy season) and second crop (dry season) (Figure 5d), we found that in the first one, the highest average (31.51 g plant^{-1}) was achieved with the dose of 20 t ha^{-1} of the organic compost, providing an increase of 27.2 g plant^{-1} of *m*MFR, which corresponds to an increase of 595% compared to the treatment without the addition of the organic compost (Figure 6b). In the second crop (dry period), the highest average of *m*MFR (53.53 g) was reached at the dose of 15.07 t ha^{-1} of organic compost, representing an increase of 40.53 g plant^{-1} of *m*MFR, corresponding to an increase of 311% compared to the treatment without application of the organic compost (Figure 5d).

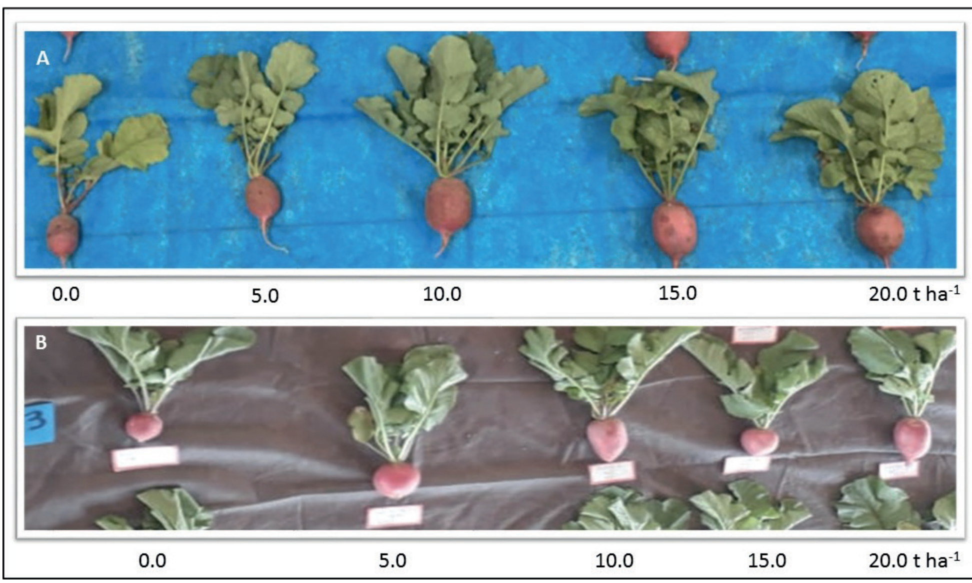

Figure 6. Tuberous roots of *R. sativus* cultivated according to increasing doses of organic compost. Dry period (A) and rainy period (B).

DISCUSSION

The quality and production of the *R. sativus* crop are influenced by the growing season and the supply of nutrients in adequate amounts. The climatic requirements of the crop make it recommended for planting in Brazil, especially in the Northeast region, from May to July (autumn), where temperatures are mild, avoiding bolting (Amaro *et al*. 2007; Silva et al., 2015; Singh 2021). However, in this study, we found that spring cultivation favoured greater *R. sativus* tuberous roots in the Coastal Tablelands region than autumn cultivation. These results are associated with high rainfall in autumn (Figure 1), which can compromise oxygen availability in soils, impairing plant root development. Excess water in soils hinders the diffusion of O_2 and favors a higher concentration of CO_2, blocking some important metabolic processes for plants (Bodolan, 2013; Pathak *et al*. 2021). Excess water in the soil can also cause losses in commercial productivity due to an increase in the number of cracked roots (Wan and Kang, 2006; Pathak *et al.* 2021). The daily irrigation frequency promotes the emergence of a region with high humidity in the root zone, which affects root growth due to low oxygen diffusion (Wan and Kang, 2006).

The Coastal Tablelands region presents mostly dense soils (Paes *et al*. 2021a), such as dense Ferralsols and Acrisols, which have poor drainage, favoring water accumulation and harming the development of crops, especially those whose commercial part is the root (Corrêa *et al*. 2008). Dense soils combined with planting in the rainy season may have favored the accumulation of water, compromising the development of *R. sativus* plants. According to Manzoor *et al*. (2021), unfavorable soil conditions, such as poor drainage and extreme changes in pH, favor the emergence of physiological disorders in *R. sativus* plants, compromising production.

Although the average monthly temperature of the dry season (autumn) was higher than that of the rainy season (spring), it was still in the appropriate range for *R. sativus* cultivation—below 28 °C (Figure 2). The best *R. sativus* yields, with high-quality roots, are obtained in climatic conditions with a temperature between 18 and 28 °C. Temperatures above 30 °C for many days can accelerate vegetative development, stimulating bolting and favoring the formation of green shoulders in the roots caused by the stimulation of photosynthesis in the roots (Silva *et al*. 2017; Pathak *et al*. 2021). High temperatures and prolonged photoperiod impair biomass accumulation by tuberous roots, such as R. *sativus*, as it accelerates the vegetative cycle of the crop, with subsequent change of the drain from the roots to the inflorescence (Ravishankar *et al*. 2007; Taiz and Zeiger, 2013; Abdel, 2016).

Regardless of the growing season, the use of organic fertilization influenced the production components of the *R. sativus* crop. In addition to providing nutrients to plants, organic fertilization improves soils' chemical, physical and biological attributes (Ahmed *et al*. 2019; Kumari *et al*. 2020). Because the *R. sativus* is a crop in which the commercial part is the root, the well-aerated soil without physical and chemical impediment is essential for the plant's high commercial productivity (Nishio 2017). According to Kathayat and Rawat (2019), the use of well-decomposed manure and adequate irrigation favors *R. sativus* production, avoiding physiological disorders in the roots. The physicochemical characteristics of the organic compost also favored the growth of *R. sativus* plants due to its neutral pH (Table 1). Studies have shown that the pH values of organic substrates must be in the range of 6.0 to 7.0 for adequate nutrient availability for plants (Altland *et al*., 2008; Farias *et al*. 2012). In addition, organic fertilization acts in the soil as a buffering agent, preventing sudden pH changes and the emergence of physiological disorders in the roots (Manzoor *et al*. 2021).

Similar results to the present study were found by Kumari *et al*. (2020), who, when using substrates formulated from food waste, observed an increase in *R. sativus* production at a dose of 20 t ha^{-1}. The use of organic fertilizer composed of cotton waste also improved *R. sativus* plants' performance compared to treatments without fertilization (Gouveia *et al*. 2020).

Balanced fertilization in the proper amount is of fundamental importance for good productivity in most agricultures. It becomes even more important for the *R. sativus* due to physiological disturbances in the roots when nutrients are in excess. In this context, organic fertilization becomes essential since nutrients are released gradually, unlike fertilization with inorganic fertilizers. Despite these important characteristics of organic fertilizers, excessive doses can promote phytotoxicity in plants due to excess micronutrients, among other factors. Maia *et al*. (2018) observed that cow manure as an organic fertilizer at a dose of 70 t ha^{-1} causes root cracks in *R. sativus* plants due to excess nitrogen.

In the lowest doses of fertilization, the reduced development of the aerial part of the *R. sativus* plants may be related to the insufficiency of nutrients, allied to the low natural fertility of the soils. Nutrient inputs were 50 % and 75 % lower when compared to the maximum efficiency doses obtained in the present study, in the dry and rainy seasons, respectively. The soils of the coastal tablelands of Brazil were developed from the barrier group formed by sediments of continental and marine origin previously weathered, resulting in soils of low natural fertility (Moreau, 2006). Given this, conservation management practices such as organic fertilization, green manure, and agroforestry systems must be adopted to raise soil fertility levels and promote greater crop productivity (Moreira *et al*. 2018; Paes *et al*. 2021b). The use of organic fertilizers in adequate amounts favored a significant increase in plant height, number of leaves, leaf width, root length, root diameter and biomass yield of the *R. sativus* crop (Khatri *et al*. 2019). Tito *et al*. (2019) found that organic fertilizer enriched with rock powder improves soil fertility conditions providing greater productive efficiency of R. sativus.

Overall, the present study showed that planting carried out in the dry season presented better vegetative performance, contributing to greater growth and development than cultivation carried out in the rainy season. For most characteristics evaluated n *R. sativus* cultivation in both periods, the greatest increases observed are related to increasing doses of organic compost to the soil, with an average dose of 17.5 t ha^{-1} being recommended in both periods. These results are explained by the greater availability of macro and micronutrients (Table 1).

Using organic compounds resulting from the composting of plant and animal waste in an organic production system can help reduce farmers' dependence on the need to use external inputs and reduce production costs. In addition, the population's food consumption pattern is changing, as there is an increase in consumers' demand for increasingly healthy foods free of fertilizers and pesticides, harming the environment as little as possible. In this sense, the present study demonstrates that the use of organic fertilization becomes a viable alternative to achieve high yields and meet the new consumption pattern of the population.

CONCLUSIONS

The cultivation in the dry season (spring) promoted greater diameter and fresh matter mass of the *R. sativus* root compared to the rainy season (autumn) in the soils of Coastal Tablelands. The use of organic compost favored the productivity of *R. sativus* in both growing seasons, with better agronomic performance obtained at the dose of 15.07 and 20 t ha^{-1} in the dry and rainy seasons, respectively.

CONFLICTS OF INTEREST

The authors like to declare that all authors do not have any competing interests.

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