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Vol. 11(39), pp. 3777-3787, 29 September, 2016
DOI: 10.5897/AJAR2016.11536
Article Number: 89AC2ED60828
ISSN 1991-637X

http://www.academicjournals.org/AJAR

African Journal of Agricultural Research

Full Length Research Paper

Guava rootstocks growth under incorporation of cattle manure and application of organic fertilizer the base of fruit of peel

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Received 9 August, 2016; Accepted 7 September, 2016

The use of rootstocks in fruit production is extremely important, as well as reducing juvenility also enables faster production. In this context, the objective was to evaluate the effect of different rates of manure and application of organic fertilizer on the growth of guava rootstocks. The experiment was conducted in the greenhouse of the State University of Paraíba (UEPB) in municipality of Catolé do Rocha-PB, Brazil. The experimental design was completely randomized (CRD), with in factorial 5 × 2, with 6 repetitions. The treatments consisted of the combination of manure proportions: (0, 20, 40, 60 and 80% v/v) mixture to the ground (2: 1 v v^{-1}) and the second factor consisted of organic fertilizer application (with and without). 30, 60, 90 and 120 days after sowing (DAS) evaluated the following variables: plant height, leaf number, stem diameter, leaf area, root length, absolute growth rate and relative plant height , stem diameter and leaf area, dry matter of root mass, shoot dry matter mass, the total dry matter and Dickson quality index. The use of cattle manure at the rate of 80% positively influenced the growth of guava rootstocks with the application of organic fertilizer.

Key words: *Psidium guajava* L., substrate, organic agriculture.

INTRODUCTION

In Brazilian Fruits there are several fruit of enormous economic importance, among them stands out the guava *(Psidium guajava* L.), a plant native to tropical America, which is distributed naturally throughout Brazil, with great economic importance because of the flavor nice, high nutritional value and great market acceptance, since its fruits are eaten both in natura as processed form (Oliveira et al., 2015). In the culture of the guava tree and some fruit, orchards consist of grafted seedlings, as the first step in the implementation of an orchard is the formation of seedlings, it influences the orchard productivity. Several factors affect the production of seedlings, including the substrate that will be used as well as its volume, which can lead to nullity or germination irregularity, malformation of plants and the appearance of symptoms of deficiency or excess of some nutrients (Mesquita et al., 2012). One of the problems in the production of seedlings is the inadequate management of nutrition, and well - nourished plants become less susceptible to pests and diseases, are more tolerant to drought and other stresses, moreover, well - nourished plants increase productivity and quality of fruit. Thus, the fertilization of the plants is a crucial step, however, the culture of guava fertilization is done with formulated fertilizers as well as the doses are equal in all seedlings. However, it is essential that the dose is recommended as to cultivate and age changes. Therefore it is essential studies to obtain the optimal dose in guava rootstocks growth and the fertilizer that provides good quality seedlings (Dias et al., 2012).

In the preparation of substrates several fertilizers and manures among them have been used, since they possess features that are beneficial to seedlings, such as improvement of physico-chemical properties, stimulating microbial processes. The manure are most organic materials used as substrate however, the type and amount of manure vary according to the plant species (Morais et al., 2012). Several research on the use of organic sources in the development of seedlings are found in literature, especially the use of manures and organic fertilizers (Mesquita et al., 2012; Morais et al., 2012; Oliveira et al., 2015). However, more studies are needed related to the use of manure in the substrate formulation for formation of fruit seedlings, as well as interaction with organic fertilizers.

Another factor that influences the production of good quality seedlings is the application of fertilizers. Organic fertilizers have many essential nutrients for plant growth. However, the lack of studies related to the supply of nutrients and the amount that should be applied is one of the obstacles faced by producers of seedlings. Another advantage with the use of organic fertilizer is to reduce the use of chemical fertilizers which in addition to being expensive pollute the environment.

While have high nutritional value and have high fiber content, furthermore, various fruit peels have high potential nutraceutical, such as passion fruit peel, used to reduce the glucose level. Moreover, the fruit peels can be used in agriculture, because they have many plant nutrients, therefore, aimed to evaluate the effect of cattle manure proportions as a function of organic fertilizer application to fruit peel based on growth rootstocks guava. Furthermore, the use of organic inputs provide an improvement in the physical characteristics of the soil, in addition to increasing the microbiological poulação and soil fauna diversity (Sall et al., 2015). In this context, the objective was to evaluate the effect of different rates of manure and application of organic fertilizer on the growth of guava rootstocks.

MATERIALS AND METHODS

The experiment was conducted from September 2015 to January 2016 in the greenhouse of the Center for Human Sciences and Agricultural in the Department of Agricultural and Exact State University of Paraíba (UEPB) in municipality of Catolé of Rock-PB, Brazil (6 20 '38 "S, 37 ° 44'48" W) and 275 meters. The experimental design was completely randomized (CRD), with a factorial 5 × 2, with 6 repetitions. The treatments consisted of the combination of manure dry proportions: (0, 20, 40, 60 and 80% v/v) mixture to the ground (2:1 v/v $^{-1)}$ and the second factor consisted of organic fertilizer application (with and without). The experimental units were composed of five seedlings grown in polyethylene bags with 2 kg capacity. The water used for irrigation had electrical conductivity of 0.8 dS m $^{-1.}$ The water analysis was carried out by the Irrigation and Salinity Laboratory (LIS) of the Center for Technology and Natural Resources of the Federal University of Campina Grande - UFCG and presented the following physicochemical characteristics: pH = 7.53, Ca = 2.30 $cmol_c\ dm^{-3}$, Mg = 1.56 $cmol_c\ dm^{-3}$, Na = 4.00 $cmol_c\ dm^{-3}$, K = 0.02 $cmol_c\ dm^{-3}$, Chloride = 3.90 $cmol_c\ dm^{-3}$, Carbonate = 0.57 $cmol_c\ dm^{-3}$, Bicarbonate = 3.85 $cmol_c\ dm^{-3}$, RAS = 2.88 $(mmol_c\ l^{-1})^{1/2}$.

The soil was classified as Fluvisol sandy clay loam texture. Samples were collected in the layer 0-20 cm in native area located on the campus of UEPB. The soil sample used for filling polyethylene bags was removed a sub-sample to be analyzed chemically, with the following characteristics: Ca = 4.63 $cmol_c\ dm^{-3}$, Mg = 2.39 $cmol_c\ dm^{-3}$, Na = 0.30 $cmol_c\ dm^{-3}$, K = 0.76 $cmol_c\ dm^{-3}$, Sum of bases - SB = 8.08 $cmol_c\ dm^{-3}$, H = 0.00 $cmol_c\ dm^{-3}$, Al = 0.00 $cmol_c\ dm^{-3}$, CTC = 8.08 and = 1.88% organic matter. The organic fertilizer was obtained by aerobic fermentation. For the preparation of fertilizer used was 20 kg peeling of fruits and 1 kg of charcoal, adding 5 kg of sugar and 5 L of milk to accelerate the metabolism of the bacteria. The fertilizer was applied 15 days after emergence and thereafter at 8 day interval, 10% of the substrate volume. Before application, the fertilizer was subjected to screen for filtering process to reduce the risk of clogging of the sieve watering holes. A sample of this fertilizer was analyzed and had the following chemical characteristics (Table 1). The sample of cattle manure was analyzed in the Soil Laboratory of Federal University of Paraíba and physicochemical analysis of this compound showed the following characteristics: pH = 7.75, P = 5.61 g kg^{-1}, K = 2.34 g kg^{-1}, Ca = 7.70 g kg^{-1}, Mg = 6.90 g kg^{-1}, In = 9.18 $cmol_c.dm^{-3}$ and MO = 38.4 g kg^{-1}.

Guava seeds were used *(Psidium guajava* L.), coming from healthy and ripe fruit. For the extraction of the seeds, the fruits were cut separating the seed from the pulp. Later, the seeds were washed in running water on fine mesh sieve for disposal of waste

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Table 1. Chemical attributes of organic fertilizer used in the experiment. Catolé do Rocha - PB, UEPB 2015.

Chemical properties	Obtained values
pH	8.46
EC (dS m^{-1})	13.65
Nitrogen (g kg^{-1})	6.2
Phosphorus (g kg^{-1})	1.66
Potassium (g kg^{-1})	136.77
Calcium $^{++}$ (mmol $_c$ L^{-1})	2.00
Magnesium $^{++}$ (mmol $_c$ L^{-1})	37,30
Sodium $^{+}$ (mmol $_c$ L^{-1})	13.83

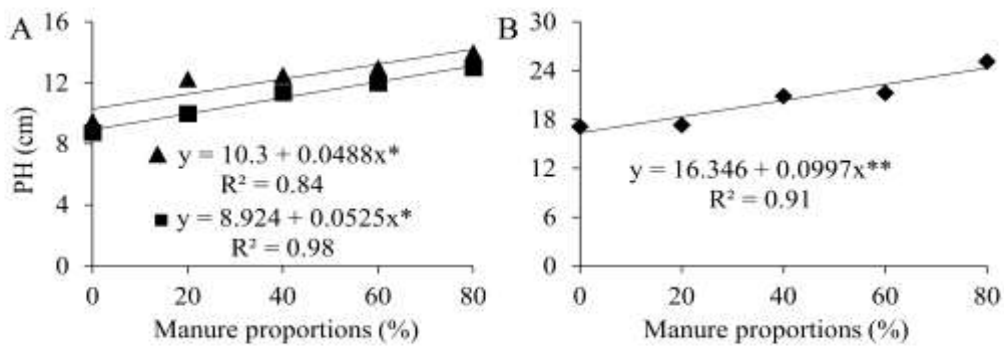

Figure 1. Plant height (PH) of guava rootstocks at 30 DAS (A) and 90 DAS (B) under the effect of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

from pulp and peel. The seeds were dried in a ventilated and shady place for a period of four days. The seeds were sown in plastic bags of 2 kg capacity, dimensions 20 × 30 cm, containing bovine manure and soil using four seeds of Paluma. At 20 days after sowing, there was thinning of seedlings keeping only the most vigorous seedling. At 30, 60, 90 and 120 days after sowing (DAS), the following variables were evaluated: plant height, leaf number, stem diameter, leaf area. At the end of the experiment were also evaluated the dry matter of the root, stem, leaf, shoot, and total Quality Index of Dickson.

For plant height, measurement was used a graduated tape measure in centimeter, the distance between the neck and the apex of the plant (younger sheet insert fully formed). The number of leaves was obtained by counting. The stem diameter measurements were taken with a digital caliper two (2) cm above the plant lap. The leaf area was obtained by measuring the width and length of the sheet (L x C). The dry matter of root, dry matter stem, dry matter of leaf and dry matter of shoots, were determined after fresh material to be approximately 48 hours in air circulation oven forced to a temperature of 60 ° C until obtaining a constant weight was weighed 0.0001 g on a precision balance. The mass of the total dry matter was obtained by adding up all the dry parts of the plant (root, stem and leaf). From the monthly average values of plant height, stem diameter and leaf area were calculated their respective absolute growth rate (AGR) and relative growth rates (RGR) as Benincasa (2003). The relationship root shoot (R/S) was measured as Benincasa (2003). The Dickson quality index was calculated according to the methodology of Dickson et al. (1960). Data were evaluated by analysis of variance by F test at 0.05 and 0.01 probability and in cases of significance, there was analysis of linear and quadratic polynomial regression using the statistical software SISVAR 5.0 (Ferreira, 2011).

RESULTS AND DISCUSSION

There was significant effect of interaction x cattle manure organic fertilizer for the plant height, stem diameter at 30 and 120 DAS to the number of sheets at 90 and 120 DAS and leaf area at 60 and 120 DAS. For the isolated effect of cattle manure, it was observed that the plant height, leaf number showed significant effects at 30, 90 and 120 DAS, to stem diameter in all periods and leaf area at 90 and 120 DAS. Regarding the application of organic fertilizer, there was a significant effect on plant height and number of leaves only the 120 DAS, to stem diameter at 30 DAS and leaf area at 30 and 60 DAS. Figure 1 shows the effect of cattle manure proportions at the time of guava rootstocks to plant 30 (A) and 90 (B) DAS. The guava rootstocks at 30 DAS, had increased plant height of 9.5 cm (0% of cattle manure) to 14 cm (80% of cattle manure), soil with organic fertilizer, an increase of 85% ratio between the minimum (0%) and maximum (80%) (Figure 1A). At 90 DAS, the door guava grafts showed a height of maximum plant of 25.12 cm, representing an increase of 68.15% by increasing the proportion of cattle

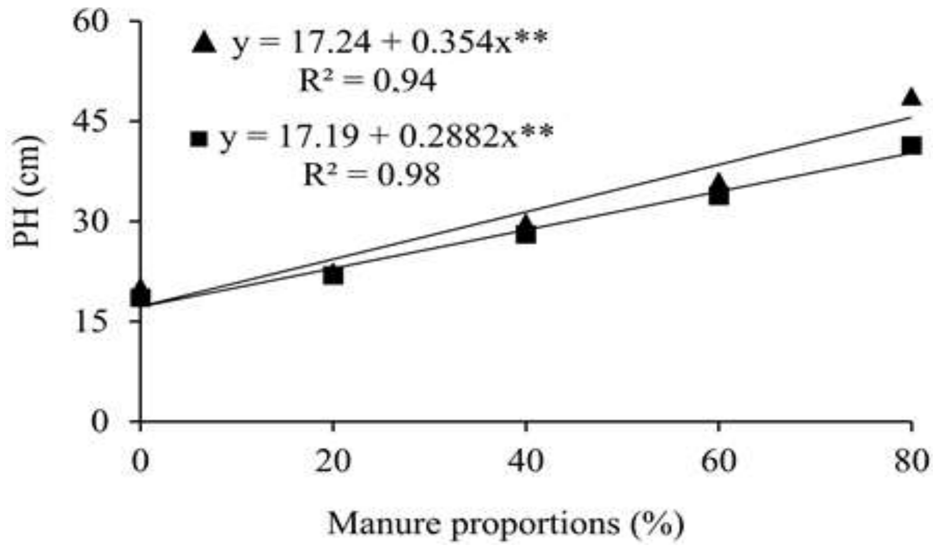

Figure 2. Plant height (PH) of guava rootstocks at 120 DAS under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

manure (Figure 1B). These results show that the use of organic fertilizer provides more nutrients to guava rootstocks, even in the absence of manure.

Cavalcante et al. (2010) studied saline water and liquid manure in the formation of guava plants Paluma observed that the plant height was higher in plants treated with cattle manure, getting a height of 16.56 cm plants with manure. Silva et al. (2008) found that the application of manure (3kg to 100kg soil) significantly increased the Paluma guavas high irrigated with saline water, which found that plants treated with manure had a height of 51.1 cm. Oliveira et al. (2015) observed that the greatest shoot length was obtained with the addition of 39.49% of cattle manure to the substrate, which reached a maximum height of 73.29 cm this ratio. It was observed that plant height of guava rootstocks at 120 DAS showed a positive effect of the manure ratios (Figure 2), obtaining with the maximum percentage (80%), 48 - point, 72 cm in the presence of organic fertilizer and 41.35 cm in the absence of organic fertilizer, a difference of 7.37 cm. In the absence of organic fertilizer lower values were observed plant height in all proportions of manure. Each unit increase of the manure proportions, there was an increase on the order of 0.354 cm and 0.288, corresponding to presence or absence of organic fertilizer respectively.

Among the most used organic fertilizers in the substrate composition, the manure is one of the most used since it improves the physical characteristics, in addition, stimulates microbial process (Arthur et al., 2007). The increase of manure proportions increased the number of guava rootstocks leaves linearly to 30 DAS. Observed maximum values of 11.75 sheets obtained in the maximum proportion of cattle manure (80%) (Figure 3) an increase of 76.59%, each unit increase in cattle manure proportions there was an increase in the order 0, 0324 sheets. Mesquita et al. (2012) in papaya, observed that the amount of 79.1% of cattle manure per plant obtained the maximum number of leaves getting an average of 15.72 leaves. In passionflower, Ribeiro (2005), yellow passion fruit seedlings substrates found that the soil base + manure in plastic bags had more leaves. The number of leaves port guava grafts at 90 and 120 DAS treated with manure proportions due to the organic fertilizer application is shown in Figure 3. Note that the highest values were obtained with the application of organic fertilizer, corresponding the maximum number of sheets 17 in rootstocks treated with 80% of bovine manure to DAS 90 (Figure 4A), the DAS 120, it was observed that the rootstocks presented a number of leaves 24.75 maximum at the ratio of 80% bovine under organic fertilizer application manure (Figure 4B), showing thus that the guava rootstocks respond directly when it raises the level of organic matter in the soil. One of the benefits of the manure is the provision of organic material, one of the fundamental components of the substrate, it provides an increase in water and nutrient retention capacity for the cuttings, besides, it reduces the apparent and bulk density as well as increasing the porosity the means (Silva et al., 2008).

Regarding the stem diameter at 30 DAS, the proportions of manure provided a linear increase as its increase, with the highest value of 1.59 mm for a ratio of 80% of cattle manure under organic fertilizer application. It is also observed that as they increased the amounts of manure there was an increase in stem diameter, representing a difference of 89.93% in the proportion of 0% and 80% of cattle manure (Figure 5A) with the application organic fertilizer. At 60 and 90 DAS, it

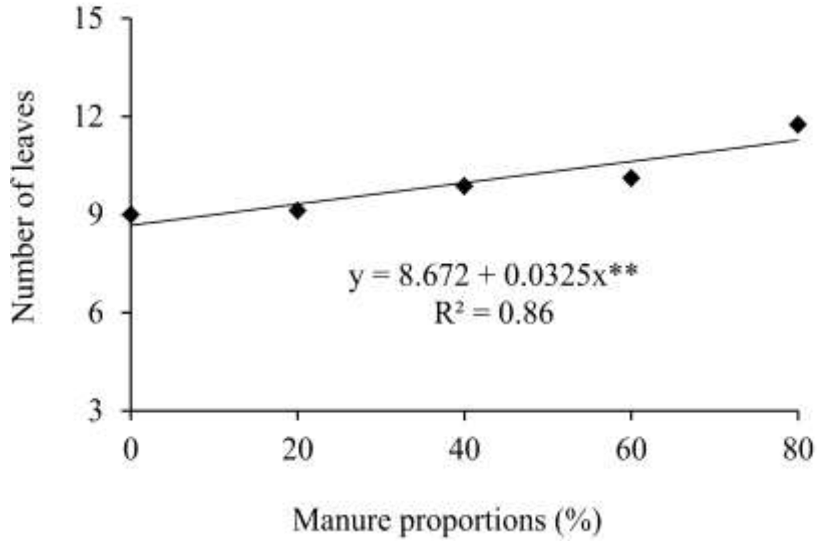

Figure 3. Number of guava rootstocks of leaves at 30 DAS under the influence of different proportions of manure.

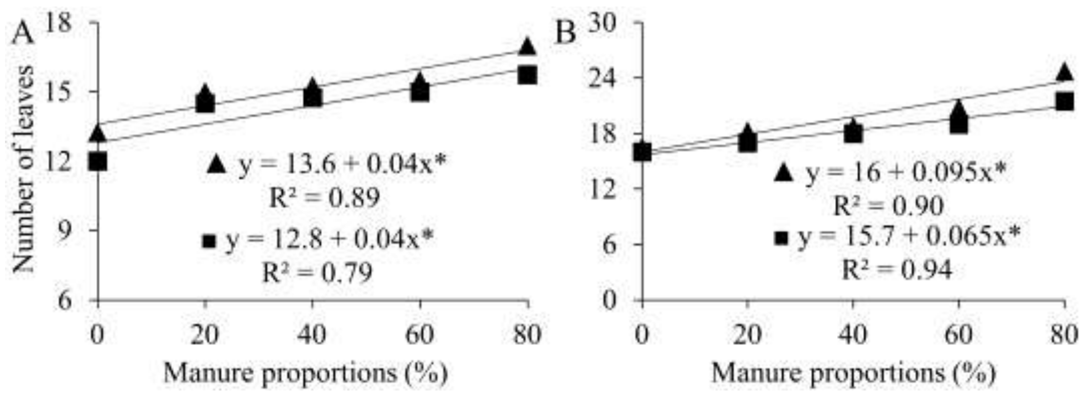

Figure 4. Number of guava rootstocks leaves at 90 DAS (A) and 120 DAS (B) under the effect of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

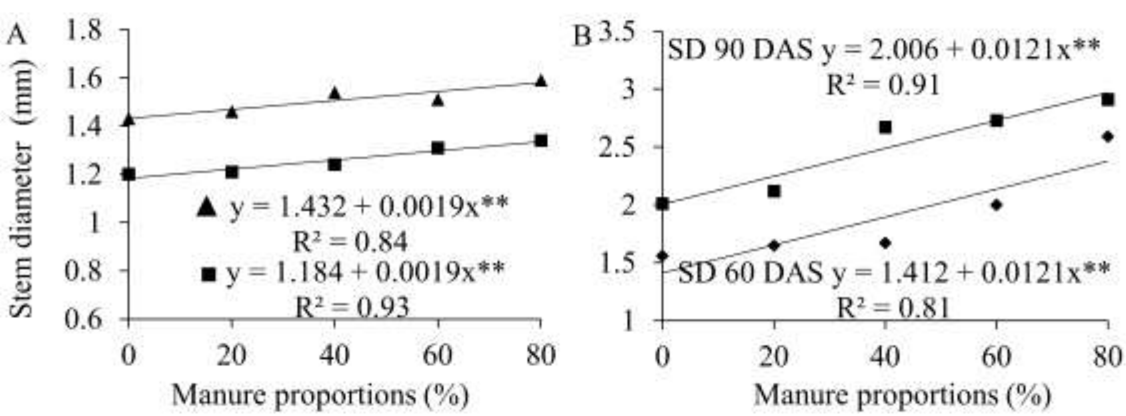

Figure 5. Stem diameter of guava rootstocks stem to 30 DAS (A) and 60 and 90 (B) DAS the under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

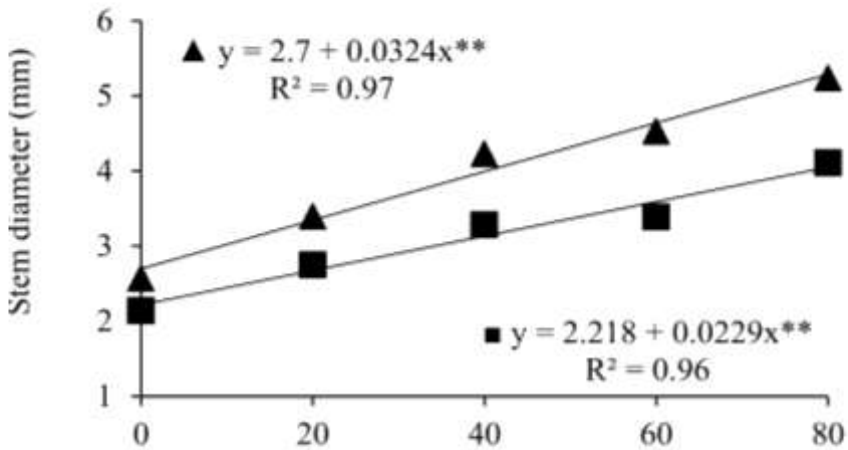

Figure 6. Stem diameter of guava rootstocks to 120 DAS under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

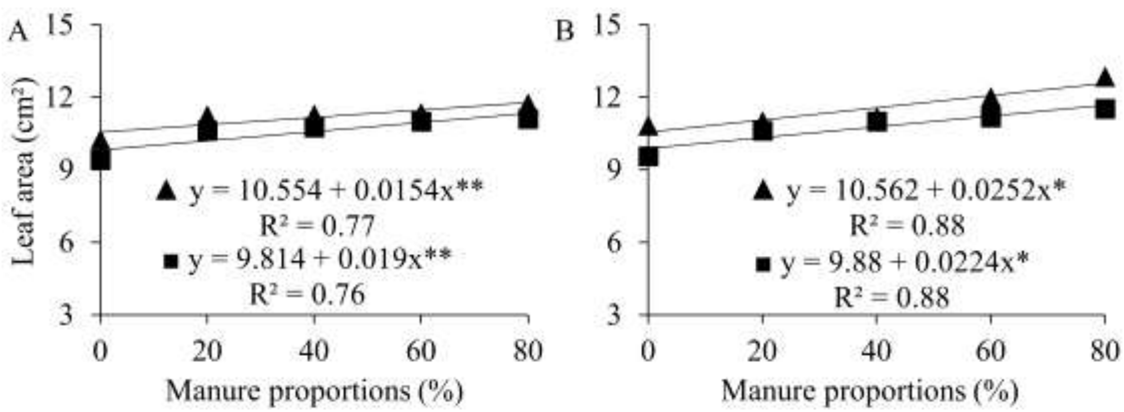

Figure 7. Leaf area of guava rootstocks to 30 (A) and 60 (B) OF THE under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

is observed that the proportions of manure provided an increase in stem diameter, with better adaptation to the linear model for the proportions of cattle manure (Figure 5B). The rootstocks showed continued growth to achieve greater stem diameter of 2.59 to 2.91 mm and 60 DAS to 90 DAS in the proportion of 80% of cattle manure. Cavalcante et al. (2010) studied saline water and liquid manure in the formation of guava plants grow paluma observed that the stem diameter was higher in plants treated with cattle manure, with a maximum of 2 mm with the use of liquid manure. Sá et al. (2015) in custard, observed that the substrate consists of 50% soil + 25% manure + 25% sand showed the best results in stem diameter (2.32 mm). Cavalcante et al. (2009) in passionflower noted that the maximum dose (10%) of liquid manure gave the highest results for the stem diameter (2.4 mm).The increase in cattle manure proportions promoted linear increase in the diameter of guava rootstocks stem to 120 DAS, the level of 0.324 mm in the presence and 0.229 in the absence of organic fertilizer for each unit increase in cattle manure (Figure 6). Treatment with the maximum proportion of manure (80%) rootstocks showed superior results (5.24 mm) in the presence of organic fertilizer, which corresponds to an increase of 49.04% in stem diameter compared to the untreated rootstocks with organic fertilizer, which showed 4.11 mm in maximum proportion of cattle manure (80%) and in the presence of organic fertilizer.

The leaf area at 30 DAS (Figure 7A) and 60 (Figure 7B) of guava rootstocks were significantly marked by the increase of cattle manure proportions. We observed the rootstocks treated organic fertilizer provide superior results when compared to those without treatment with the organic raw material. At 30 DAS, an increase of

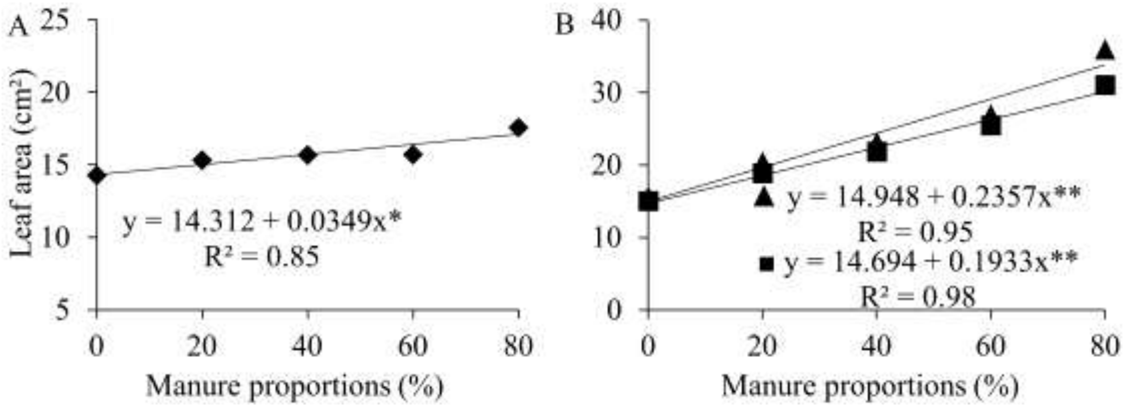

Figure 8. Leaf area of guava rootstocks to 90 (A) and 120 (B) DAS the under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

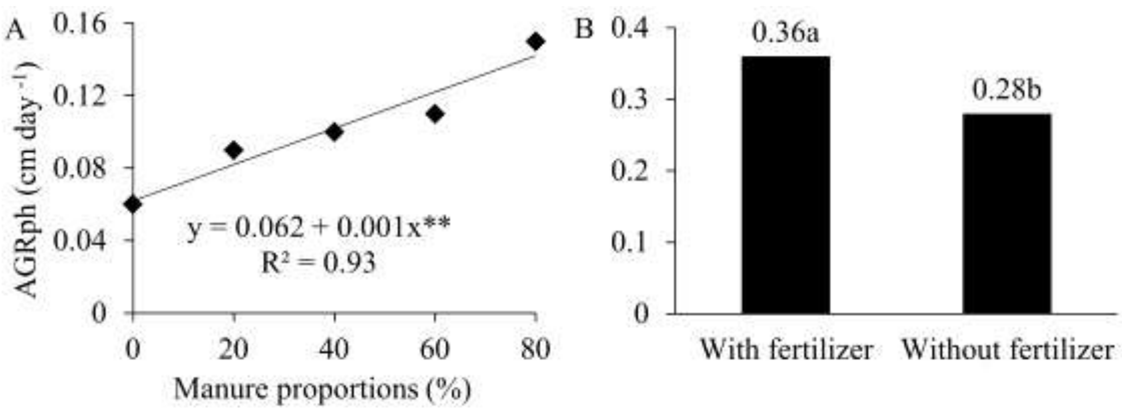

Figure 9. Absolute growth rate - AGRph height guava rootstocks plant under the influence of different proportions of cattle manure (A) due to the presence and absence of organic fertilizer (B) in the period 60-120 DAS.

0.0154 cm² and 90 DAS an increase in the order of 0.0252 cm² in rootstocks under organic fertilizer application, respectively. Cavalcante et al. (2010) in guava plants observed that treatment with cattle manure was superior to the leaf area and length of the guava root, with a maximum of 167.5 cm² value for leaf area and 29 cm long root. Barros et al. (2013) in passion fruit, obtained the best results for leaf area (966.3 cm²) and root length (17 cm) with substrates composed of hardened soil + cattle manure. In guava rootstocks treated with manure proportions, there was increasing linear behavior due to the increase of manure ratios for the leaf area to 90 (Figure 8A) and 120 DAS (Figure 8B), representing increases of 0,0349 cm² to 90 DAS for each unit increase in cattle manure proportions. At 120 DAS 0.2357 and 0.1933 cm² in the presence and absence of organic fertilizer, respectively, for each unit increase in cattle manure proportions. For the absolute growth rate and relative plant height, stem diameter and leaf area, there was significance to the interaction between the factors proportions of fertilizer x manure only for the absolute growth rate of leaf area, while the isolated effect of manure provided significant effect on all variables. It was further found that the organic fertilizer showed a significant effect only for the absolute growth rate of plant height and leaf area. The proportions of cattle manure (Figure 9A) and organic fertilizer application (Figure 9B) provided an increase in the absolute growth rate of the plant height of guava rootstocks. It was observed that the maximum proportion rootstocks treated manure results showed peak (0.15 cm day $^{-1}$), resulting in increasing order of 0.001 every unit increase in the bovine manure proportions. For the application of organic fertilizers, it was found that without its application, a reduction in the absolute growth rate of plant height, giving a value of 0.28 cm $^{-1}$ and day under application of organic fertilizer on 0.36 cm $^{-1.}$

The increase in the proportion of manure also gave an increase in relative growth rate in height of the rootstocks guava plant, as it increased the manure proportions a

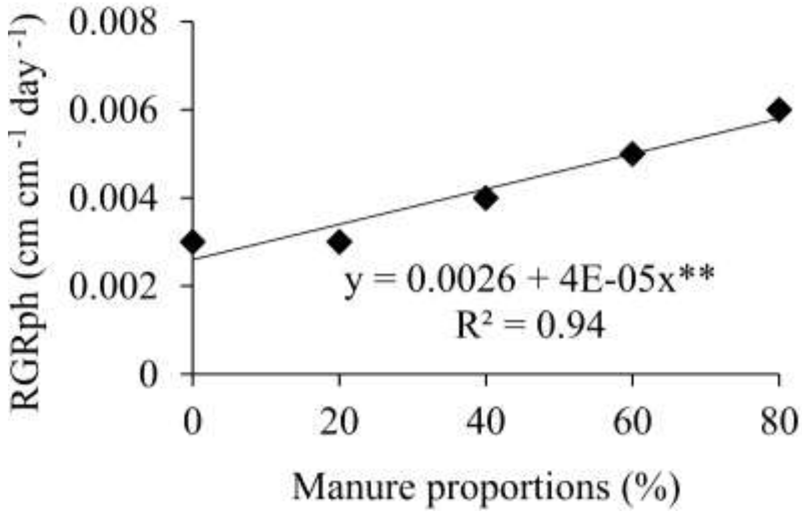

Figure 10. Growth rate relative – RGRph plant height guava rootstocks plant under the influence of different proportions of cattle manure in the period 60-120 DAS.

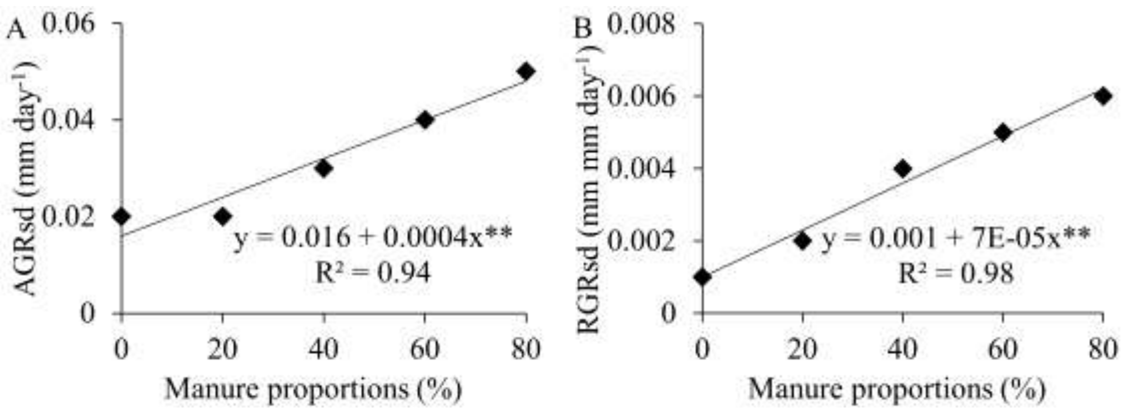

Figure 11. Absolute growth rate – AGRsd (A) and relative - RGRsd (B) diameter of guava rootstocks stem under the influence of different proportions of cattle manure in the period 60-120 DAS.

gain so that the control presented 0.003 cm cm $^{-1}$ day $^{-1}$ and the maximum ratio showed a growth rate relative height of 0,006 cm $^{-1}$ cm $^{-1}$ day plant, resulting in an increase in the order of 50% per unit increase in the bovine manure ratios (Figure 10). As for the plant height growth rate, absolute and relative growth rate of stem diameter was a linear increase with rising of manure proportions. It also appears that each unit increase in the bovine manure proportions rootstocks showed an increase of 0.0004 mm $^{-1}$ to day absolute growth rate (Figure 11A) and the relative growth rate was observed that the witness showed a value of 0.001 while the maximum proportion of cattle manure (80%) was obtained a value of 0.006, an increase of 16.66% for each increase in the proportion of cattle manure (Figure 11B). The absolute growth rate of leaf area responded significantly to the effects of cattle manure interaction × organic fertilizer. It was observed that the treatments with organic fertilizer values increased linearly at the level of 0.0038 cm ^{2} d $^{-1}$ per unit increase in the proportion of cattle manure, 0.38 in the treatment with the highest proportion of cattle manure (80%). In rootstocks without organic fertilizer application, it was observed that the results were lower, resulting in the highest percentage of cattle manure (80%) a value of 0.26 cm $^{-1}$ d ^{2} (Figure 12A).

The increase in cattle manure proportions provided a linear increase in the relative growth rate of leaf area. Upon verification, the treatments with the highest proportion of cattle manure (80%), rootstocks showed a50% increase compared to rootstock treated with the control (0%) (Figure 12B). It was found that significant

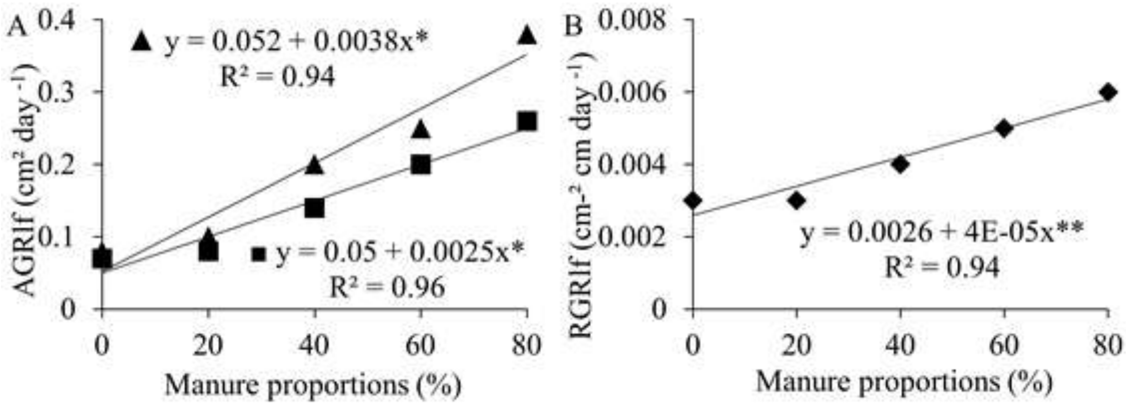

Figure 12. Absolute growth rate - AGRlf (A) and relative – RGRlf (B) of leaf area guava rootstocks under the influence of different proportions of manure due to the presence (▲) and absence (■) of fertilizer organic in the period 60-120 DAS.

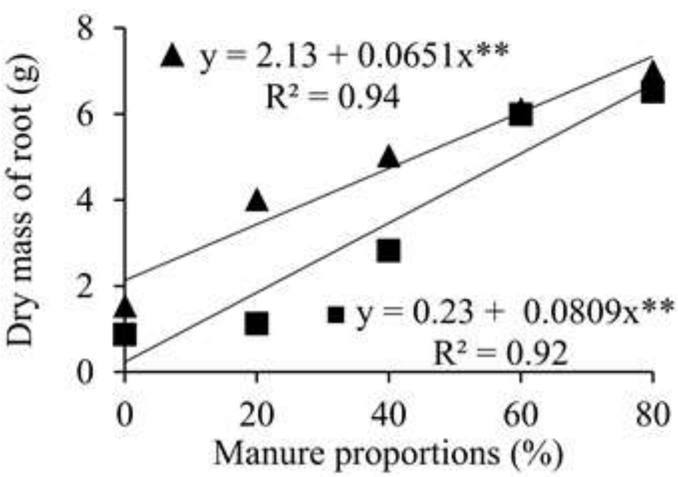

Figure 13. Dry mass of root guava rootstocks under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

effect of cattle manure x interact organic fertilizer to the root dry weight, shoot dry weight, total dry weight and Quality Index of Dickson.For the isolated effect of cattle manure was no significant effect on all variables. Regarding the application of fertilizer, significant effects were observed for dry root mass, shoot dry weight, total dry weight, relative root and shoot Dickson Quality Index. Figure 13 shows the interaction between the proportions of cattle manure in the presence and absence of organic fertilizer to the root dry mass, noting that the rootstocks of guava treated with cattle manure at the rate of 80% was superior in the results, yielding 6.99 g plant $^{-1}$ values in the presence of organic fertilizer and 6.52 g plant^{-1} in the absence organic fertilizer. Oliveira et al. (2015) observed that the proportion of 37.25% of manure gave the highest root dry mass values (3.49 g). Barros et al. (2013) in passionflower, achieved the best results (1.32 g) to root dry mass with substrates composed of cattle manure + hardened soil. Cavalcante et al. (2010) studied saline water and liquid manure in the formation of guava plants grow paluma observed that plants treated with liquid manure bovine had damage to a lesser extent in the treatments with organic input. It is noted that there was an increase of dry matter of the stem (Figure 14A) and leaves (Figure 14B), with the increase in the percentage of cattle manure in the composition of the substrate to achieve the maximum dry mass 10.76 g plant stem $^{-1}$ and dry weight of leaf 24.73 g plant $^{-1}$, referring to the proportion of 80% of cattle manure, respectively. Similar results were obtained by Cavalcante et al. (2010) evaluated guava plants, and found that the treatment eat liquid manure was superior in getting the dry weight values of the root.

As for the other variables, the dry weight of shoot (Figure 15A) and total (Figure 15B) were significantly scaled up as they increased manure proportions beef and higher in treatments with organic fertilizer. The largest increases were obtained in the ratio of 80% of cattle manure and in the presence of organic fertilizer, resulting in an increase of 46.21% to the dry weight of shoot and 47.14% to the total dry mass. Cavalcante et al. (2010) and guava, observed that plants treated with liquid manure bovine showed superior results in dry mass of shoot and total dry matter in the treatments with the use of manure. Oliveira et al. (2015) in guava rootstocks, observed that the incorporation of increasing proportions of manure provided the best results for dry matter of shoot and total, which observed that the highest values were 12.53 and 16.01 g plant $^{-1}$ in the proportions of 40.16 and 39.64% of cattle manure, respectively. For the relationship root shoot, there was an increase as increased the proportions of manure, where the best result was found in the maximum proportion of cattle manure (80%), a difference of 45.86% between the

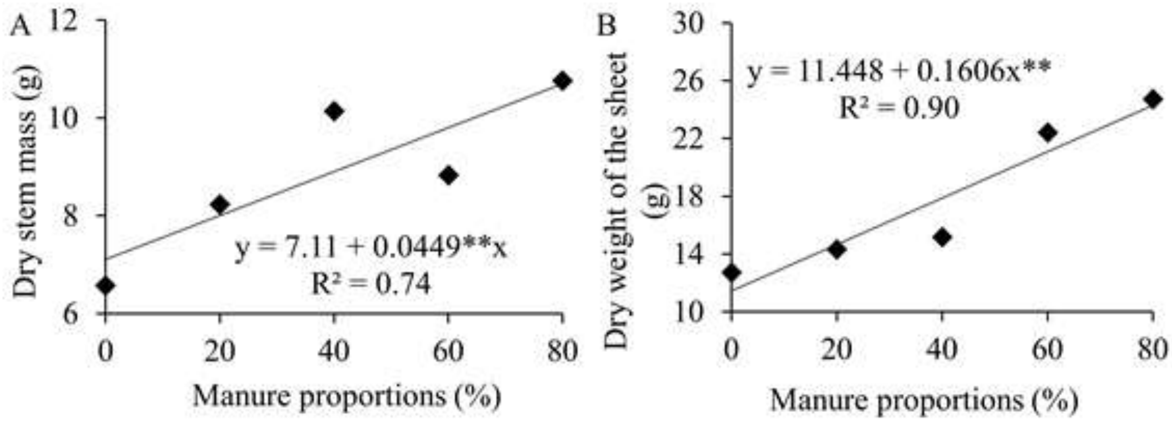

Figure 14. Dry stem mass (A) and dry weight of the sheet (B) of guava rootstocks under effect of different proportions of manure

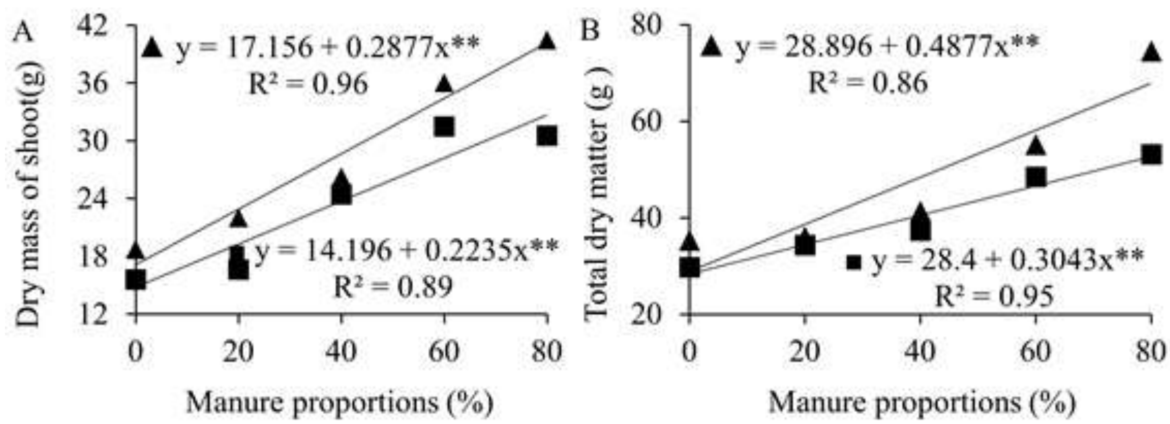

Figure 15. Dry mass of shoot (A) and total dry matter (B) rootstocks of guava under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

proportion minimum and maximum of cattle manure (Figure 16A). It was also observed that the treatments with the application of fertilizer was made was an increase in the shoot root ratio, obtaining a value of 1.83 in rootstocks treated with organic input (Figure 16B). The manure acts to increase the availability of nutrients in addition, the manure is widely used in most farms, since it presents low cost. Kumar and Ponnuswami (2013) indicate that the manure suitably provides the organic material, nurturing plants and can thus contribute to greater production as well as the quality of the fruit, since the supply of organic material improves the properties soil, increasing microbial biochemical activity of soil and edaphic (Mandal et al., 2007; Dunjana et al., 2012.). The use of manure had a positive effect on the Quality Index of Dickson, and the corresponding treatment to 80% of cattle manure and in the presence of organic fertilizer provided the best results, showing that the guava rootstocks respond positively to increase cattle manure in the substrate. Dickson Quality Index adjusted to the linear equation in terms of the proportion of cattle manure in the substrate and showed a continuous increase until reaching the highest rates in the order of 2.52 in the maximum proportion (80% cattle manure) in the presence of fertilizer (Figure 17).The Quality Index of Dickson is one of the most important parameters to assess the quality of a change; good quality seedlings are more robust and better distribution of biomass, allowing greater development capacity in the field, for their high force (Silva et al., 2011).

Conclusion

Proportions of 80% of cattle manure provide rootstock higher quality guava. The use of manure positively influenced the growth of guava rootstocks together with the organic fertilizer application.

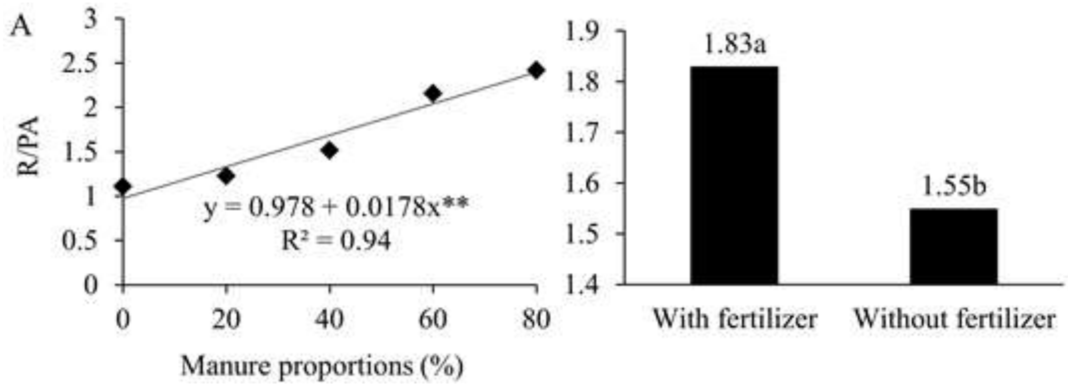

Figure 16. Aerial root ratio (R/PA) of guava rootstocks under the influence of different proportions of manure due to the presence and absence of organic fertilizer.

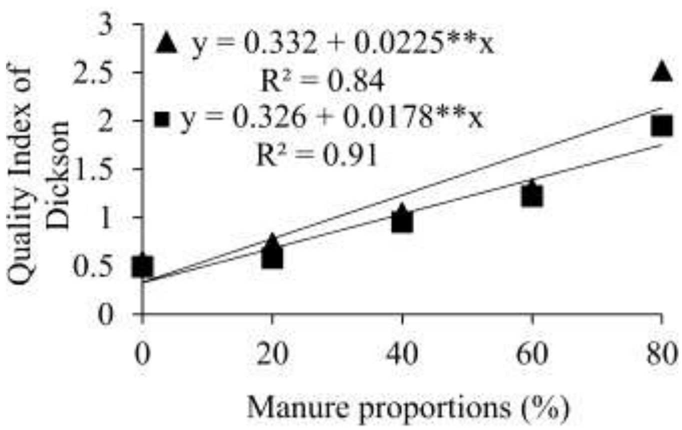

Figure 17. Quality Dickson guava rootstocks Index under the influence of different proportions of manure due to the presence (▲) and absence (■) of organic fertilizer.

Conflict of interests

The authors have not declared any conflict of interests.

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