

Original Research Article

New substrates based on decomposed babassu stem in the production of melon seedlings

ABSTRACT

Melon production in recent years has shown great growth, success in cultivation depends on a good production of seedlings, and poor quality of the substrate can cause problems in germination. The objective of this study was to evaluate changes of melon with different proportions of the substrate based on the decomposed stem of babassu. For this, different proportions of decomposed babassu stem (DBS) were used in proportions S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS + 40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS, using a completely randomized design, having six treatments with four replicates, were evaluated: emergence speed index, germination percentage (%), plant height (cm); stem diameter (mm); root length (cm); root volume (cm³), dry root mass and dry mass of shoot (g). Although germination did not show any difference, the rate of emergence showed statistically equal results between them and higher than the control. Based on the data obtained, we conclude that substrates based on the decomposed stem of babassu with proportions between 40, 60 and 80% can be used for the production of seedlings of melon. These predictors, however, need further work to validate reliability.

Keywords: Alternative substrates; *Attalea speciosa* Mart.; *Cucumis melo*; quality seedlings.

1. INTRODUCTION

Melon (*Cucumis melo* L.) is a fruit with great representativeness in the market of tropical countries, with great economic and social relevance, mainly for the generation of jobs due to intensive labor in all stages of the production system (Dalastra et al., 2016). In Brazil, melon ranks 13th among the most produced fruits, being the second main product of the Brazilian fresh fruit export market (Treichel et al., 2016). Its cultivation is concentrated in the northeastern region of Brazil, especially in the states of Rio Grande do Norte and Ceará (Santos et al., 2016).

The success of melon cultivation begins in the viability of producing quality seedlings. One of the major challenges lies in the type of substrate used, since commercial substrates, generally consisting of expanded vermiculite and organic materials (Cavalcante et al., 2012) are expensive and do not provide all the required nutrients. The quality of the substrate can lead to problems in the germination and formation of the plants, compromising the development of the crops (Medeiros et al., 2010; Pelizza et al., 2013).

It is important to note that in order to obtain an efficient substrate, it is necessary to have appropriate chemical and physical characteristics, which is available in the locality and presents low cost (Severino et al., 2006). In this sense, the use of alternative materials as substrates for seedling production has been increasing, seeking to offer options to producers that facilitate and reduce production costs, as well as reduce environmental impacts due to the large generation of solid waste.

Several materials have been studied as alternative substrates in the production of melon seedlings, among them: animal manures, earthworm humus, carbonized rice husk, coconut fiber, sugarcane bagasse and decomposed stem (Bezerra and Bezerra, 2001; Almeida et al., 2004). The decomposed stem of the babassu palm (*Attalea speciosa* Mart.) Has a high concentration in the North and Northeast of Brazil, and has beneficial chemical characteristics because it is an organic material (Cruz et al., 2018).

37 Considering the importance of the definition of alternative regional substrates with low cost and easy
38 acquisition for this region that has promising characteristics in the production of melon and meets
39 ideal conditions of cultivation and logistics. The present research had the objective of evaluating the
40 use of the babassu decomposed stem as a substrate for the production of melon seedlings

41

42 2. MATERIAL AND METHODS

43

44 2.1. Characterization of the test site and the treatments analyzed

45 The experiment was carried out in a greenhouse with 70% luminosity control, from July to August
46 2016, at the Agricultural and Environmental Sciences Center (CCAA) of the Federal University of
47 Maranhão (UFMA) (03°44'17 "S and 43°20'29 "W and altitude of 107 m). The climate of the region is
48 classified as tropical humid (Selbach & Leite, 2008), with rainy season concentrated between
49 December and July, with annual rainfall ranging from 1,600 to 2,000 mm (Nogueira et al., 2012) and
50 annual average temperature higher than 27 ° C (Passos et al., 2016).

51 The experiment was conducted in a completely randomized design with six treatments and four
52 replicates, totaling twenty - four plots. The plots consisted of 16 seedlings, thus totaling a stand of 385
53 seedlings. The treatments consisted of different substrate formulations containing the decomposed
54 babaçu stem (DBS): S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS
55 + 40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS.

56 The soil used in the formulation of the substrates was classified as a sandy loam textured Dystrophic
57 Yellow Latosol (Santos et al., 2013), with granulometry: 384 g coarse sand.kg-1; 336 g fine sand.kg-1;
58 112 g of silt.kg-1; 168 g of total clay.kg-1; 38 g of natural clay.kg-1 with flocculation degree of 77g /
59 100g. The physical-chemical characterization of the substrates analyzed are expressed in Tables 1
60 and 2, respectively.

61 Table 1. Values of pH, electrical conductivity (EC) and total (N), phosphorus (P), potassium (K),
62 calcium (Ca) and magnesium (Mg) and sulfur (S) substrates based on decomposed babassu stem
63 (DBS).

Substrates	pH	CE	N	P	K	Ca	Mg	S
		dS m ⁻¹	g kg ⁻¹	mg kg ⁻¹		cmol _c kg ⁻¹		
S1	5,06	0,10	0,63	13	0,07	0,80	0,30	1,5
S2	4,88	0,61	1,23	14	0,67	1,60	1,00	3,8
S3	5,11	1,36	1,46	13	1,82	3,20	1,70	7,6
S4	4,83	1,79	2,02	13	2,35	4,40	2,80	10,8
S5	5,16	3,00	3,47	27	6,17	10,90	4,60	24,6
S6	5,32	4,34	5,88	33	3,63	20,60	15,20	41,5

64 S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS + 40% soil; S5: 80% DBS +
65 20% soil; and S6: 100% DBS.

66

67 Table 2. Density (D), particle density (PD) and porosity (P) of the substrates based on
68 decomposed babaçu stem (DBS).

Substrates	Porosity (%)	Density (g/cm ³)	
		DG	DP
S1	45,99	1,44	1,67
S2	51,53	1,28	2,64
S3	54,01	1,18	2,57

S4	56,22	0,98	2,24
S5	60,91	0,73	1,88
S6	65,95	0,33	0,97

S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS + 40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS.

2.2. Management and variable responses analyzed

Yellow melon seeds with 99.9% purity and a minimum germination guarantee of 85% were used. The sowing was done in a polystyrene tray with 128 cells, two seeds were placed per cell at one centimeter depth, the thinning of the seedlings was done when they had two leaves leaving the most vigorous. Daily irrigation with a 25 ml. plantula-1 crude leaf divided into two shifts at 8 and 17 hours was performed. During the test there was daily monitoring to ascertain phytosanitary issues, and no damage was detected in the experiment.

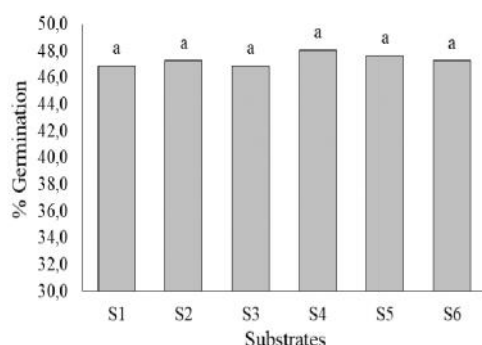
The emergence of seedlings (G%) was determined by counting the number of seedlings emerged daily until stabilization, and emergency speed index (ESI) by the method of Maguire (1962). At the end of the experiment, 27 days after sowing, the plants were removed from the substrates, washed in water and taken to the laboratory, where the plant height (cm) was determined; stem diameter (mm); root length (cm); root volume (cm³), according to methodology described by Basso (1999); (g): obtained by the oven drying method with forced air circulation at a temperature of 65°C until reaching constant.

2.3. Experimental and statistical planning

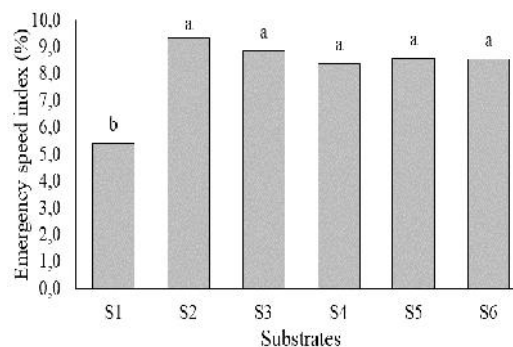
In the analysis of the data, the normality was verified by the Kolmogorov Smirnov test and the homogeneity of variance by the Cochran test, both at 5% significance. Then, we performed a variance analysis according to the statistical model: $Y_{ij}(k) = \mu + S_i + \text{erro}_{ij}(k)$, where: $Y_{ij}(k)$: is variable depends on analyzed; μ : is the overall mean; S_i : is the effect of the i-th substrate and $ij(k)$: it is the experimental error, the mean values being compared by the "F" test, for a significant effect diagnosis, and by the Tukey test at 5% significance level. The analyzes were performed with the assistance of the ASSISTAT® program (Silva and Azevedo, 2016).

3. RESULTS AND DISCUSSION

There was no significant effect on the percentage of germination (G%) among the evaluated substrates. However, the substrates based on decomposed babassu stem (DBS) presented mean values higher than the substrate composed entirely of soil (S1) for the emergency speed index (ESI). The results obtained by G% and ESI may be related to the chemical characteristics of the substrate, because with the inclusion of the DBS the substrates present gains of N, P, K, Mg, Ca and S. In addition to higher porosity and lower general density (Table 2). As reported by Albano et al. (2014), which showed an increase in ESI in papaya, due to the higher proportion of buriti stem (*Mauritia vinifera* Mart.), The palm leaf used in the substrate composition (Figure 1A and B).



(A)



(B)

Figure 1. Mean values of germination percentage (G%) value of $F = 0,40ns$; $DMS = 3.22$; $CV = 3.04\%$ (A) and emergency speed index (ESI) value of $F = 7.18^{**}$; $DMS = 2.34$; $CV = 12.78\%$ (B). Caption: DBS: decomposed babassu stem; S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS + 40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS; equal letters do not differ by Tukey test ($P < 0.05$).

As shown in figure 2A and B, plant height (PH) and stem diameter (SD), behaved in a similar manner, the use of CBD with intermediate proportions (40, 60 and 80%) were superior ($p < 0.05$) to the other substrates analyzed. For the variables in question, it is suggested that this proportionality between the height of the plant and the diameter of the stem indicates a good development of the seedlings, since the balance between height and diameter demonstrates that there was no seedling detachment. The increase of the DBS attributes a positive correlation to the pore volume of the respective substrates, promoting greater water retention and germination.

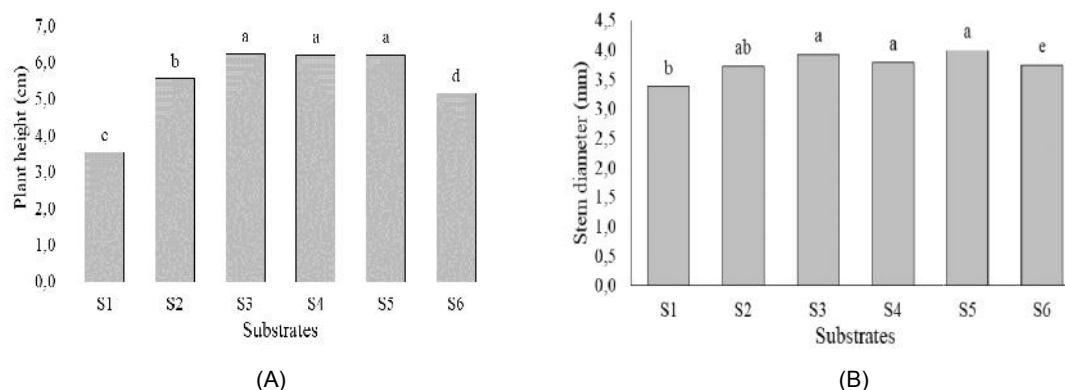


Figure 2. Mean values for plant height (cm) value of $F = 0,40ns$; $DMS = 0.66$; $CV = 5.09\%$ (A) and stem diameter (mm) value of $F = 6.51^{**}$; $DMS = 0.38$; $CV = 4.50\%$ (B). Caption: DBS: decomposed babassu stem; S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS + 40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS; equal letters do not differ by Tukey test ($P < 0.05$).

In relation to the root volume (RV), the substrates composed of DBS did not present ($P > 0.05$) difference between them, and were superior to the substrate composed entirely of soil. On the other hand, the root length (RL) occurred the reverse behavior of the RV, where the substrate composed entirely of soil showed the highest average value, and as the proportions of DBS increased the radicle length reduced (Figure 3A and B).

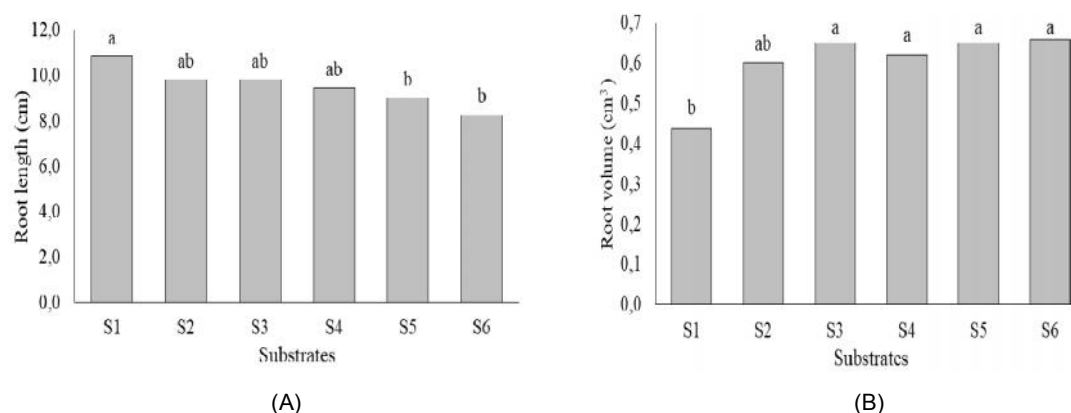


Figure 3. Mean values for root length (cm) value of $F = 5.63^{**}$; $DMS = 1.62$; $CV = 7.61\%$ (A) and root volume (cm³) F value = 5.31^{**} ; $DMS = 0.16$; $CV = 11.99\%$ (B). Caption: DBS: decomposed babassu stem; S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS +

40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS; equal letters do not differ by Tukey test ($P < 0.05$).

As regards VR and RL, this should be associated with higher resistance in the substrate caused by the presence of DBS (Table 2), which implies a higher formation of short roots due to the higher resistance in the substrate, resulting in seedlings with greater number of roots and therefore a larger volume and a shorter energy-saving time to compete with higher resistance in the DBS.

The dry mass of the aerial part (DMAP) was higher ($P < 0.05$) with the use of 40% of DBS (S3), responsible for the greater accumulation of biomass, these results indicate the viability of the production of melon seedlings using this one treatment. On the other hand, there was no difference for dry mass of root system (DMRS) between the substrates analyzed, suggesting a similar formation of roots between the treatments (Figure 4A and B).

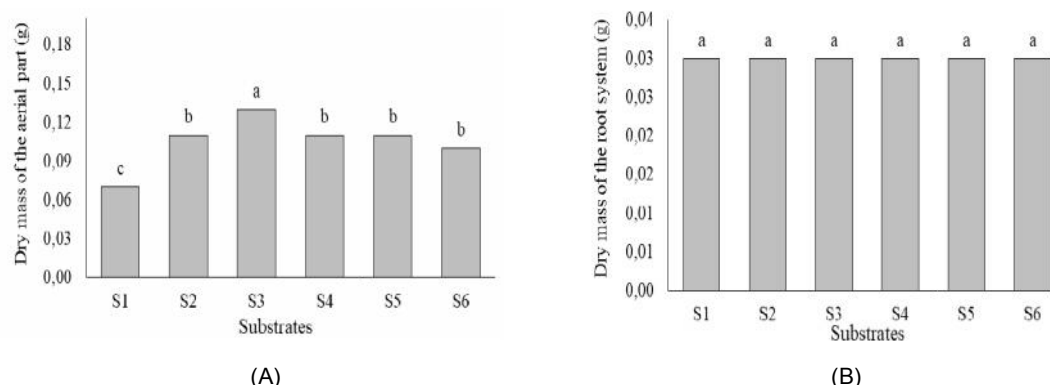


Figure 4. Average values for aerial shoot dry mass (g) F value = 29.70 **; DMS = 0.01; CV = 6.74% (A) and dry mass of the root system (g) value of F = 1.13ns; DMS = 0.01; CV = 17.73% (B). Caption DBS: decomposed babassu stem; S1: 100% soil; S2: 20% DBS+ 80% soil; S3: 40% DBS + 60% soil; S4: 60% DBS + 40% soil; S5: 80% DBS + 20% soil; and S6: 100% DBS; equal letters do not differ by Tukey test ($P < 0.05$).

As regards DMAP, it can be explained by the greater porosity and retention of water to the substrate, and consequently the better development of the seedlings and, in addition, the greater balance between the supply of nutrients by the CBD and the conditions of density and porosity in that substrate.

Aragão et al. (2011) evaluating the growth and development of melon seedlings produced in different types of substrates also did not observe a significant difference in the DMRS, however the DMAP was lower in the treatments that used the alternative substrate sugarcane bagasse. Other research, such as that conducted by Reis et al., (2015) obtained the highest average DMRS in the proportion of 100% coconut fiber in the production of watermelon seedlings (*Citrullus lanatus* Thunb.).

Bezerra and Bezerra (2000) evaluating the production of melon seedlings in alternative substrates, related the higher dry matter yield with a higher moisture retention and higher nutrient content observed in the treatment of coconut fiber powder with earthworm humus, and thus promoting greater development of the seedlings, corroborating with Klein et al. (2012) which is an important part of the production of lettuce (*Lactuca sativa* L.), because in addition to lower costs, it collaborates with the physico-chemical characteristics of the mixture, attributing greater porosity and water retention to the substrate, and consequently better seedling development. The properties of the substrates can vary according to their origin, production method or production, proportions of their components, among other characteristics, being fundamental that they meet the physical, chemical and biological characteristics compatible with the seedling to be produced (Klein et al., 2012).

4. CONCLUSION

The use of the decomposed babassu stem is feasible for the production of melon seedlings, being recommended in the proportion of 40% of the substrate whit soil.

REFERENCES

- Albano FG, Marques AS, Cavalcante IHL. Alternative substrate for production of seedlings of papaya formosa (cv. Caliman). Scientific 2014; 42 (4): 388-395. Brazil. DOI: <http://dx.doi.org/10.15361/1984-5529.2014v42n4p388-395>.
- Aragão CA. Quality of melon seedlings produced on different substrates. Caatinga Magazine. 2011; 24 (3): 209-214. Brazil.
- Arruda JC, Silva CJ, Sander NL. Knowledge and use of babassu (*Attalea speciosa* Mart.) By quilombolas in mato grosso. Fragments of Culture. 2014; 24 (2): 239-252. Brazil. DOI: <http://dx.doi.org/10.18224/frag.v24i2.3307>.
- Basso SMS, 1999. Morphological characterization and biological nitrogen fixation of *Adesmia* DC and *Lotus* L. species Doctoral Thesis. Federal University of Rio Grande do Sul, Rio Grande do Sul, Brazil.
- Bezerra FC, Bezerra GSS. Different substrates for the formation of melon seedlings. In: Brazilian Congress of Olericultura, Brasília. Annals. Brasília: CBO, 2001. CD-ROOM. Brazil.
- Bezerra FC, Bezerra GSS. Effect of substrate on the formation of melon seedlings (*Cucumis melo*). Embrapa Tropical Agroindustry. 2000; 78.1-3. Brazil.
- Cavalcante IHL, Petter FA, Albano FG, Silva RRS, Silva Junior GB. Biochar in the substrate for production of yellow passion fruit seedlings. Facultad Agronomía Magazine. 2012; 111.41-47. Brazil.
- Cruz AC, Lima JS, Andrade HAF, Oliveira ARF, Milk MRL, Santos LR, Silva TF, Gondim MMS, Machado NAF, Silva-Matos RRS. Stalk decomposed babassu for production of seedlings of *bougainvillea spectabilis* willd in different levels of indolebutyric acid. Asian Academic Research Journal of Multidisciplinary. 2018; 5 (1): 98-107.
- Dalastra GM, Echer MM, Klosowski ES, Hachmann T. Production and quality of three types of melon, varying the number of fruits per plant. Ceres. 2016; 63 (4): 523-531. Brazil. DOI: <http://dx.doi.org/10.1590/0034-737X201663040013>.
- Dickson A, Leaf AL, Hosner JF. Quality appraisal of white spruce and white pine seedling stock in nurseries. The Forestry Chronicle. 1960; 36 (1): 10-13. DOI: <https://doi.org/10.5558/tfc36010-1>.
- Ferreira F, Costa CC, Leite DT, Silva AS, Silva MF. Production of melon seedlings in different types of substrates. Brazilian Horticulture. 2011; 29 (2): 3722-3727. Brazil.
- Klein C, Vanin J, Calvete EO, Klein VA. Chemical and physical characterization of substrates for the production of lettuce seedlings. Agricultural Research Gaúcha. 2012; 18 (2): 115-124. Brazil.
- Lima JF, Silva MPL, Teles S, Silva F, Martins GN. Evaluation of different substrates in the physiological quality of carah melon seeds [*Sicana odorifera* (Vell.) Naudim]. Brazilian Journal of

- 216 Medicinal Plants. 2010; 12 (2): 163-167. Brazil DOI: <http://dx.doi.org/10.1590/S1516-05722010000200007>.
- 217
- 218 Maguire JD. Speed of germination-aid in selection and evaluation for seedling emergence and vigor. Crop science. 1962; 2 (2): 176-177.
- 219
- 220 Medeiros DC, Marques LF, Dantas MRS, Moreira JN, Azevedo CMSB, 2010. Production of melon seedlings with pisciculture effluent in different types of substrates and trays. Brazilian Journal of Agroecology. 2010; 5 (2): 65-71. Brazil.
- 221
- 222
- 223 Nogueira VFB, Correia MF, Nogueira VS. Impact of Soil and Equatorial Pacific Ocean Planting on Precipitation and Temperature in the City of Chapadinha-MA. Revista Brasileira de Geografia Física. 2012; 3,708-724. Brazil.
- 224
- 225
- 226 Steps MLV, Zambrzycki GC, Pereira, RS. Water balance and climatic classification for a specific region of Chapadinha-MA. Brazilian Journal of Irrigated Agriculture. 2016; 10 (4): 758-766.
- 227
- 228 Pelizza TR, Silveira FN, Muniz J, AHcher Echer, Morselli TBGA. Production of yellow melon seedlings under protected cultivation on different substrates. Ceres. 2015; 60 (2): 257-261. Brazil. DOI: <http://dx.doi.org/10.1590/S0034-737X2013000200015>.
- 229
- 230
- 231 Reis LO, Mistura C, Araujo CF, Mendes DB, Nunes TSS. Production of watermelon seedlings in different amounts of coconut fiber. Notebooks Macambira. 2015; 1 (2): 120-131. Brazil.
- 232
- 233 Santos HG, Jacomine PKT, LHC Anjos, Oliveira VA, Oliveira JB, Coelho MR, Lumberras JF, Cunha TJF. Brazilian Soil Classification System - 3th. Extended version - Brazil, 2013. 353p.
- 234
- 235 Santos JRP, Santos JM. Study of the competitiveness of melon exports in the states of Rio Grande do Norte and Ceará from 1997-2014. Journal of Economic Development. 2016; 2 (34): 616-642. Brazil.
- 236
- 237 Selbach JF, JRSA Milk. Environment in Lower Parnaíba: eyes in the world, feet in the region. São Luís: EDUFMA, Brazil, 2008. 216p.
- 238
- 239 Silva FAS, Azevedo CAV. The Assistat Software Version 7.7 and its use in the analysis of experimental data. African Journal of Agricultural Research. 2016; 11 (39): 3733-3740.
- 240
- 241 Severino LS, Lima RLS, Beltrão NEM, 2006. Chemical composition of eleven organic materials used in substrates for seedling production. Ministry of Agriculture, Livestock and Supply, 2006.
- 242
- 243 Simões AC, Alvez GK, Ferreira RLF, Araújo Neto SE, 2015. Mould quality and productivity of organic lettuce with substrate conditioners. Brazilian Horticulture. 2015; 33 (4): 521-526. Brazil. DOI: <http://dx.doi.org/10.1590/S0102-053620150000400019>.
- 244
- 245
- 246 Sousa LB, Nobrega RSA, JFL Filho, Amorim SPN, Ferreira LVM, Nobrega JCA. Cultivation of Sesbania virgata (Cav Pers) on different substrates. Journal of Agricultural Sciences / Amazonian Journal of Agricultural and Environmental Sciences. 2015; 58 (3): 240-247. Brazil. DOI: <http://dx.doi.org/10.4322/rca.1942>.
- 247
- 248
- 249

- 250 Treichel M, Kist BB, Santos CE, Carvalho C, Beling RR, 2016. Brazilian Yearbook of Fruticulture.
251 Santa Cruz do Sul: Gazeta Santa Cruz, 2016. 88 p.