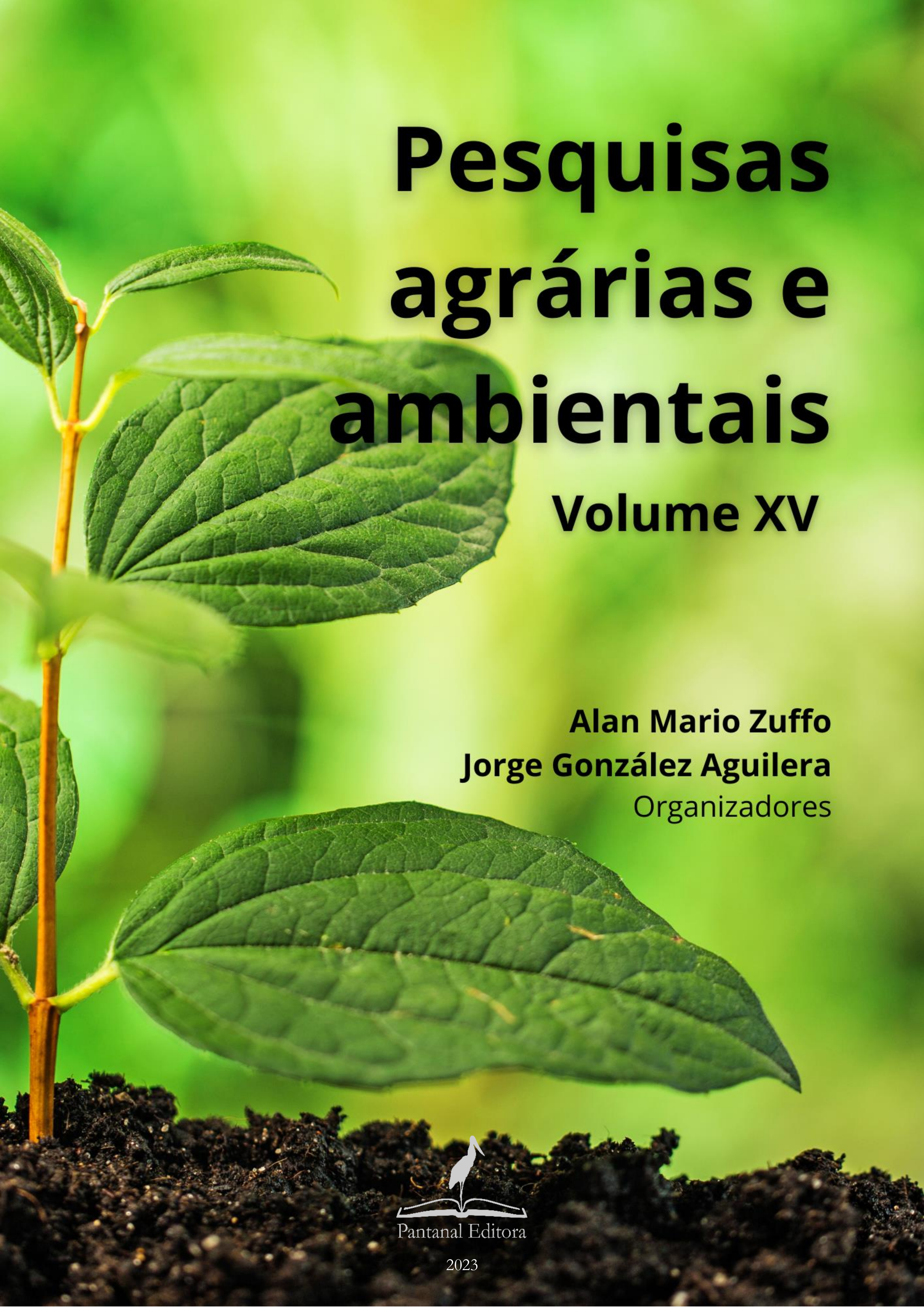

Pesquisas agrárias e ambientais

Volume XV

Alan Mario Zuffo
Jorge González Aguilera
Organizadores

Pantanal Editora

2023

Alan Mario Zuffo
Jorge González Aguilera
Organizadores

Pesquisas agrárias e ambientais
Volume XV

Pantanal Editora

2023

Editor Chefe: Prof. Dr. Alan Mario Zuffo
Editores Executivos: Prof. Dr. Jorge González Aguilera e Prof. Dr. Bruno Rodrigues de Oliveira

Diagramação: A editora. **Diagramação e Arte:** A editora. **Imagens de capa e contracapa:** Canva.com. **Revisão:** O(s) autor(es), organizador(es) e a editora.

Ficha Catalográfica

Catalogação na publicação
Elaborada por Bibliotecária Janaina Ramos – CRB-8/9166

P474

Pesquisas agrárias e ambientais: Volume XV / Organizadores Alan Mario Zuffo, Jorge González Aguilera. – Nova Xavantina-MT: Pantanal, 2023. 90p. ; il.

Livro em PDF

ISBN 978-65-81460-86-0
DOI https://doi.org/10.46420/9786581460860

1. Agricultura. 2. Meio ambiente. I. Zuffo, Alan Mario (Organizador). II. Aguilera, Jorge González (Organizador). III. Título.

CDD 630

Índice para catálogo sistemático

I. Agricultura

Pantanal Editora

Rua Abaete, 83, Sala B, Centro. CEP: 78690-000.
Nova Xavantina – Mato Grosso – Brasil.
Telefone (66) 99682-4165 (Whatsapp).
https://www.editorapantanal.com.br
contato@editorapantanal.com.br

Apresentação

As áreas de Ciências Agrárias e Ciências Ambientais são importantes para a humanidade. De um lado, a produção de alimentos e do outro a conservação do meio ambiente. Ambas, devem ser aliadas e são imprescindíveis para a sustentabilidade do planeta. A obra, vem a materializar o anseio da Editora Pantanal na divulgação de resultados, que contribuem de modo direto no desenvolvimento humano.

O e-book "Pesquisas Agrárias e Ambientais Volume XV" é a continuação de uma série de volumes de e-books com trabalhos que visam otimizar a produção de alimentos, o meio ambiente e promoção de maior sustentabilidade nas técnicas aplicadas nos sistemas de produção das plantas e animais. Ao longo dos capítulos são abordados os seguintes temas:

Crescimento e desenvolvimento Helicônia; teste de vigor em sementes feijão-caupi; períodos de hipoxia durante o crescimento inicial do milho; valoração da madeira produzida por pequenos produtores florestais no semiárido mineiro; forma-jurídica e forma política-estatal: a crítica Ecossocialista à possibilidade de tutela ambiental adequada nas sociedades burguesas; cultivo orgânico de rabanete; produtividade de alface; contribuição das épocas de incorporação da glória-de-escarlate na produtividade da cenoura; crescimento inicial de feijão-caupi submetido a adubação fosfatada. Portanto, esses conhecimentos irão agregar muito aos seus leitores que procuram promover melhorias quantitativas e qualitativas na produção de alimentos e do ambiente, ou melhorar a qualidade de vida da sociedade. Sempre em busca da sustentabilidade do planeta.

Aos autores dos capítulos, pela dedicação e esforços sem limites, que viabilizaram esta obra que retrata os recentes avanços científicos e tecnológicos na área de Ciência Agrárias e Ciências Ambientais Volume XV, os agradecimentos dos Organizadores e da Pantanal Editora. Por fim, esperamos que este ebook possa colaborar e instigar mais estudantes e pesquisadores na constante busca de novas tecnologias e avanços para as áreas de Ciências Agrárias e Ciências Ambientais. Assim, garantir uma difusão de conhecimento fácil, rápido para a sociedade.

Os organizadores

Sumário

Capítulo 7

Productivity of lettuce with different amounts of the mixture of scarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Calotropis procera*) applied in soil cover

Recebido em: 18/03/2023
Aceito em: 26/03/2023
10.46420/9786581460860cap7

Paulo César Ferreira Linhares[1*]
Lunara de Sousa Alves[2]
Roberto Pequeno de Sousa[3]
Janilson Pinheiro de Assis[3]
Antônia Vilma de Andrade Ferreira Amâncio[4]
Walter Martins Rodrigues[3]
Maria Eduarda Pereira dos Santos[5]
Thiffany Louhanne Alves Dantas [5]
Aline Carla de Medeiros[6]
Eudes de Almeida Cardoso[3]

INTRODUCTION

Among vegetables, lettuce (*Lactuca sativa*) is the most commercialized leafy vegetable in Brazil and is considered a highly consumed horticultural crop due to its low caloric value and source of minerals. It is usually produced in green belts close to large consumer centers, given the high perishability of the product in the postharvest period, due to its high water content and large leaf area (Filgueira et al., 2013).

Its production in the northeast region, specifically in the Mossoró-RN region, is mainly carried out by small farmers who basically use inputs produced on the property such as manure (beef, goat and sheep) in an organic production system. However, the acquisition of these inputs burdens production, reducing the return that the producer can obtain from marketing the vegetable (Linhares et al., 2014).

One of the alternatives to make the organic production system viable is the use of green manure, which, according to Souza et al. (2012), consists of a sustainable practice in incorporating or leaving plant residue on the soil of species cultivated on site or in another area. According to Fontanétti et al. (2004), green manuring with legumes provides the formation and stabilization of aggregates, improving

[1]PhD Researcher at the Federal Rural University of the Semi-Arid, leader of the Jitirana Research Group, Mossoró, RN, Brazil.
[2]PhD in Agronomy from the Federal University of Paraíba-UFPB, member of the Jitirana Research Group, UFERSA, Mossoró, RN, Brazil.
[3]Professor and PhD at the Federal Rural University of the Semi-Arid, Member of the Jitirana Research Group, Mossoró, RN, Brazil.
[4]Master in animal production at the Federal Rural University of the Semi-Arid, Jitirana Research Group, Mossoró, RN, Brazil.
[5]Agronomy student and member of the Jitirana research group, Federal Rural University of the Semiarid, Mossoró, RN, Brazil.
[6]PhD in Process Engineering, Professor of the master's degree in Agroindustrial Systems-UFCG-PB.
* Autor(a) correspondente: **paulolinhares@ufersa.edu.br**

conditions of aeration, infiltration and moisture retention with greater availability of nutrients. Moreover, these species have the capacity to fix nitrogen by symbiosis with bacteria of the genus Rhizobium in their root systems.

However, Linhares (2021) states that species from other families can be used for this purpose. In this context, there are several spontaneous caatinga species with potential for use as green manure, including Scarlet starglory (*Merremia aegyptia* L.), rooster tree (*Calotropis procera*) and pasture kill (*Senna uniflora* L.) (Linhares, 2009; Linhares et al., 2011 and 2012).

Spontaneous species from the semiarid region have agronomic potential to be used as green manure due to the availability of green and dry phytomass and the levels of macronutrients, in which scarlet starglory (*Merremia aegyptia* L.) stands out, with production of green and dry phytomass of approximately 42.0 t ha^{-1} and 6.04 t ha^{-1}, respectively, with a nitrogen content of 22.4 g kg^{-1} in dry matter and a carbon-nitrogen ratio of 17/1 at the phenological stage of 126 days after emergence (Linhares et al., 2021). Another species with potential use as green manure, the rooster tree (*Calotropis procera*) is a species adapted to semiarid regions with the capacity to supply phytomass throughout the year. It is an evergreen shrub and abundant in the region of Mossoró, RN, throughout the year (Linhares et al., 2022).

In green manure, there is no ideal plant. Thus, depending on the species used and the conditions, there are advantages and disadvantages, and it is necessary to gather information about the plants involved before planting. Greater efficiency of green manures is enhanced through the choice of plant species suitable for the edaphoclimatic conditions of the region, associated with the planning of its use (Espindola et al., 2004).

Given the importance of studying alternative forms of fertilization in the production of vegetable crops, the objective was to evaluate the productivity of lettuce with different amounts of the mixture of scarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Calotropis procera*) applied in soil cover.

MATERIALS AND METHODS

Characterization of the experimental area

The study was conducted at the Rafael Fernandes Experimental Firme of the Universidade Federal Rural do SemiÁrido (UFERSA), located in the district of Alagoinha, 20 km away from the seat of the municipality of Mossoró (5° 11' S and 37° 20' W, 18 m altitude) in soil classified as Red Yellow Argisol sandy loam (Embrapa, 2006).

The climate in this region, according to the Köppen classification, is BsWh, that is, dry, very hot and with a rainy season in the summer, with an average maximum temperature between 32.1 and 34.5 °C and a minimum average between 21.3 and 23.7 °C, with June and July being the coldest months and the average annual rainfall approximately 625 mm (Carmo Filho et al., 1995).

Soil samples were taken from the experimental area and sent to be processed and analyzed at the UFERSA Soil Chemistry and Fertility Laboratory, providing the following values: pH (water) = 6.00; Ca

= 2.00 cmolc dm^{-3}; Mg = 0.50 cmolc dm^{-3}; Al = 0.00 cmolc dm-³; K = 44.8 mg dm-³; Na = 44.7 mg dm^{-3}; P = 7.7 mg dm-³.

Experimental design

The design was randomized blocks with six treatments and four replications. The treatments consisted of mixtures of green manures {scarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Calotropis procera*) in a ratio of 1:1} in the amounts of (0.0; 0.7; 1.4; 2.1; 2.8 and 3.5 kg m^{-2} of area).

For the lettuce crop, the cultivar "Babá de Verão" was planted, and the plots were composed of six rows of plants spaced 0.2 m x 0.2 m apart, with one plant per hole. The plots were 1.2 x 1.2 m and had six longitudinal sowing rows, with the four central rows considered useful. The total area of the plots was 1.44 m², and the useful area was 0.64 m², containing 16 plants (Figure 1).

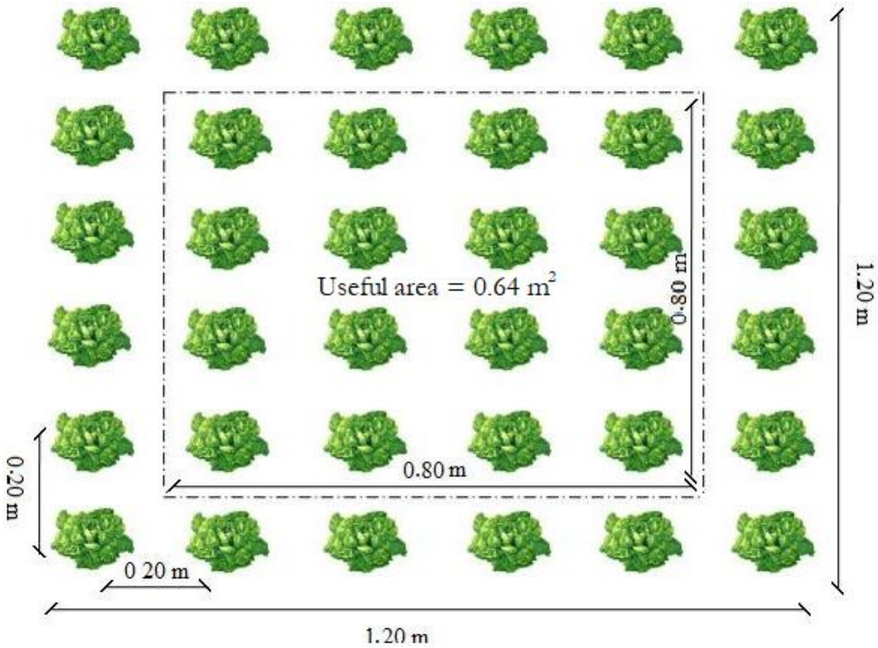

Figure 1. Graphical representation of the experimental plot of lettuce planted at a spacing of 0.20 m x 0.20 m and fertilized with different amounts of green manure.

Soil preparation consisted of manual cleaning with a hoe, removal of material outside the experimental area followed by harrowing and raising of the beds, carried out manually using a hoe. After construction of the beds, solarization was carried out (method developed by Katan et al. (1976) for 30 days to reduce the population of phytopathogens in the soil, which might harm the development and productivity of crops.

Spontaneous species used as organic fertilizer

Spontaneous species {Scarlet starglory (*Merremia aegyptia* L.) and rooster tree (*Calotropis procera*)} were collected from native vegetation within the UFERSA campus at the beginning of the flowering period, when the plant has the maximum concentration of nutrients. Then, they were crushed in a forage machine in fragments of 2 to 3 cm in diameter and dried in the sun. They were stored in raffia bags with moisture contents of 10% and 8% for scarlet starglory and rooster trees, respectively (Figure 2), at UFERSA facilities in a dry environment to be used in the experiment.

Figure 2. A representation of scarlet starglory (*Merremia aegyptia* L.) (A) and rooster tree (*Calotropis procera*) (B) in the flowering period in a semiarid region. Mossoró, RN, Brazil. Photograph: Researcher D.Sc. Paulo César Ferreira Linhares.

When the experiment was set up, four samples of the mixture of scarlet starglory plus rooster tree were taken and sent to the soil fertility and plant nutrition laboratory at the Center for Agricultural Sciences at UFERSA for carbon analysis (C); nitrogen (N); phosphorus (P); potassium (K+); calcium (Ca^{2+}); magnesium (Mg^{2+}) and carbon/nitrogen ratio. The results were 520 g kg^{-1} C, 20.0 g kg^{-1} N, 16.6 g kg^{-1} P, 18.9 g kg^{-1} K, 12.6 g kg^{-1} Ca, 10.2 g kg^{-1} Mg and a nitrogen/carbon ratio of 26/1. Quantified according to the dry matter being incorporated into the 0 – 20 cm layer of soil.

Evaluation characteristics of the lettuce culture

The harvest was carried out twenty-five days after transplanting the lettuce. Soon after harvesting, the plants were transported to the Laboratory of PostHarvest Vegetables of the Department of Agronomic and Forestry Sciences at UFERSA, where the following characteristics were evaluated: plant height (measuring ten plants from ground level to the end of the highest leaves, expressed in cm $plant^{-1}$); plant diameter (taken from a sample of ten plants, measuring the distance between the opposite margins of the leaf disc, using a millimeter ruler, expressed in mm $plant^{-1}$); number of leaves per plant (determined in a sample of ten plants, counting the number of leaves per plant over five centimeters, expressed in $plant^{-1}$ units); lettuce productivity (determined by the weight of all the plants in the useful area, expressed in g $plant^{-1}$) and lettuce dry mass (determined after drying in an oven with forced air circulation, with temperature regulated at 65 °C, until reaching constant mass and expressed in g $plant^{-1}$).

Statistical Analysis

Statistical analysis was performed according to conventional methods of analysis of variance (Banzatto; Kronka, 2006) using ESTAT statistical software. The response curve fitting procedure was performed using ESTAT Software.

RESULTS AND DISCUSSION

There was a significant difference in the amounts of jitirana plus silk flower at the level of $p<0.01$ of probability for the characteristics plant height, number of leaves, diameter, productivity and dry mass of the lettuce crop (Figures 3 to 6).

The use of a mixture of spontaneous species rich in nitrogen, such as those used in this experiment {Scarlet starglory (*Merremia aegyptia* L.) and rooster tree (*Calotropis procera*), with a nitrogen content of 24.0 g kg^{-1} dry matter, probably contributed to the increase in all evaluated characteristics, as the lettuce culture is very demanding on nitrogen. In addition, the application of these residues as cover favored slower decomposition, with greater moisture retention, improving the soil conditions for the lettuce crop.

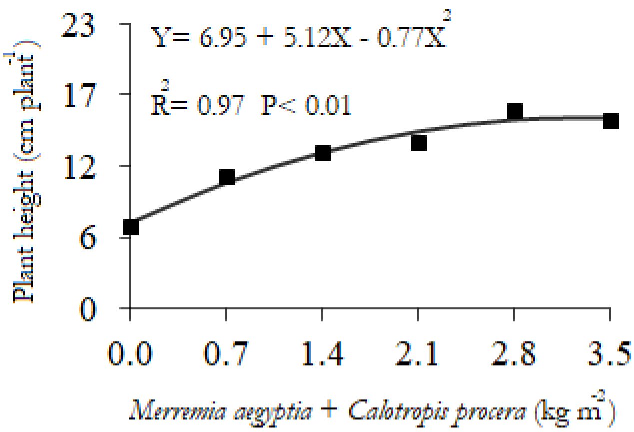

Figure 3. Plant height as a function of different amounts of the mixture of sacarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Calotropis procera*) applied to the soil in coverage.

For plant height, a maximum value of 15.43 cm $plant^{-1}$ was observed in the amount of 3.5 kg m^{-2} (Figure 4). The addition between the smallest (0 kg m^{-2} of bed) and the largest amount of the mixture of scarlet starglory plus rooster tree (3.5 kg m^{-2} of bed) was on the order of 8.5 cm $plant^{-1}$. The addition between the smallest (0 kg m^{-2} of bed) and the largest amount of the mixture of starglory plus rooster tree (3.5 kg m^{-2} of bed) was on the order of 8.5 cm $plant^{-1}$. This value was lower than that obtained by

Bezerra Neto et al. (2011), who evaluated different amounts and decomposition times of jitirana in lettuce, with an average height of 21.14 cm, using spacing between plants similar to the aforementioned work (0.2 m x 0.2 m). This difference is probably related to the amount of organic residue used in the research. Paula et al. (2017) evaluated the production of fertilized lettuce with rooster tree in different amounts and incorporation times and found surface responses for plant height, with a maximum value of 16.37 cm in the amount of 15.6 t ha^{-1} rooster tree, similar to the present research.

Regarding the number of leaves, a maximum point was observed, with a maximum average value of 18.5 leaves $plant^{-1}$, in the amount of 3.1 kg m^{-2} of bed, corresponding to an increase of 10.6 leaves $plant^{-1}$ in relation to the dose (0 kg m^{-2}) (Figure 5). Lower behavior than that obtained by Padovezzi et al. (2007) obtained 23 leaves per plant, using the pigeonpea dry matter mass in coverage in the agronomic performance of lettuce. The use of 15 t ha^{-1} of organic compost may have been a preponderant factor in the increase in the number of leaves, according to the referenced research. The number of leaves in leafy vegetables is of paramount importance, in view of being responsible for photosynthesis, in addition to being the consumable part. Moura et al. (2020) studied the agronomic efficiency of lettuce fertilized with different organic compounds and found a number of leaves of 11.34 $plant^{-1}$ units, a value below that of the aforementioned research.

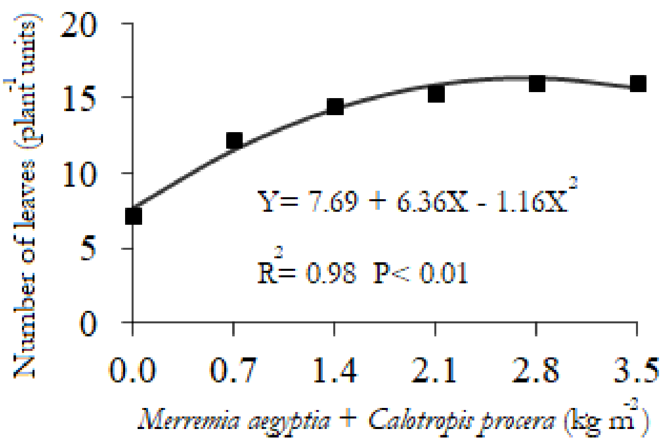

Figure 4. Number of leaves as a function of different amounts of the mixture of sacarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Calotropis procera*) applied to the soil in coverage.

For lettuce diameter, there was no maximum point, with a value of 210.77 mm $plant^{-1}$, in the amount of 3.5 kg m² of bed, corresponding to an average increase of 167 mm plant-1 in relation to a smaller amount (0 kg m^{-2} of bed) (Figure 5). Almeida et al. (2015) studied the agronomic efficiency of lettuce-arugula intercropping fertilized with silk flowers and found a diameter of 25.66 cm, equivalent to 256 mm $plant^{-1}$ in the amount of 35.8 t ha^{-1}, a value superior to that research. In addition, Sperandio et al. (2021) evaluated the application of barnyard litter and poultry litter in lettuce cultivation and found a lettuce diameter of 28.68 cm, equivalent to 286 mm $plant^{-1}$ with the application of vegetable soil + barnyard bed, with 50 g $plant^{-1}$ value higher than the present work.

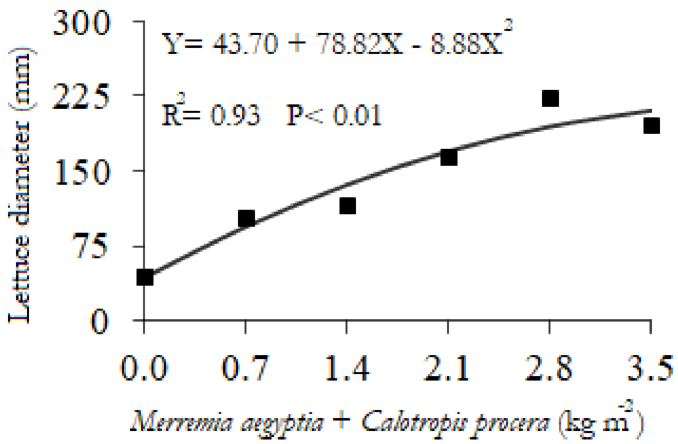

Figure 5. Lettuce diameter as a function of different amounts of the mixture of sacarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Calotropis procera*) applied to the soil in coverage.

For the productivity and dry mass of lettuce, the point of maximum production was not observed, with values of 148.29 and 11.19 g plant^{-1} obtained in the amount of 3.5 kg m^{-2} of the mixture of scarlet starglory plus rooster tree, respectively (Figures 6A and 6B). The lettuce weight obtained in this experiment is within the commercialization standard at the agroecological fair in Mossoró, RN, Brazil. Almeida et al. (2015) studied the agronomic efficiency of lettuce-arugula intercropping fertilized with rooster trees and found a lettuce productivity of 15.7 t ha^{-1}, corresponding to 62.8 g plant^{-1} in the amount of 36.69 t ha^{-1} of rooster trees incorporated into the soil, which was lower than that in the referenced research. Freitas et al. (2009) evaluated the use of different organic compounds in the fertilization of lettuce crops and found that industrial organic compounds provided an average productivity of 12883 kg ha^{-1}, equivalent to 73 g plant^{-1}, lower than that in the referenced work.

Silva (2013) evaluated the biculture of lettuce intercropped with beet under different amounts of scarlet starglory incorporated into the soil and spatial arrangements and found increasing behavior in productivity and dry mass, with maximum values of 19.20 t ha^{-1} and 77 g plant^{-1}, corresponding to plant populations of 250,000 ha^{-1} and 1.34 t ha$^{-1,}$ respectively, in amounts of 38.91 and 37.00 t ha^{-1} of incorporated scarlet starglory, lower than the referred research.

In addition, Linhares et al. (2009b) studied the effect of green management with scarlet starglory in cover on the agronomic performance of lettuce and found green and dry mass, with values of 133.57 g plant^{-1} and 12.93 g plant^{-1} at 42 days of decomposition before planting, which were lower than those in that research. Linhares et al. (2011) evaluated different types of soil and periods of incorporation of jitirana in the lettuce crop in a 4 x 3 factorial scheme, corresponding to four periods of incorporation of scarlet starglory (*Merremia aegyptia* L.) (0; 10; 20 and 30 days before transplanting) and three types of soils (Quartazrene neosol, cambissoil and argisol) found fresh mass of lettuce of 64.7 g plant^{-1} within 30 days of incorporation of in quartazrene neosol, value that differentiates from the aforementioned research.

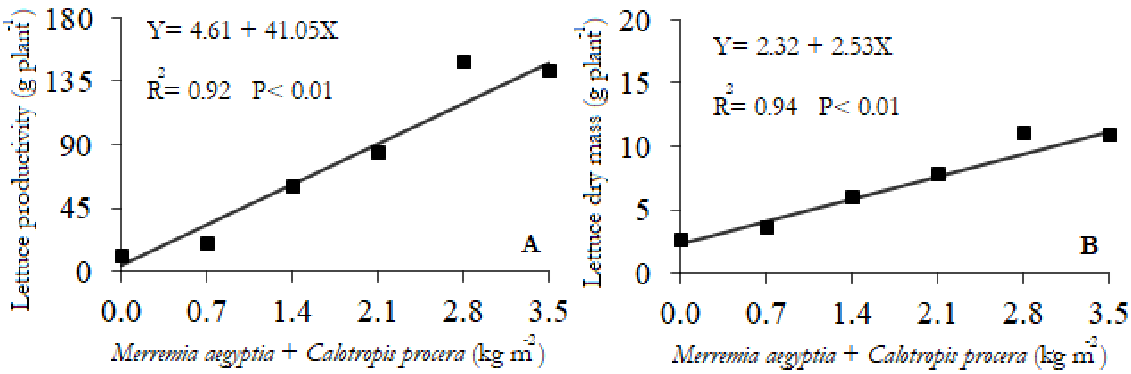

Figure 6. Lettuce productivity (A) and dry mass (B) as a function of different amounts of the mixture of sacarlet starglory (*Merremia aegyptia* L.) with rooster tree (*Clalotropis procera*) applied to the soil in coverage.

FINAL CONSIDERATIONS

The highest productive efficiency of the lettuce crop in agroecological cultivation was obtained in the amount of 3.5 kg m^{-2} of the mixture of scarlet starglory (*Merremia aegyptia* L.) with roostre tree (*Calotropis procera*), with a value of 148.29 g plant^{-1}.

The use of spontaneous species from semiarid regions is of great importance in the agroecological system of vegetables.

ACKNOWLEDGMENT

Special thanks to the jitirana (*Merremia aegyptia* L.) research group, committed to the study of spontaneous species from the semiarid region as green manure in olericolas, beyond the Department of Agronomic and Forestry Sciences the Federal Rural SemiArid University (UFERSA), for support in conducting research.

REFERENCES

Almeida A.E.S., Bezerra Neto F., Costa L.R., Silva M.L., Lima J.S.S., Barros Júnior A.P. (2015). Eficiência agronômica do consórcio alface-rúcula fertilizado com flor-deseda. Revista Caatinga, 28(3): 79-85.

Bezerra Neto F., Góes S.B., Sá J.R., Linhares P.C.F., Góes G.B., Moreira J.N. (2011). Desempenho agronômico da alface em diferentes quantidades e tempos de decomposição de jitirana verde. Revista Brasileira de Ciências Agrárias, 6(2): 236-242.

Carmo Filho F. and Oliveira O.F. 1995. Mossoró: um município do semiárido nordestino, caracterização climática e aspecto florístico. Mossoró: ESAM, (Coleção Mossoroense, Série B) 62p.

Empresa Brasileira De Pesquisa Agropecuária – Embrapa, 2018. Brazilian system of soil classification (Sistema brasileiro de classificação de solos). 2.ed. Rio de Janeiro: Embrapa, 306p.

Espindola J.A.A., Almeida D.L., Guerra J.G.M. (2004). Estratégias para utilização de leguminosas para adubação verde em unidades de produção agroecológica, Embrapa Agrobiologia, Seropédica, 24 p. (Embrapa Agrobiologia. Documentos, 174).

Filgueira F.A.R. 2013. Manual de olericultura: Agrotecnologia moderna na produção ecomercialização de hortaliças. UFV: Viçosa. 402p.

Freitas M.E. de, Bono J.A.M., Pedrinho D.R., Chermouth K. da S., Yamomoto C.R., De Vidis R.Y. (2009). Utilização de compostos orgânicos para adubação na cultura da alface. Agrarian, 2(3): 41–52.

Katan J., Greenberger A., Alon H., Grinstein A. (1976). Solar heating by polyethylene mulching for the control of diseases caused by soil-borne pathogens. Phytopathology, 66(1): 683-688.

Kronka S.N. and Banzato D.A. Estat, 1995: system for statistical analysis (Estat: sistema para análise estatística. Versão). 2. 3.ed. Jaboticabal: Funep, 243 p.

Linhares P.C.F. (2009). Vegetação espontânea com adubo verde no desempenho agroeconômico de hortaliças folhosas. Tese (Doutorado em Agronomia: Fitotecnia), Universidade Federal Rural do SemiÁrido (UFERSA), Mossoró, RN, 109 f.

Linhares P.C.F., Maracajá P.B., Liberalino Filho J., Assis J.P., Sousa R.P., Medeiros A.C. (2021). Jitirana (*Merremia aegyptia* L. Urban) [livro eletrônico]: Potencialidade de uso como espécie espontânea do semiárido na adubação verde de hortaliças. In: Linhares P.C.F., Cunha L.M.M., Silva N.V., Neves A.M., Medeiros B.B.M. and Paiva A.C. Fitomassa verde e seca, teores e acúmulo de macronutrientes da jitirana (*Merremia aegyptia* L. Urban) em diferentes estádios fenológicos– Nova Xavantina, MT: Ed. Pantanal. 96p. Cap. 2, p.24-45.

Linhares P.C.F., Maracajá P.B., Sousa R.P., Assis J.P. (2022). Jitirana (*Merremia aegyptia* L. Urban) [livro eletrônico]: Adubação verde com flor-de-seda {*Calotropis procera* (Aiton) W.T. Aiton} em culturas olerícolas na região semiárida. In: Linhares P.C.F., Maracajá P.B., Sousa R.P., Assis J.P., Alves L.S., Silva N.V., Medeiros A.C., Gomes G.A.D. Aplicação da flor-de-seda (*Calotropis procera* (Aiton) W. T. Aiton) como adubo verde em hortaliças folhosas (coentro, rúcula e alface)– Nova Xavantina, MT: Ed. Pantanal. 90p. Cap. 3, p.26-56.

Linhares P.C.F., Maracajá P.B.M., Pereira F.S., Assis J.P. and Sousa R.P. (2014). Roostertree (*Calotropis procera*) under different amounts and periods of incorporation on yield of coriander. Revista Verde de Agroecologia e Desenvolvimento Sustentável, 9(3): 07-12.

Linhares P.C.F., Pereira M.F.S., Assis J.P. and Bezerra A.K.H. (2012). Quantidades e tempos de decomposição da jitirana no desempenho agronômico do coentro. Ciência Rural. 42(2): 243-248.

Linhares P.C.F., Pinto A.R.M., Pereira M.F.S., Paz A.E.S., Moreira J.C. (2011). Rendimento de alface sob diferentes tipos de solos e períodos de incorporação da jitirana (*Merremia aegyptia* L.). Revista Verde de Agroecologia e Desenvolvimento Sustentável, 6(4): 11-18.

Linhares P.C.F., Silva M.L., Silva J.S., Bezerra A.K.H. (2009). Influência da jitirana em cobertura como adubação verde sobre o desenvolvimento agronômico da alface. Revista Caatinga, 22(4): 65-69.

Moura A.Q., Correa E.B., Fernandes J.D., Monteiro Filho A.F., Leão A.C., Boava L.P. (2020). Eficiência agronômica de alface adubada com diferentes compostos orgânicos. Revistan Brasileira de Agropecuária Sustentável, 10(1): 155-163.

Padovezzi V.H., Sacchi R.T., Padovan M.P. (2007). Efeito de diferentes coberturasdo solo sobre o desempenho da alface num sistema sob manejo orgânico. Revista Brasileira de Agroecologia, 2(1):863-866.

Paula V.F.S., Lima J.S.S., Bezerra Neto F., Fernandes Y.T.D.F., Chaves A.P., Silva J.N., Linhares P.C.A. (2017). Production of fertilized lettuce with roostertree in different amounts and incorporation times, Bulgarian Journal of Agricultural Science, 23(5): 799-805.

Silva I.N. (2013). Bicultivo de alface consorciada com beterraba sob diferentes quantidades de Jitirana incorporadas ao solo e arranjos espaciais. Dissertação (Mestrado em Agronomia: Fitotecnia), Universidade Federal Rural do SemiÁrido (UFERSA), Mossoró-RN. 73p.

Souza C.M. et al. (2012). Adubação verde e rotação de culturas. Viçosa- MG: Ed. UFV. 108p.

Sperandio I.F., Buttgen J.E., Gasparotto F., Schmidt E., Paccola E.A.S. (2021). Aplicação da cama de curral e cama de frango no cultivo da alface. Revista Ibero Americana de Ciências Ambientais, 12(11): 1-10.

Índice Remissivo

Sobre os organizadores

Alan Mario Zuffo

Engenheiro Agrônomo, graduado em Agronomia (2010) na Universidade do Estado de Mato Grosso (UNEMAT). Mestre (2013) em Agronomia - Fitotecnia (Produção Vegetal) na Universidade Federal do Piauí (UFPI). Doutor (2016) em Agronomia - Fitotecnia (Produção Vegetal) na Universidade Federal de Lavras (UFLA). Pós - Doutorado (2018) em Agronomia na Universidade Estadual de Mato Grosso do Sul (UEMS). Atualmente, possui 165 artigos publicados/aceitos em revistas nacionais e internacionais, 127 resumos simples/expandidos, 66 organizações de e-books, 45 capítulos de e-books. É editor chefe da Pantanal editora e revisor de 18 revistas nacionais e internacionais. Professor adjunto na UEMA em Balsas. Contato: alan_zuffo@hotmail.com.

Jorge González Aguilera

Engenheiro Agrônomo, graduado em Agronomia (1996) na Universidad de Granma (UG), Bayamo, Cuba. Especialista em Biotecnologia (2002) pela Universidad de Oriente (UO), Santiago de Cuba, Cuba. Mestre (2007) em Fitotecnia na Universidade Federal do Viçosa (UFV), Minas Gerais, Brasil. Doutor (2011) em Genética e Melhoramento de Plantas na Universidade Federal do Viçosa (UFV), Minas Gerais, Brasil. Pós - Doutorado (2016) em Genética e Melhoramento de Plantas na EMBRAPA Trigo, Rio Grande do Sul, Brasil. Professor Visitante (2018-2022) na Universidade Federal de Mato Grosso do Sul (UFMS) no campus Chapadão do Sul (CPCS), MS, Brasil. Professor substituto (2023-Atual) na Universidade Estadual de Mato Grosso do Sul (UEMS), Cassilândia, MS, Brasil. Atualmente, possui 91 artigos publicados/aceitos em revistas nacionais e internacionais, 29 resumos simples/expandidos, 56 organizações de e-books, 40 capítulos de e-books. É editor da Pantanal Editora e da Revista Agrária Acadêmica, e revisor de 19 revistas nacionais e internacionais. Contato: j51173@yahoo.com, jorge.aguilera@ufms.br.

9 786581 460860

Pantanal Editora
Rua Abaete, 83, Sala B, Centro. CEP: 78690-000
Nova Xavantina – Mato Grosso – Brasil
Telefone (66) 99682-4165 (Whatsapp)
https://www.editorapantanal.com.br
contato@editorapantanal.com.br