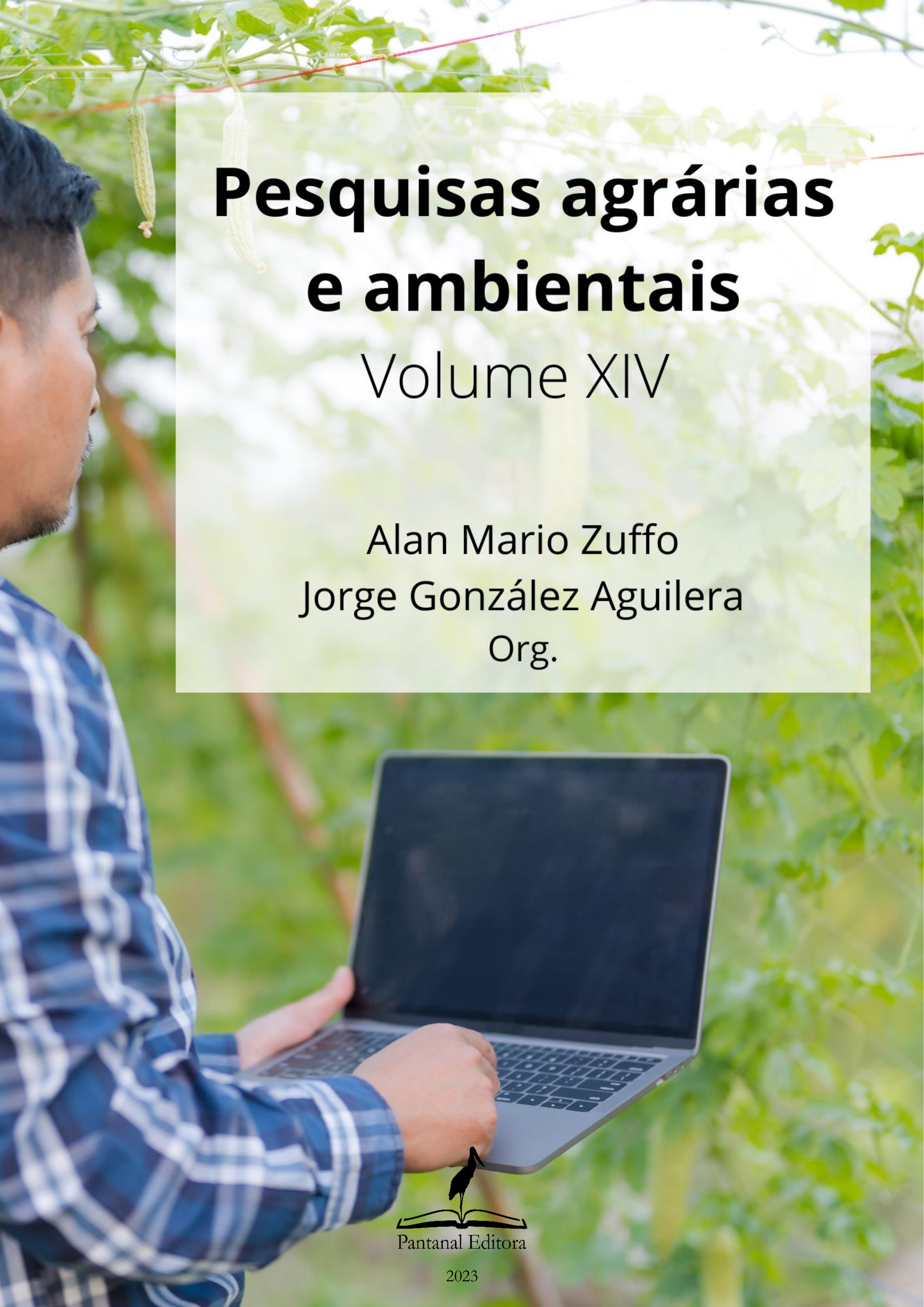

Pesquisas agrárias e ambientais

Volume XIV

Alan Mario Zuffo
Jorge González Aguilera
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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 XIV" 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: Qualidade de vida e segurança do trabalho na mineração frente ao risco de rompimento de barragens sustentabilidade na agricultura; os condicionantes socioambientais da dengue na área urbana; estrutura, agregação e erosão do solo: da matéria orgânica à desestabilização; biologia floral do pepino e sua relação com os polinizadores; estressores na abelha sem ferrão; biologia floral e polinização no quiabeiro; adubação orgânica com espécies espontâneas do semiárido na produtividade do coentro; produtividade de hortelã adubada com mistura de jitirana e mata-pasto; floração, frutificação, síndrome de dispersão e de polinização de espécies florestais em projetos de restauração. 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 XIV, 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 8

Organic fertilization with spontaneous species from the semiarid region in the of coriander productivity

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INTRODUCTION

The coriander crop is largely produced by family farmers in the region of Mossoró, RN, Brazil, considering that this vegetable has a large volume of commercialization in fairs and supermarkets. In this region, coriander sowing takes place in planting lines carried out in the beds, spaced 20 cm apart, or broadcast sowing in the beds, with a number of plants from 800 to 1000 plants m^{-2} (Linhares et al., 2018).

An important aspect in coriander production is fertilization, which is carried out by family farmers organically using manure (cattle, goat and sheep). However, the dependence on these resources contributed to the increase in production costs, considering that the farmer does not always have this resource available on his properties (Linhares et al., 2018).

According to Linhares et al. (2021), the use of plant residues in agriculture promotes an improvement in soil structure, contributing to greater water infiltration, increasing the soil organic matter content, favoring the microbiota and making the edaphic environment more suitable for crop cultivation.

These species have the potential to be used as green manure, as they have a nitrogen content of 22.4 g kg^{-1} and a carbon-nitrogen ratio of 17/1 with a green phytomass production of 42.0 t ha^{-1} and a

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dryness of 6.04 t ha-1 for jitirana (*Meremia aegyptia* L.) (Linhares et al., 2021), for the forest crop mata-pasto (*Senna uniflora* L.) nitrogen content is 18.5 g kg-1 and carbon-nitrogen ratio of 25/1, with green biomass production of 35.0 t ha^{-1} and dry mass of 8.7 t ha^{-1}.

These species are already being used as green manure in the organic production of several vegetable crops, such as arugula (Linhares, 2007; Almeida et al., 2015; Oliveira, 2015); lettuce (Linhares et al., 2011; Góes et al., 2011; Silva, 2013); radish (Linhares et al., 2013; Linhares et al., 2011; Linhares et al., 2010; Paiva et al., 2013); mint (Almeida, 2017); and carrot (Linhares et al., 2014).

The species most used as fertilizer in production systems are legumes, as they have the ability to fix nitrogen by symbiotic bacteria in their root systems, in addition to having high biomass production. However, spontaneous species from semiarid regions have the same potential in the process of soil fertilization as a function of macronutrient levels (Linhares et al., 2018).

Given the importance of using spontaneous species from semiarid regions as a source of organic fertilizer to meet the nutritional needs of olericultural plants, this technology seeks to reduce production costs. In this sense, the objective was to study the effect of organic fertilization with spontaneous species from a semiarid region on coriander productivity.

MATERIALS AND METHODS

Characterization of the experimental area

The experiment was carried out in the research area of the Rafael Fernandes Experimental Farm of the Universidade Federal Rural do SemiÁrido (UFERSA), located in the district of Alagoinha, 20 km from Mossoró-RN, municipality (5° 03' 37" S and 37° 23'50" W, 70 m altitude) (RÊGO et al., 2016). According to Carmo Filho et al. (1995) and the Köppen classification, the local climate is BSwh', dry and very hot, with the dry season normally from June to January and the rainy season from February to May. The average annual precipitation is 673.9 mm, and the average relative humidity is 68.9%. The soil of the research area was classified as Red–Yellow Latosol Sandy loam (EMBRAPA, 2018).

Before installing the experiment, soil samples were taken at a depth of 0-20 cm, which were air-dried and sieved through a 2 mm mesh and then analyzed at the Laboratory of Soil Chemistry and Fertility at UFERSA. The results were as follows: pH (water 1:2.5) = 7.0; Ca = 1.6 cmol dm^{-3}; Mg = 0.5 cmolc dm^{-3}; K = 14.0 mg dm^{-3}; Na = 10.0 mg dm^{-3}; P = 22.0 mg dm^{-3} and M.O. = 0.8 g kg^{-1}.

Experimental design

The experimental design used was complete randomized blocks with seven treatments and four replications. The treatments consisted of seven amounts of the mixture of jitirana with mata-pasto (0.0, 0.8, 1.6, 2.4, 3.2, 4.0 and 4.8 kg m^{-2}). Green manures remained incorporated into the soil for a period of thirty days before sowing, as recommended by Linhares et al. (2012).

Each plot consisted of twelve rows of plants spaced 0.1 m x 0.05 m, with 05 plants hole^{-1}, corresponding to 1000 plants m^{-2} of bed, which corresponds to the population of plants economically viable for agronomic exploitation (Linhares et al., 2014).

The total area of the plot was 1.44 m² with a useful area of 0.80 m², containing 800 plants. The coriander cultivar sown was "Verdão", widely used by farmers, with a very greenish color and a cycle of 30 to 35 days from sowing to harvest. Soil preparation consisted of manual cleaning, removal of spontaneous vegetation present in the experimental area and manual lifting of the beds, using the hoe as a tool.

The spontaneous species from the Brazilian semiarid region, jitirana (*Merremia aegyptia* L.) and mata-pasto (*Senna uniflora* L.) were collected from the native vegetation inside the campus of Universidade Federal Rural do Semiárido-UFERSA at the beginning of the flowering period, when the plant presents the maximum concentration of nutrients.

On the occasion of the installation of the experiment, five samples of the mixture of jitirana with mata-pasto, a spontaneous species of the semiarid region, were taken and sent to the soil fertility and plant nutrition laboratory at the Center for Agricultural Sciences of UFERSA for carbon analysis (C); nitrogen (N); phosphorus (P); potassium (K+); calcium (Ca2+); magnesium (Mg2+) and carbon/nitrogen ratio. For jitirana (*Meremia aegyptia* L.) The results were 570 g kg^{-1} C, 25.0 g kg^{-1} N, 12.5 g kg^{-1} P, 18.0 g kg^{-1} K, 12.0 g kg^{-1} Ca, 16.0 g kg^{-1} Mg and a nitrogen/carbon ratio of 23/1 (Figures 1 and 2).

Figure 1. Representation of the jitirana (*Merremia aegyptia* L.) in full bloom in the semiarid region of Mossoró, RN, Brazil. **Photograph:** Researcher DSc. Paulo César Ferreira Linhares

Figure 2. Representation of mata-pasto (*Senna uniflora* L.) in full bloom in the semiarid region of Mossoró, RN, Brazil. **Photograph:** Researcher DSc. Paulo César Ferreira Linhares

Prior to sowing, irrigation was carried out to maintain soil moisture between 50 and 70% of field capacity, which is an ideal condition for the nitrification process (Meurer, 2007). Ten days after plant emergence, thinning was performed. Manual weeding was performed to control weeds whenever necessary to avoid competition for water and nutrients. Irrigation was carried out by a microsprinkler, with a daily irrigation shift divided into two applications (morning and afternoon), providing an average water depth of 8 mm day^{-1} as a function of evapotranspiration.

Measurement of agronomic characteristics

Thirty-three days after sowing, the experiment was harvested where the plants were transported to the PostHarvest Vegetables Laboratory of the Department of Plant Science at UFERSA, where the following characteristics were analyzed: *plant height* (performed from a sample of thirty plants per plot, measuring the height from the base to the apex of the plant using a millimeter ruler and expressed in $plant^{-1}$); *number of stems* (obtained by counting all stems from a sample of thirty plants, expressed in stems $plant^{-1}$); *productivity* (performed by the weight of all plants in the useful area of the plot, expressed in g m^{-2} of bed); *number of bunches* (determined through productivity m^{-2} per 50 g, reference weight for a bunch of coriander, expressed in units m^{-2} of bed) and *dry matter mass* (obtained by weighing twenty plants $plot^{-1}$ on an electronic scale with a precision of 1.0 g, followed by drying in a heating oven with forced air at 65 °C, until constant mass was obtained).

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 the ESTAT Software.

RESULTS AND DISCUSSION

There was a significant difference at the level of P<0.01 of probability for the different doses of jitirana plus mata-pasto (Table 1). The use of a mixture of jitirana with mata-pasto contributed greatly to better soil fertilization, which resulted in the increment of all evaluated characteristics, denoting the importance of using spontaneous species from the semiarid region in the soil fertilization process.

For the characteristic plant height, there was an increase depending on the doses of jitirana with pasture, with a maximum value of 18.38 cm plant (Figure 3). There was an increase of 13.14 cm^{-1} plant between the largest (4.8 kg m^{-2}) and smallest amount (0.0 kg m^{-2}). The results obtained were superior to those found by Linhares (2009) when evaluating different amounts and types of fertilizers, with maximum heights of 14.18, 13.66 and 11.90 cm $plant^{-1}$ for coriander culture, using jitirana, silk flower and pasture, respectively, in the amount of 15.6 t ha^{-1}, equivalent to 1.56 kg m^{-2}. The height of the plant is important, bearing in mind that small plants, less than 10 cm, are out of the commercialization standard.

Linhares et al. (2018) studied the agronomic efficiency of organic fertilizer in the production of the intercropping of coriander and mint in northeastern Brazil and found a plant height of 22.0 cm $plant^{-1}$, which differs from the results of this research. Linhares al. (2014), evaluating the use of gliricidal mixed with sabiá and the agronomic performance of coriander, found a plant height of 14.4 cm $plant^{-1}$, which is lower than the aforementioned research.

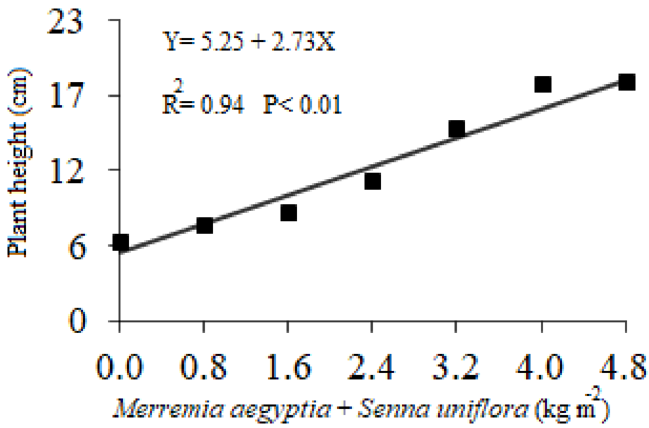

Figure 3. Different amounts of jitirana (*Merremia aegyptia* L.) with mata-pasto (*Senna uniflora* L.) at the height of the coriander plant.

For the number of stems, there was no maximum point, with a maximum value of 6.78 plant units (Figure 4). Linhares et al. (2021), studying the cultivation of coriander in succession with lettuce culture, found a coriander productivity of 3180 kg ha^{-1}, equivalent to 318 g m^{-2}, which is lower than the aforementioned work. Novaes et al. (2021), studying sources of organic fertilization in the consortium of coriander and arugula in Cruz das Almas, found a fresh mass of 316 g m^{-2}, different from the aforementioned research. The number of stems has a direct influence on plant height, considering that with the increase in plant height, there is a greater number of stems.

Linhares et al. (2014), evaluating the use of gliricidal mixed with sabiá in the agronomic performance of coriander, found a value of 7.6 stems $plant^{-1}$, which is similar to the aforementioned research. Linhares et al. (2015), studying the yield of coriander (*Coriandrum sativum* L.) fertilized with cattle manure at different doses and times of incorporation into the soil, found a number of stems of 6.3 $plant^{-1}$, which is lower than the present study. Linhares et al. (2018) studied the agronomic efficiency of organic fertilization in the production of the intercropping of coriander and mint in northeastern Brazil and found a value of 6.3 plant stems in single cultivation, a value similar to that research.

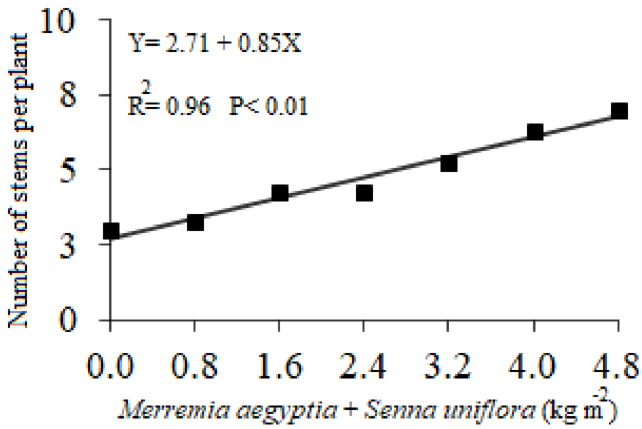

Figure 4. Different amounts of jitirana (*Merremia aegyptia* L.) with mata-pasto (*Senna uniflora* L.) at the number of stems of coriander.

There was an increase in the productivity and number of bunches of coriander with the increase in the amounts of jitirana with pasture, with maximum values of 1210 g m^{-2} and 24.2 units m^{-2} referring to productivity and number of bunches, respectively (Figures 5 and 6). The number of bunches is very important for farmers who work in coriander production, considering that this is the way coriander is sold in supermarket shelves and vegetable fairs.

Tavella et al. (2010) evaluated the organic cultivation of coriander using mulch fertilized with compost, with a productivity of 34.5 kg m^{-2}, equivalent to 345 g m^{-2}, corresponding to 6.9 units of bunches, less than the referred search. Linhares et al. (2021), studying the cultivation of coriander in succession with lettuce culture, found a coriander productivity of 3180 kg ha^{-1}, equivalent to 318 g m^{-2}, which is lower than the aforementioned work.

Novaes et al. (2021), studying sources of organic fertilization in the consortium of coriander and arugula in Cruz das Almas, found a fresh mass of 316 g m^{-2}, different from the aforementioned research.

Ramalho (2015) studied the intercropping of coriander with beet fertilized with bovine manure with jitirana, with the agronomic performance of coriander 525 g m^{-2} of green mass, equivalent to 52.5 kg 100 m^{-2} corresponding to 525 bunches in 100 m^{-2}, which is lower than the aforementioned survey. Cunha et al. (2018) studied the agronomic efficiency of different amounts of jitirana mixed with bovine manure in coriander and mint intercropping and found green mass and number of bunches of 56.4 kg/100 m^2 and 1691 units/100 m^2, respectively, with the incorporation of 3 0 kg/m^2.

Pereira (2014), studying the effect of the top dressing application of jitirana mixed with silk flower on the agronomic characteristics of coriander cultivars, found interaction, with unfolding of the amounts of straw of spontaneous caatinga species within the cultivars, for the variable yield, noting that the maximum amount (24.0 t ha^{-1}) was the one that promoted the highest yield for the verdão, Super Verdão and Tabocas cultivars, with average values of 3341, 3283 and 2830 kg ha^{-1}, respectively.

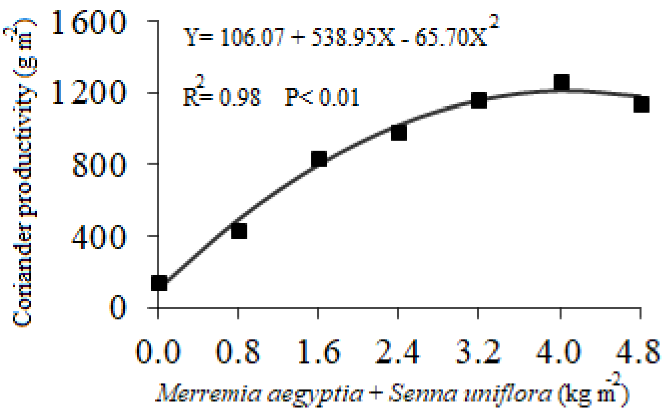

Figure 5. Different amounts of jitirana (*Merremia aegyptia* L.) with mata-pasto (*Senna uniflora* L.) at the coriander productivity.

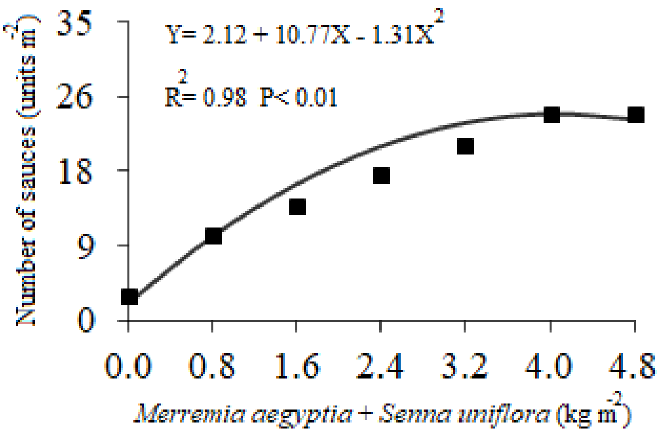

Figure 6. Different amounts of jitirana (*Merremia aegyptia* L.) with mata-pasto (*Senna uniflora* L.) at the number of coriander bunches.

In the coriander dry mass, there was a point of maximum production, with 4.0 kg m^{-2} incorporated into the soil, obtaining a value of 120.35 g m^{-2} of dry mass (Figure 7). Ramalho (2015) studied the intercropping of coriander with beet fertilized with bovine manure with jitirana, with the agronomic performance of coriander 525 g m^{-2} of green mass, equivalent to 52.5 kg 100 m^{-2} corresponding to 525 bunches in 100 m^{-2}, which is lower than the aforementioned survey. The dry matter mass is a very important characteristic, as it reflects, in a more direct way, the growth of the plant, being the most appropriate for the analysis of growth (Taiz; Zeiger, 2004), reflecting the influence of the treatments imposed on the crop.

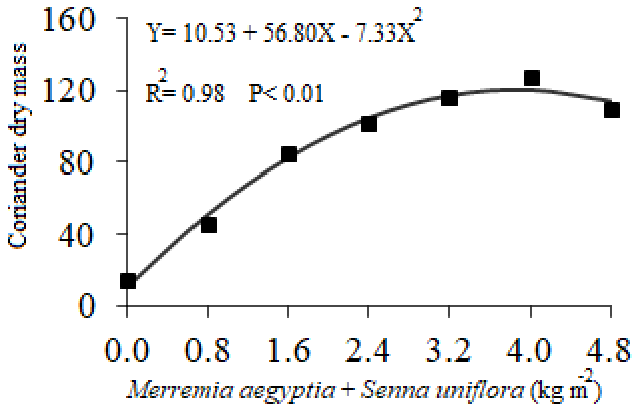

Figure 7. Different amounts of jitirana (*Merremia aegyptia* L.) with mata-pasto (*Senna uniflora* L.) in the dry mass of coriander.

FINAL CONSIDERATIONS

The highest productive efficiency for the coriander culture in relation to the amount of the mixture of jitirana with mata-pasto was 4.0 kg m^{-2}, with values of 1210 g m^{-2} and 24.2 units of bunches m^{-2}.

The mixture of spontaneous species from the semiarid region as an organic fertilizer was effective in promoting an increase in the evaluated characteristics.

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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.

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