

## Roostertree (*Calotropis procera*) under different amounts and periods of incorporation on yield of coriander

### *Flor-de-seda (Calotropis procera) sob diferentes quantidades e períodos de incorporação no rendimento do coentro*

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**ABSTRACT** - The goal of this paper was to evaluate the roostertree under different amounts and periods of incorporation on yield of coriander. This paper was conducted at the experimental farm Rafael Fernandes of, Universidade Federal Rural do Semi-Árido (UFERSA), Mossoró-RN, in the period October-December 2009. Experimental design was a randomized complete block with treatments arranged in a factorial 4 x 4, with three replications, with 144 plants per plot, with the first factor consists of the amounts of roostertree (5.4, 8.8, 12.2 and 15.6 t ha<sup>-1</sup> on a dry basis), the second by periods of soil incorporation (0, 10, 20, and 30 days before sowing - DAS). The cultivar was planted cilantro palm trees. The characteristics evaluated were such: plant height, number of stems plant<sup>-1</sup>, yield and dry matter weight of shoots. Significant interaction between treatments was observed for the characteristic coriander yield with better agronomic performance observed in the amount of 15.6 t ha<sup>-1</sup> roostertree applied between incorporation 30 days before sowing coriander, with an average yield of 4404 kg ha<sup>-1</sup>.

**Keywords:** spontaneous species; *Coriandrum sativum*; green manure.

**RESUMO** - Objetivou-se avaliar a flor-de-seda sob diferentes quantidades e períodos de incorporação na produtividade do coentro. Este trabalho foi conduzido na fazenda experimental Rafael Fernandes da Universidade Federal Rural do Semi-Árido (UFERSA), Mossoró-RN, no período de outubro a dezembro de 2009. O delineamento experimental usado foi de blocos completos casualizados com os tratamentos arranjados em esquema fatorial 4 x 4, com três repetições, com 144 plantas por parcela, sendo o primeiro fator constituído pelas quantidades de flor-de-seda (5,4; 8,8; 12,2 e 15,6 t ha<sup>-1</sup> em base seca), o segundo pelos períodos de incorporação ao solo (0, 10; 20; e 30 dias antes da semeadura - DAS). A cultivar de coentro plantado foi a Verdão. As características avaliadas foram: altura e número de hastes planta<sup>-1</sup>, rendimento e massa da matéria seca da parte aérea. Interação significativa entre os fatores estudados foi observada para a característica rendimento de coentro, com melhor desempenho agrônômico observado na quantidade de 15,6 t ha<sup>-1</sup> de flor-de-seda aplicado no período de incorporação de 30 dias antes a semeadura do coentro, com produtividade média de 4404 kg ha<sup>-1</sup>.

**Palavras-chaves:** espécie espontânea; *Coriandrum sativum*; adubação verde

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## INTRODUCTION

Coriander is a very oleracea marketed in Brazil, is of great commercial importance, with large volume of import and seed production in Northeast Brazil and is operated almost exclusively for the production of green leaves. Its nutritional importance is due to the presence of vitamins A, B1, B2 and C, good source of calcium and iron (FILGUEIRA, 2003). According to Pereira (2012), Palm trees are the most widely cultivated trees in the state of Rio Grande do Norte, preferably by farmers because it fits well the local climate conditions and its rapid growth ensures faster return compared to Tabocas and Super-Palm trees.

In the region of Mossoró-RN, where there's the most widely produced and consumed vegetable crop, with plantings made in home gardens, which are conducted by farmers, using labor, family labor and manure (cattle, goat and birds) as a source of fertilizer. Thus, the dependence of these inputs makes it vulnerable to shortages producer since not always have this feature on their property, which increases production costs.

One of the alternatives to allow these production systems is green manure, since its use in vegetable production may represent an option for producers working in the organic system as a way to reduce the use of manure, so scarce in production areas (PERIN et al. 2004). According Favero et al. (2000) the species most frequently used in production systems are legumes, because these have the ability to fix nitrogen by symbiotic bacteria in their root systems, besides having high biomass production. However, the same author states that the wild species may contribute to the fertility of the soil in the same way that the legumes. Within this context, several wild species have been used for this purpose, because their agronomic characteristics compatible with vegetables.

Among the wild species of the caatinga biome with the potential to be used as green manure, there is the rooster (*Calotropis procera*), considered weed in arable areas due its rapid establishment in planted areas, influenced by the spread their seeds by wind occurring, contributing to the increase in the number of plants per unit area. The roostertree suits in various types of soils, how argisoi, cambissolo, Psament and Vertisol.

The species has a constant availability of dry weight up to  $3.0 \text{ t ha}^{-1}$  / court during the absence of rainfall, being able to make three cuts per year (EMPARN, 2004). Has a nitrogen concentration of about  $22.6 \text{ g kg}^{-1}$  and carbon nitrogen ratio of 20/1 (LINHARES et al., 2011), which enables the species to use as green manure for its rapid decomposition of straw.

In this sense, the goal was to evaluate the rooster in different amounts and periods of incorporation in organic cultivation of coriander.

## MATERIALS AND METHODS

The experiment was conducted in the district of Alagoinha, Mossoró-RN, in the period October to December 2009, on soil classified as Typic Franco argisolic sandy (EMBRAPA, 2006). The district Alagoinha is situated at the following coordinates: latitude  $5^{\circ}03'37'' \text{ S}$  and longitude  $37^{\circ}23'50'' \text{ Gr W}$ , with an approximate height of 72 m, lying 20 km to the town of Mossoró-RN. According to Thornthwaite, the local climate is NDAA'ie, semiarid (CARMO FILHO et al. 199).

Prior to the experiment soil samples were collected at a depth of 0-20 cm which were air dried and sieved on a 2 mm mesh, were then analyzed, obtaining the following results: pH (water 1:2.5) = 6.0; Ca =  $1.8 \text{ cmolc dm}^{-3}$ ; Mg =  $0.6 \text{ cmolc dm}^{-3}$ ; K =  $0.16 \text{ cmolc dm}^{-3}$ ; In  $\text{cmolc} = \text{cmolc} \cdot 0.10 \text{ dm}^{-3}$ ; P =  $14.0 \text{ mg dm}^{-3}$  Mehlich e M.O. = 0.25%. The experimental design was a randomized complete block with treatments arranged in a factorial  $4 \times 4$  with 3 replications. Treatments included a combination of four quantities of silk-flower incorporated into the soil (5.4, 8.8, 12.2 and  $15.6 \text{ t ha}^{-1}$  on a dry basis), four periods of incorporation (0, 10, 20 and 30 days before sowing coriander).

Each plot comprised dimensions of 1.2 m x 1.2 m, with six rows of plants spaced 0.2 m, twenty-four plants per row, with rows considered the side borders. The total area of the plots was  $1.44 \text{ m}^2$ , with 144 plants and floor area of  $0.80 \text{ m}^2$ , containing 80 plants. The cultivar was sown cilantro Palm trees Palmeiras. Soil preparation consisted of manual cleaning, removal of natural vegetation present in the experimental area and manual lifting of the beds, using a tool to hoe.

The roostertree used in the experiment was collected in an area of  $1.0 \text{ ha}^{-1}$ , in December 2008. Therefore, the plant was cut from the apex to the insertion of the green stem, not using the lignified part of plant. The plants were crushed in a conventional forage machine to yield segments between 2.0 and 3.0 cm these were sun-dried and packed in raffia bags remaining with average humidity of 12%, stored in suitable for storing dry materials fenado environment (Figure 1). At the time of the experiment (20/10/2009) Installation five samples of roostertree, taken to the laboratory for analysis of the levels of nitrogen, phosphorus, potassium, calcium, magnesium, sulfur and carbon / nitrogen ratio were taken, whose results: N =  $22.0 \text{ g kg}^{-1}$ ; P =  $10.0 \text{ g kg}^{-1}$ ; K =  $18.80 \text{ g kg}^{-1}$ ; Ca =  $14.23 \text{ g kg}^{-1}$ ; Mg =  $1.5 \text{ g kg}^{-1}$  and S =  $2.0 \text{ g kg}^{-1}$ . Quantified as a function of dry matter, taking into account the 12% humidity, being incorporated in the 0 – 20 cm soil.



**Figure 1.** Roostertree (*Calotropis procera*) in full bloom stage in the savanna biome herbaceous. Photo. Paulo Linhares, 2009.

During the period of stay of residues in the soil, prior to planting, irrigations were made in order to maintain soil moisture at 70 % of field capacity, and this is an ideal condition for nitrification (NOVAES, 2007).

After the merger of roostertree, proceeded planting coriander on 23/11/2009. Eight days after emergence thinning took place. Manual weeding and irrigation were performed by micro - sprinkler, split shift with daily watering in two applications (morning and after noon).

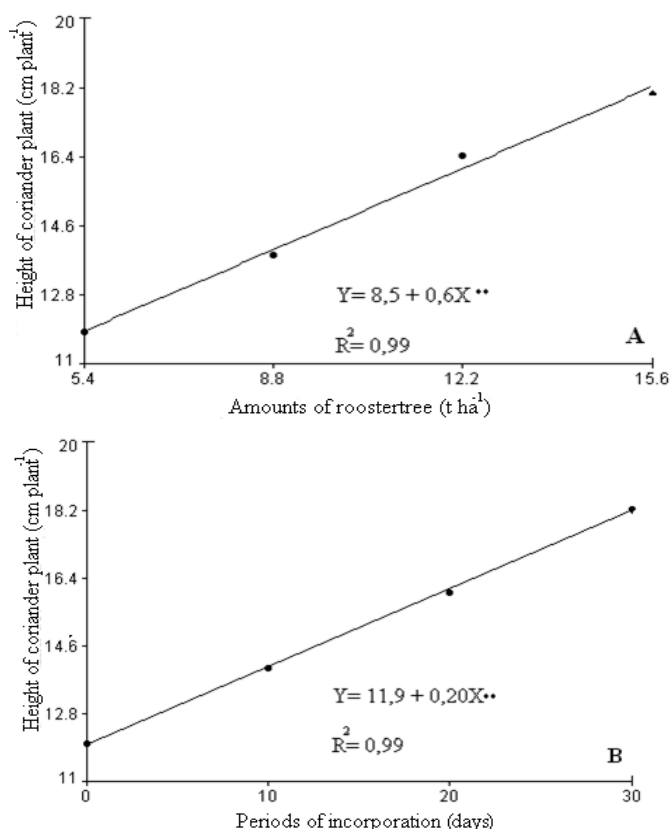
At thirty-five days after sowing (28/12/2009) there was the harvest of the experiment. The following characteristics were evaluated: plant height (cm plant<sup>-1</sup>), number of stems plant<sup>-1</sup>, yield and dry matter coriander (kg ha<sup>-1</sup>). Plant height was taken from a sample of twenty plants per plot by measuring the height from the base to the apex of the plant using a millimeter ruler. Number of stems consisted of counting of a sample of twenty plants and expressed as average. To coriander yield used the index 70 % of the total area as the spaces between the beds (30%) are not grown, (regional condition). Thus, it is considered as income, the result of the product of the weight of m<sup>-2</sup> and the patch area of one hectare, corresponding to 70%, since 30 % not cultivated. The yield was obtained by weighing on an electronic scale accurate to 1.0 g after cutting above the top of the plant. The dry matter was obtained in greenhouse heating with forced air at 65 °C to constant weight.

A univariate analysis of variance for randomized block design with treatments arranged in a factorial design was performed on each feature of coriander, through the application SUM (KRONKA & BANZATO, 1995). The procedure for adjusting the response curve was performed using the Table Curve (JANDEL SCIENTIFIC, 1991) application. The response functions were evaluated based on the following criteria: biological rationale, significance of the mean square of the regression (QMRr), high coefficient of determination (R<sup>2</sup>), significance of the regression parameters, using the t test at 1 % probability).

## RESULTS AND DISCUSSION

No interaction among the quantities of roostertree incorporated into the soil and decomposition times for plant height , number of stems and dry matter , however , was no interaction for yield (Figures 2 was observed 5).

For height , an upward curve was observed in the quantities of roostertree incorporated into the soil (Figure 2A), with an average height of 18.2 cm plant<sup>-1</sup> at the maximum amount of 15.6 t ha<sup>-1</sup>, corresponding an average increase of 6.4 cm<sup>-1</sup> plant compared to the lower amount (5.4 t ha<sup>-1</sup>). The same behavior was observed for periods of incorporation (Figure 2B) , with a mean increase of 6.2 cm plant<sup>-1</sup> between the shortest (0 day), compared to the longer period of incorporation Roostertree (30 days), with an average height of 18.1 cm plant<sup>-1</sup>.

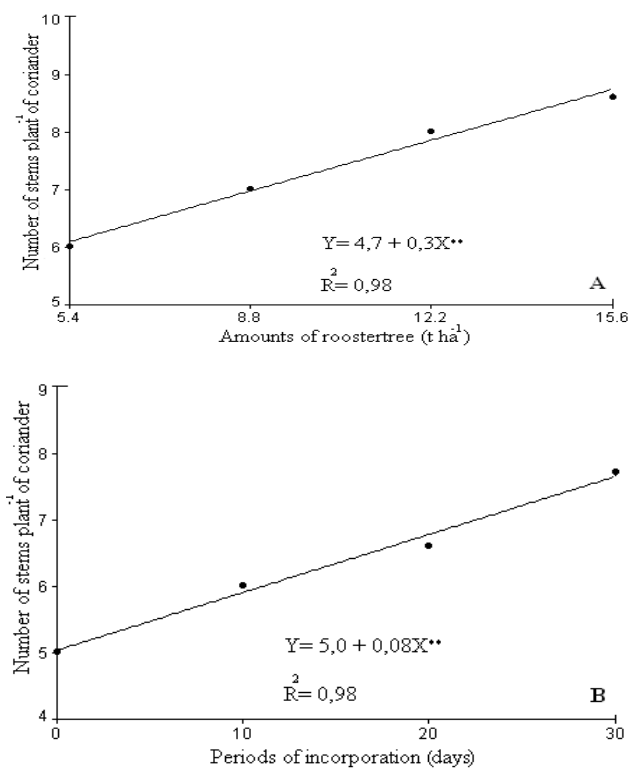


**Figure 2.** Height of coriander plant under different quantities (A) and periods of incorporation (B) of roostertree. UFERSA. Mossoró-RN, 2009. \*\* Significant at p < 0:01 by t test.

This behavior is possibly due to increased availability of nutrients, especially nitrogen and potassium, elements that are responsible for leaf expansion, better root development, which contributed to greater plant height in the largest amount (15.6 t ha<sup>-1</sup>). Similar behavior was observed by Linhares et al. (2012)

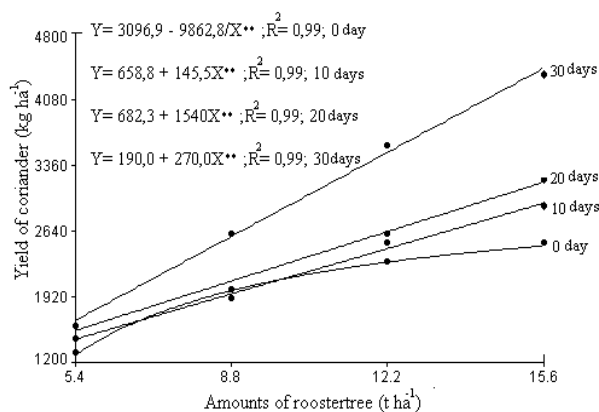
evaluated quantities and times of decomposition of jitrana the agronomic performance of coriander, found a mean height of 15.0 cm plant, in the amount of 15.6 t ha<sup>-1</sup>. These results are lower than those found by Nunes et al. (2007), who evaluated the effects of sources, doses and intervals of application of organic compounds on yield of cabbage and cilantro in organic production system, observing plant height of 29.6 cm coriander and use of 40 t ha<sup>-1</sup> organic compound. This superiority may be related to the high dose of compost compared to 15.6 t ha<sup>-1</sup> roostertree.

Increase in plant<sup>-1</sup> stems of cilantro with increasing amounts of roostertree applied, with an average of 8.7 stems plant<sup>-1</sup> in the amount of 15.6 t ha<sup>-1</sup> (Figure 3A) was recorded. For periods of incorporation value of 9.7 stems plant<sup>-1</sup> with 30 days of incorporation (Figure 3B) was observed. In coriander, the number of stems plant<sup>-1</sup> is of paramount importance, given be the vegetative part of the plant used for consumption. Linhares et al. (2010) evaluated the decomposition of forest - pasture in coriander, found 6.0 stems plant<sup>-1</sup>, lower than the present work. Moreover, Cavalcante Neto et al. (2010) studied the cultivation of coriander with and without coverage obtained with wood shaving 8.4 leaves stems plant<sup>-1</sup>, is also lower than that obtained in the present study. The shaving of wood has a high C/N ratio, which prevents its use in the production of coriander.



**Figure 3.** Number of leaves plant<sup>-1</sup> of coriander under different amounts of coriander (A) and periods of decay (B) de roostertree. UFERSA, Mossoró-RN, 2009. \*\* Significant at p < 0:01 by t test.

Unfolding the interaction of the quantities within the periods of incorporation roostertree embedded in the ground, an upward curve in the yield of coriander in the different periods of incorporation into the soil (Figure 4) was observed. Between the highest (15.6 t ha<sup>-1</sup>) and the lowest amount (5.4 t ha<sup>-1</sup>) of roostertree incorporated into the soil, was an increase of about observed; 1194; 1485; 1620 and 2754 kg ha<sup>-1</sup> for periods of incorporation: 0; 10; 20 and 30 days, respectively. The coriander yield increased with increasing amounts of the roostertree, to the average values 2464; 2930; 3160 and 4404 kg ha<sup>-1</sup>, corresponding to periods of incorporating 0, 10, 20 and 30 days, respectively (Figure 4). The highest yields were recorded in greater quantity and period of incorporation in soil conditions of this study, which suggests that the amount and period of introduction to this culture is above the values quoted above.

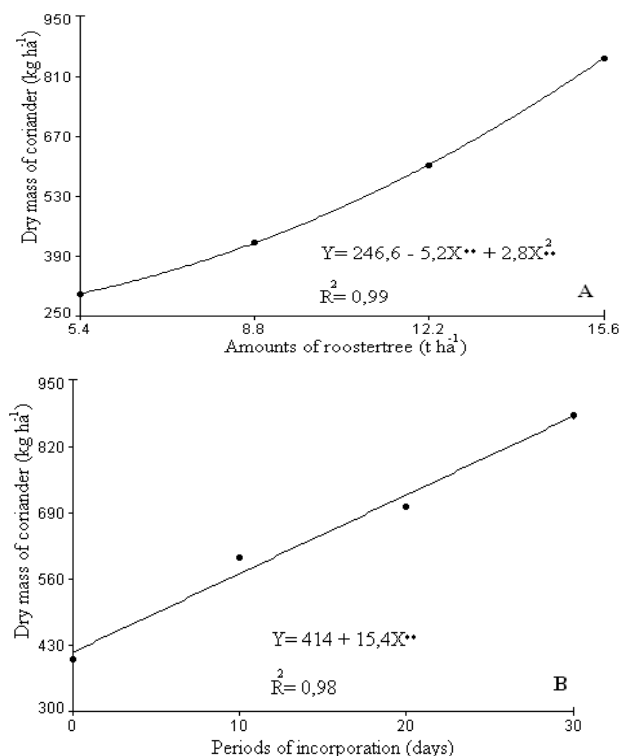


**Figure 4.** Yield of coriander under different amounts and periods of incorporation of roostertree. UFERSA. Mossoró-RN, 2009. \*\* Significant at p < 0:01 by t test.

Tavella et al. (2010) studied the organic cultivation of coriander tillage and using living mulch, fertilized with compost, found productivity of 3454 kg ha<sup>-1</sup> at planting with weeds, which resembles that search system. Different behavior occurred when the authors used organic compost (30 t ha<sup>-1</sup>) associated with the presence of dead stubble (wild species), with productivity of 8.000 kg ha<sup>-1</sup>, which was possibly contributing to such a high productivity. Already, Linhares et al. (2012) assessing quantity and time of decomposition of the agronomic performance jitrana coriander, found yield of 7064 kg ha<sup>-1</sup> in the amount of 15.6 t ha<sup>-1</sup> and incorporation period of 30 days before sowing, and higher said search. This superiority is probably due to the jitrana nitrogen concentration (25.6 g kg<sup>-1</sup>) compared with the roostertree (20.4 g kg<sup>-1</sup>), given that this element is responsible for leaf expansion, which favored the cilantro which is a hardwood.

The accumulation of dry matter is not a desirable feature for the consumer, considering that the same prefer tender leaves and succulent which gives a nice flavor. However, the feature is important when it comes as a parameter for evaluation of plant growth. In this context, it

was observed that the greater accumulation of dry matter occurred in the amount of 15.6 t ha<sup>-1</sup> (850 kg ha<sup>-1</sup>) (Figure 5A) the period 30 days of incorporation, averaging (876 kg ha<sup>-1</sup>) (Figure 5B).



**Figure 5.** Mass of dry coriander in different quantities (A) and periods of incorporation of silk -flower (B). UFRSA Mossoró-RN, 2009. \*\* Significant at  $p < 0:01$  by t test.

## CONCLUSIONS

Significant interaction between treatments was observed for the characteristic coriander yield with better agronomic performance observed in the amount of 15.6 t ha<sup>-1</sup> roostertree applied along incorporation 30 days before sowing coriander, with an average yield of 4404 kg ha<sup>-1</sup>.

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