English Version

Foliar biofertilizer applied in cover fertilization in the production of lettuce cv. Veronica

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Abstract

The use of biofertilizer through leaves can be a supplement of the applied fertilization in the soil and in the fastest correction of possible deficiencies. Due to that, this practice has been increasingly used by the producers in olericultural species, especially broadleaves. The present work aimed at evaluating the performance of lettuce plants (cv. Veronica) in response to biofertilizer doses in different concentrations applied through leaves. The experiment was installed in the completely randomized blocks design with three replications and each plot was constituted by 64 plants. The treatments consisted of doses biofertilizer applied through leaves, in solution, in the concentrations: 0%; 10%; 20% and 30% of biofertilizer. The appraised characteristics were: diameter of the head (DH), number of leaves (NF), plant heigh (PH) and total fresh matter of shoot (TFMS). There was no effect of the biofertilizer concentrations over DH. NL, PH and TFMS were changed by the biofertilizer concentrations, emphasizing the concentration of 20% that tended to favor the expression of those characteristics.

Keywords: *Lactuca sativa* L.; alternative manuring; income

Introduction

Lettuce (*Lactuca sativa* L.) has a short cycle and it is demanding in the physical and chemical characteristics of the soil, requiting for its cultivating a soil rich in organic matter and nutrients. Due to this fact, the appropriated supply of nutrients to the crop is directly related to the fertilization, in which it must be of major importance the availability of nutrients to the plant (MALAVOLTA et al., 2002). Regarding to the production, the organic fertilizers have great importance, mainly in soils of tropical climate, in which the degradation of the organic matter is accelerated and the effect in the physical, chemical and biological properties of the soil is significantly intensified (SWIFT, 1993).

The leaf fertilization in the culture of lettuce is recommended as complement of the fertilizations performed trough soil and when it is expected quick response of the culture, in cases of lack of nutrients. In this sense, the main nutrients applied trough leaves in the lettuce are N, P, K, Ca and Mg (FILGUEIRA, 2003).

The use of biofertilizers trough leaves in the cultivation of olericulture may be an important alternative to the supply of nutrients, specially for the cultures of relatively short cycle, as lettuce. Besides being rich in nutrients, the biofertilizers have bioactive compounds (MEDEIROS e LOPES, 2006), which vary in composition, depending on the material used. According to SILVA et al. (2007), biofertilizers have almost all the macro and micro elements needed to vegetal feed.

The use of foliar biofertilizer is a practice that has been increasingly used by producers, who use alternative materials as animal manure, vegetal materials and minerals in its formula. The obtaining of biofertilizers is done trough the aerobic or anaerobic transformation which varies in composition according to the applied dilution and the material used (KIEHL, 1993). In the composition of the biofertilizers it can be found live or dormant cells of microorganisms with aerobic, anaerobic and fermentation metabolism (bacteria, yeasts, algae and filament fungus) and also metabolites and organo-

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mineral chetaled in aqueous solution (MEDEIROS e LOPES, 2006).

The biofertilizers in foliar applications in plants are normally used in concentrations which vary from 0.1% to 5%, however SANTOS and AKIBA (1996) verified that these values may vary from 20% to 50%. These authors still report that in very high concentrations, biofertilizers may affect metabolic deviations which are linked to the production of substances of defense, retarding mainly the growth, flowering or fructification.

According to VESSEY (2003) and FREIRE et al. (2010), the organic solution of the cattle biofertilizer may provide more appropriated conditions to the cellular enlargement of the plants caused by the physical improvement of the edaphic environment, of the stimulus to the action of proteins and organic solutions, resulting in better nutrient availability to plants and higher microbial activity.

In the evaluation of the growth of seedlings of yellow passion fruit in saline soil treated with liquid cattle manure or biofertilizer, CAVALVANTE et al. (2009) presented results that evidence that the increase of the percentage of input has stimulated the plant growth in height, collar diameter, leaf area, length on the main root, shoot and root phytomass in the yellow passion fruit seedlings. Moreover, for FREIRE (2011), the initial growth in plant height for the yellow passion fruit was positively influenced with the addition of the organic input, with the exception of the treatments in which there was saline water and mulch.

In tropical conditions, the use of alternative products as additional source of nutrients to some species, especially oleiricultural, certainly is one of the ways that may contribute significantly to provide the sustainability of the agricultural environments, either in levels of small or big producers. Facing these aspects, the objective of the work was to evaluate the performance of crunchy lettuce plants (cv. Verônica) in response to doses of biofertilizers in several concentrations applied trough leaves.

Material and Methods

The experiment was installed in the Sector of Olericulture of the Experimental Station of the Universidade Federal do Tocantins (UFT - Federal University of Tocantins), University Campus of Gurupi – TO, located in the latitude 11º 43' S, longitude 49º 15' W and altitude of 300 m, in Latossolo Vermelho-Amarelo[1], which presented the following results of the chemical analysis for the layer of 0-20 cm of depth: pH ($CaCl_2$): 5.0; O.M.: 3.38%; P resine: 12.5 mg dm^{-3}; K: 0.2 $cmol_c$ dm^{-3}; Ca: 3.1 $cmol_c$ dm^{-3}; Mg: 1.5 $mmol_c$ dm^{-3}; H+AL: 4.3 $mmol_c$ dm^{-3}; SB: 4.9 $mmol_c$ dm^{-3}; V: 53.26%.

The experiment was conducted in opened field in fall-winter. It was used the crispy lettuce cultivar Verônica®. The seedlings were obtained in polystyrene trays expanded with commercial substrate, with two to three seeds per cell.

After the emergence it was conducted thinning, leaving only a plant per cell, until the period of transplanting which occurred 24 days after the seeding. The transplanting was performed to plots with one meter of height previously fertilized with manure from the cattle enclosure in the dosage of 20 t ha^{-1}.

The design used was randomized block with three replications. Each plot was constituted of 64 plants distributed in spacing of 25 cm x 25 cm between rows and between plants inside the rows, respectively. The treatments consisted in doses of biofertilizer applied in the seventieth day after the transplanting, in solution, in the concentrations 0%; 10%; 20% and 30% trough leaves.

The biofertilizer used, product of an anaerobic fermentation of the mixture of fresh manure and water, presented the following chemical composition: pH: 6.4; O.M.: 27.47%; P: 8 mg dm^{-3}; K: 0.887 $cmol_c$ dm^{-3}; Ca: 0.44 $cmol_c$ dm^{-3}; Mg: 10.20 $cmol_c$ dm^{3}; H+AL: 0.05 $cmol_c$ dm^{-3}. The irrigation was conducted twice a day using the dropping irrigation system according to the necessities of the culture.

In competitive plants of each plot, at each five days, it was evaluated the following characteristics: diameter of the head (DH), number of leaves (NF), plant height (PH) and total fresh matter of shoot (TFMS). The TFMS was evaluated in the end of the experiment.

The averages of the data observed of each

1 Brazilian Soil Classification

treatment were submitted to the analysis of variance and it was adjusted equations of regression which would describe the behavior of the data, using the software Sisvar 5.1 (FERREIRA, 2007).

Results and discussion

During the periods of evaluation, the response between the concentrations of biofertilizer applied for diameter of head (DH) was similar, however, there was a light decrease of this characteristic in the solution with concentration of 30%, in the last period of evaluation (Figure 1). In general, the increase in the concentrations of the solution of biofertilizer provided a linear increase in the concentration of 20% and quadratic to the other concentrations (Figure 1).

For number of leaves (NL) (Figure 2) and plant height (PH) (Figure 3) it was observed that the plants which received 20% of the biofertilizer solution has higher values in the different periods of evaluation, with linear behavior until the end of the evaluation periods. For NL, the increase was superior than the others, specially in the last periods of evaluation (Figure 2). Those which received the solution with 30% presented lower values to NL and PH, and the last period was the one that promoted the largest difference to both characteristics, which aparently demonstratedthat this concentration may have been harmful for plant development. According to KIEHL (1985), the organic fertilizers provide positive response over the culture production, and are equal or even better than the effects of the chemical fertilizers. However, depending on its chemical composition, rate of mineralization and content of nitrogen, which by their turn suffer influence of the climate conditions, the organic fertilizers in high doses are harmful to the cultures.

Regarding to the concentration of 30%, it is suggested that the excessive concentration of nutrients cause a nutritional unbalance in the plant, which collaborated to a lower growth and consequent a reduced value to DH, NL and PH. For potato, the use of biofertilizers in concentrations superior to 20%, promoted a reduction in the production of tuber in function of the increase of the concentration. This occurred probably in function of the increase of the content of nitrogen and water in the vegetal tissue above the great of the culture, causing an increase in the electric conductivity and nutritional unbalance, with negative impact in the potato productivity (SANTOS et al., 2009). Results obtained by TEIXEIRA et al. (2004), cultivating hydroponic lettuce with effluent of swine production in the doses

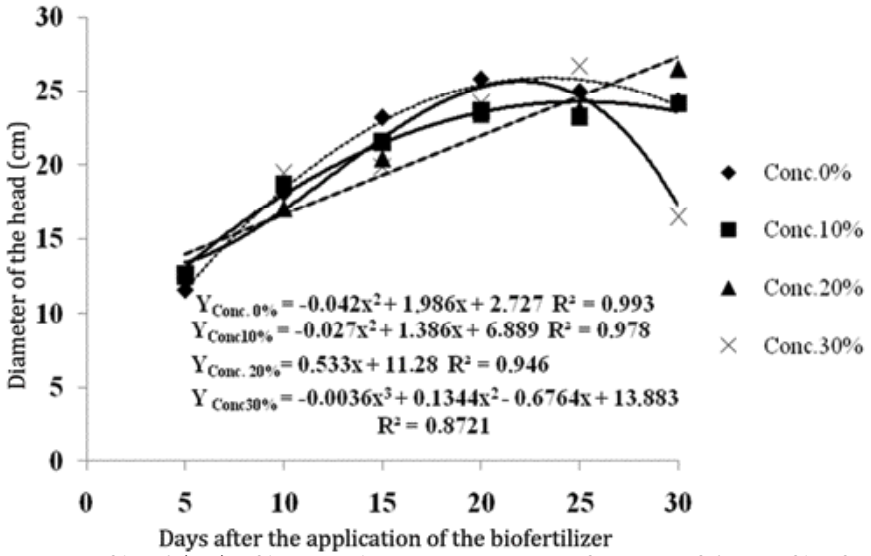

Figure 1. Diameter of head (cm) of lettuce plants cv. Verônica in function of doses of biofertilizer applied trough leaves, UFT, Gurupi, TO, 2009.

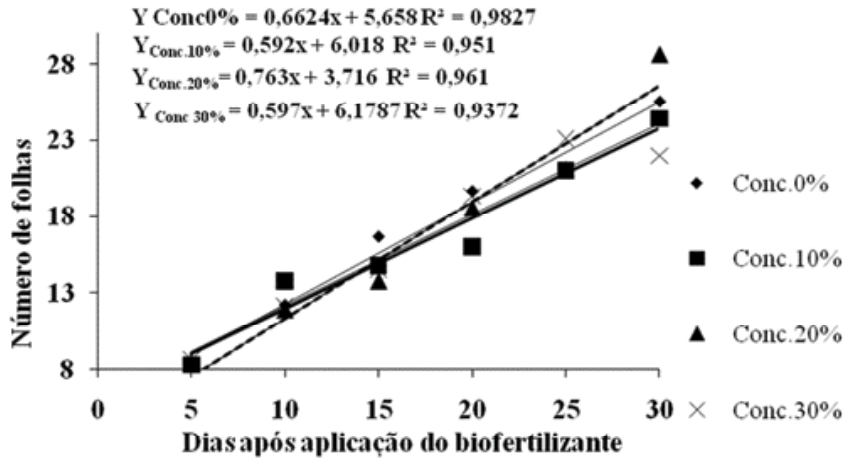

Figure 2. Number of leaves of lettuce plants cv. Verônica in function of doses of biofertilizer applied trough leaves, UFT, Gurupi, TO, 2009.

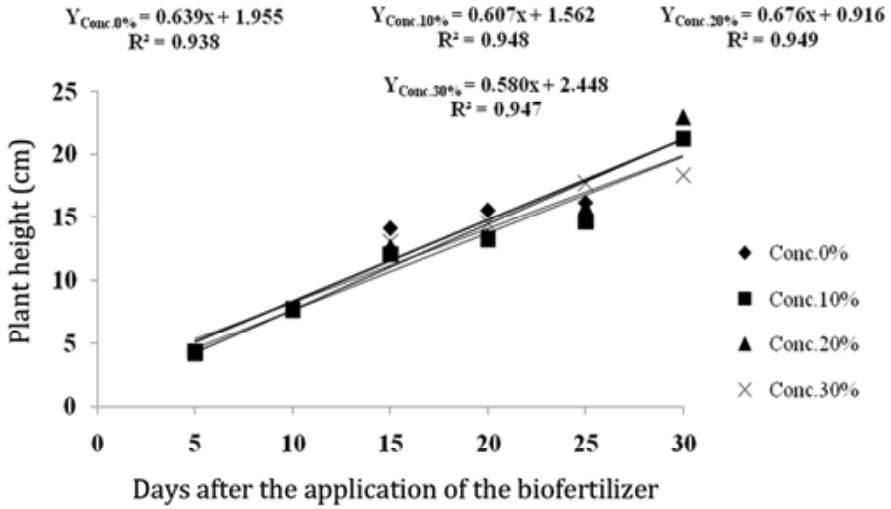

Figure 3. Plant hight of lettuce cv. Verônica in function of doses of biofertilizer applied trough leaves, UFT, Gurupi, TO, 2009.

of 5 and 10% as nutritive solution, were not efficient, which according to the author may be caused by the excess of copper and zinc in the swine deject or the lack of dilution in water of the effluent until the ideal electric conductivity.

The larger production of total dry matter of leaves (TDML) was obtained with the treatment of 20% especially in the last collection (Figure 4). In general, there was a linear increase in the dry matter for the plants for all the concentrations of biofertilizer used, with emphasis to those which received 20% of the solution, which tended to originate plants with higher total dry matter of leaves, especially in the end of the evaluations. This treatment reached approximately 8 g of leaves (dry matter) per plant 30 days after the application of the biofertilizer.

The solution of 30% provided plants with lower values of dry matter (6.7 g) that the plants which did not receive application of the biofertilizer (6.9 g), and as it was previously said, it is suggested that this concentration of nutrients provided a nutritional unbalance in the plant, which collaborated

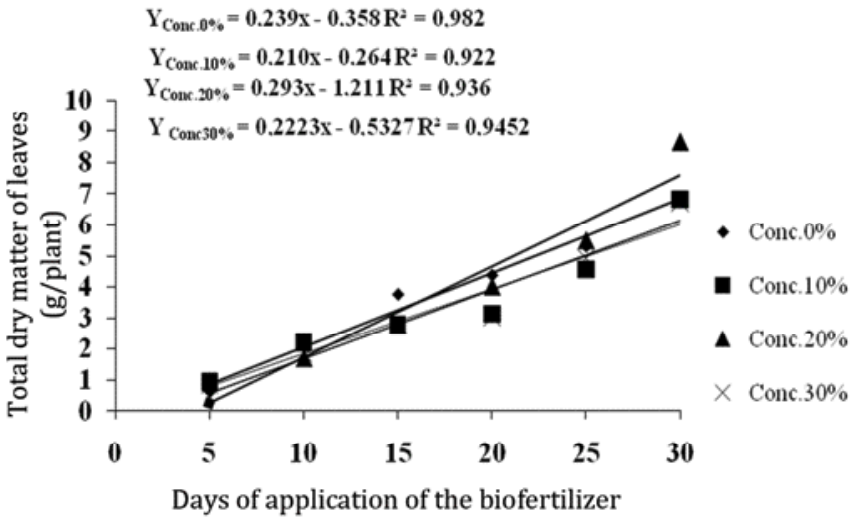

Figure 4. Total dry matter (g plants^{-1}) of leaves of lettuce cv. Verônica in function of doses of biofertilizer applied trough leaves, UFT, Gurupi, TO, 2009.

to a lower growth and consequently a reduced value to this characteristic. RIBEIRO et al. (2007) verified that there was no significant difference to lettuce dry matter between the treatments in which it was used 10, 20, 40 and 60% of biofertilizer, in substitution to the nutritive solution, in relation to the control, however the biofertilizer in the concentration of 80% (maximum dose) did not have a good performance. VERONKA et al. (2008) did not observe significant effect of the biofertilizer in the growth, development and production of lettuce cultivar Vera, but verified a light effect of the biofertilizer, which was not detected in the statistic analysis.

The response to TFMS was similar (Figure 5) at the end of the experiment, between the different concentrations of biofertilizer used, however, lightly superior values of TFMS were found in the concentration of 20%, confirming the data observed to NL, PH and TDML, which were also superior to this treatment. In cowpea, SANTOS et al. (2007)

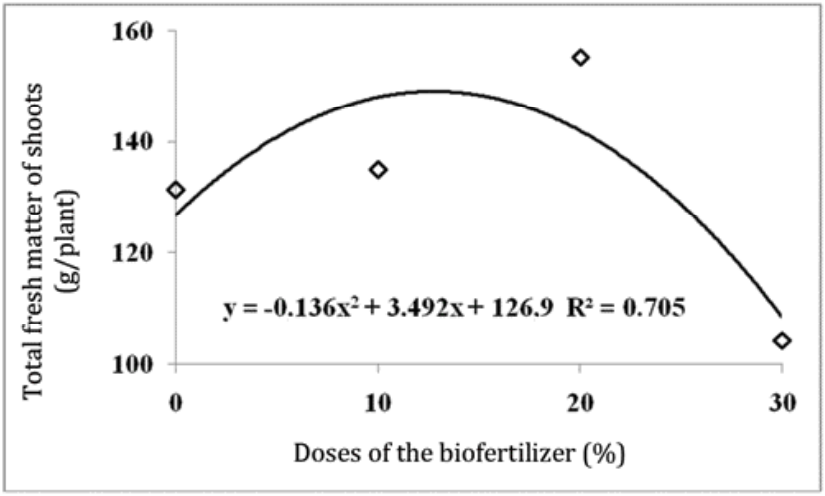

Figure 5. Total fresh matter (g plants^{-1}) of shoots of lettuce plant cv. Verônica in function of doses of biofertilizer applied trough leaves, UFT, Gurupi, TO, 2009.

obtained higher production of dry grain when applying biofertilizer in the concentration between 27.44% and 33.00%.

In the culture of muskmelon (*Cucumis melo* L.) in hydroponic system, using as nutritive solution one biofertilizer, VILLELA JÚNIOR (2003) observed that the substitution of the mineral fertilizers for biofertilizer in the nutritive solution is possible, and it is a possible alternative to oleiriculturers.

It is still noteworthy to emphasize that the foliar fertilization cannot substitute completely the supply of inorganic and organic minerals to the plant trough the soil, in order to absorb trough roots. However, the expansion of the use of the leaf fertilization to a number increasingly high of cultures has shown that there are cultures that can be maintained, in relation to certain nutrients, almost exclusively trough leaves (CAMARGO and SILVA, 1975; MALAVOLTA, 1967; MALAVOLTA, 1997).

Conclusion

1. The application of the biofertilizer in the culture of the lettuce cv. Verônica has provided an increase in the phytotechnical parameters when applied in the concentration of 20%, which is the more recommended concentration for all the characters evaluated.

2. The solution with the concentration of 30% of biofertilizer promoted decrease for the diameter of the head.

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