Migration Letters

Volume: 20, No: S2 (2023), pp. 1297-1302

ISSN: 1741-8984 (Print) ISSN: 1741-8992 (Online)

www.migrationletters.com

Received: 20 -12- 2022
Accepted: 25- 03- 2023
Published: 22 -07- 2023

Productivity Efficiency Of Microbian Soil Conditioner And Vermicompost In Oryza Sativa (L)

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ABSTRACT

Fertilization is an irreplaceable practice in agricultural activity, consisting of replenishing the soil with nutrients that are depleted by the extraction of the crops themselves, which is one of the most valuable items in the structure of production costs in rice cultivation. It is therefore necessary to identify strategies that allow both the good development of the crop and the reduction of costs, and to use agrosostainable and environmentally friendly alternatives. The objective of this study was to evaluate the efficiency of the application of earthworm compost and a microbiological soil conditioner for 90 days. A completely randomized block experiment was carried out with 4 replicates and five treatments (Tto1: Control, Tto2: soil conditioner with 3L/ha; Tto3: soil conditioner with 4L/ha; Tto4: soil conditioner with 4L/ha and Tto5: soil conditioner with 4L/ha): vermicompost 200 kg/ha. The field evaluation was carried out in three time periods: 30, 60 and 90 days after the application of the respective treatments. The results show that the treatment where microbial soil conditioner was applied at a dose of 4 L/Ha presented the highest efficiency averages in the increase of productive parameters in rice cultivation. This is the first study to be carried out using a microbial soil conditioner.

Key words. *Vermicompost, microbial soil conditioning, rice cultivation, productive parameters.*

1. INTRODUCTION

According to FAO (2018), rice is one of the main crops of global importance for its nutritional, economic and social value. For more than half of the world's population, especially in the poorest areas, rice is an essential source of nutrients and calories in the daily diet. According to the Food and Agriculture Organization of the United Nations, rice provides, on average, 20% of the world's dietary energy supply and is predominantly consumed in countries in Asia, Africa and Latin America, where it provides 70%, 48% and 30% of dietary energy, respectively.

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Worldwide, there is a problem that rice soils present problems and limitations, due to the fact that at least one third of rice soils are of low fertility, with problems of salinity, alkalinity, acidity and low organic matter content, which negatively alters the physical, chemical and biological properties, promoting their degradation, therefore, the implementation of technologies for their management and recovery is necessary.

On the other hand, organic and mineral amendments are considered as alternatives for the recovery of degraded soils and as sources of nutrients. Similarly, the use of biofertilizers based on microorganisms is considered to some extent as an alternative in the agricultural sector due to their great potential to fix environmental nitrogen, solubilize nutrients, improve crop production and food security (Mahanty et al., 2016). Furthermore, the use of biostimulant has become a common practice in organic agriculture, as it provides a number of benefits such as stimulating plant development and protecting plants from biotic and abiotic stresses (Van Oosten et al., 2017).

The current outlook for rice production is not very favorable for small farmers in Colombia. Among the actions that farmers have been taking is to look for alternative treatments for the fertilization of their crops, however, the wide variety of products and methods that exist in the market make this decision not an easy one, after all there are several factors that affect the choice of a good fertilizer for the development of the plant.

As stated by Ramos and Terry (2014), they mention that applying different levels of organic fertilizers leads to an increase in the soil's organic matter content, moisture retention capacity and pH, as well as an increase in available potassium, calcium and magnesium. In terms of physical properties, they improve water infiltration, soil structure and hydraulic conductivity; they decrease bulk density and evaporation rate, as well as promote better plant health.

Based on the above, the objective was to evaluate in the field the effect of vermicompost and microbial soil conditioner on the productive parameters of rice cultivation in the municipality of Monteria, Cordoba, Colombia.

2. MATERIALS AND METHODS

2.1 Study area. The experiment was carried out at the experimental farm La Victoria of the Fondo Nacional del Arroz-Fedearroz, located in the village of Mocarí, in the municipality of Montería, Córdoba, Colombia.

2.2 Production parameters. The evaluation of the efficiency of vermicompost and microbial soil conditioner was carried out on a commercial rice crop. The treatments used were applied at the moment of sowing and the data of the productive parameters: plant number, root weight, leaves, root weight and root length, were taken in three periods: 30, 60 and 90 days after the application of the respective treatments.

2.3 Experimental design. A completely randomized block experiment was carried out with 4 replicates and five treatments (Tto1: Control, Tto2: soil conditioner with 3L/ha; Tto3: soil conditioner with 4L/ha; Tto4: soil conditioner with 4L/ha and Tto5: soil conditioner with 4L/ha and Tto6: soil conditioner with 4L/ha): vermicompost 200 Kg/ha. The distribution of the field treatments is shown in figure 1.

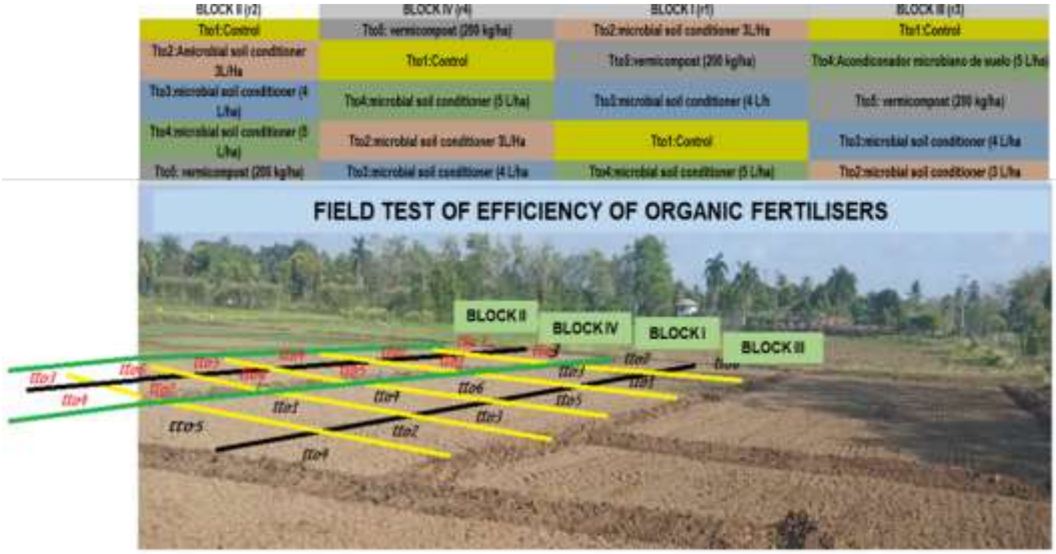

Figure 1. Distribution of experimental design in the field

3. RESULTDS AND DISCUSSION

Figure 2 shows the data obtained from the field evaluation test on the efficiency of the organic fertilizers based on: microbial soil conditioner and vermicompost evaluated with respect to the control without application of any inorganic or organic compound.

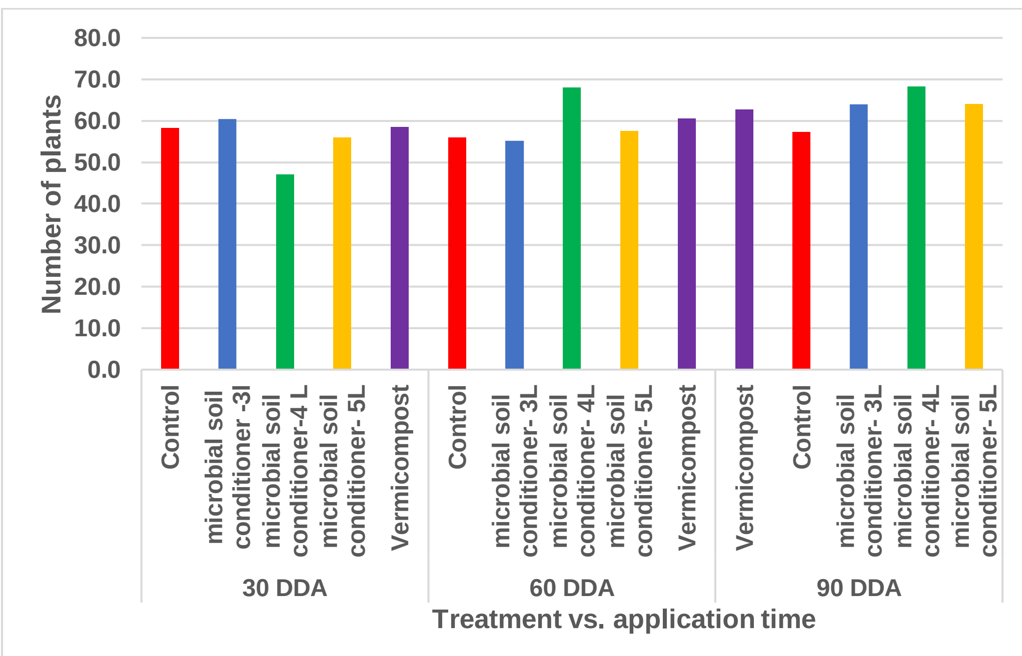

Figure 2. Leaf number parameter in rice variety with the use of earthworm compost and microbial soil conditioners.

The results of the field trial show how the number of plants per plot increased from the evaluation at 30, 60 and 90 days after applying the treatments. The results show that the average number of rice plants obtained after 90 days indicate that with the soil conditioner, the number of plants obtained was 65.4, compared to the treatment of compost with earthworm compost, which was 62.8, compared to the control with 57.3 plants. Likewise, when comparing the doses of 3L, 4L and 5L of the microbial soil conditioner, the best dose was 4L/Ha. All the above shows the efficiency of both organic fertilizers to increase the productivity and number of plants in commercial rice cultivation in the department of Cordoba, Colombia.

Figure 3 shows the results obtained on the productive parameters (plant weight, root weight, leaf weight and root length) evaluated 30, 60 and 90 days after the application of the treatments with microbial soil conditioner and vermicompost with respect to the control. The results show that the highest mean values of plant weight (13.0 g); root weight (1.6 g); leaf weight (11.4 g) and root size (11.2 g) were found with the soil conditioner at the dose of 4 L/ha at 60 and 90 days compared to the worm-compost treatment and the control.

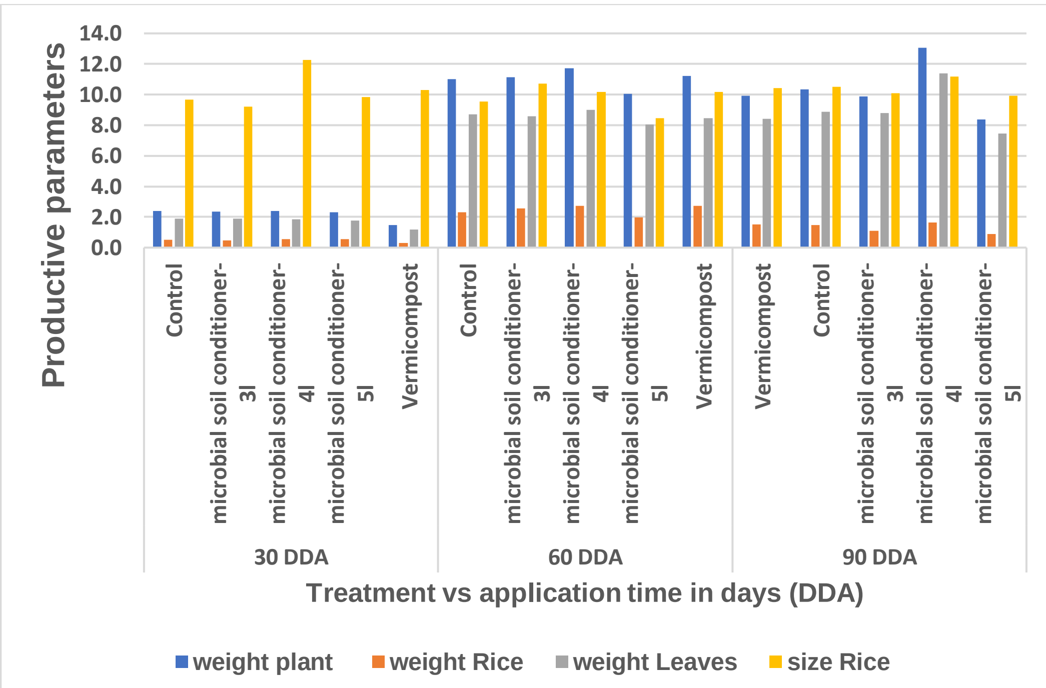

Figure 3. Parameters of plant weight, root weight, leaf weight and root length in rice variety with the use of earthworm compost and microbial soil conditioner.

In general terms, there are various factors that influence the growth and production of rice crops, with nutrition being one of the main ones so that plants can express their yield potential. Nutrition is the absorption of the nutrients necessary for the plant to develop its vital functions and obtain good yields at lower production costs (Castilla and Tirado, 2018).

As mentioned by Castilla and Tirado, (2018), the supply of nutrients to plants is a function of a complex interaction of different factors and processes, so it must be taken into account that not every time you fertilize you are nourishing because there are several aspects that influence to have a well nourished plant; among which are the genotype - environment interaction, understanding as environment the influence that the soil, water availability and climate have on the absorption and availability of nutrients in the soil solution. Likewise, climate has a direct influence on yields, which is why it is necessary to identify the ideal sowing times when conditions such as solar radiation and maximum and minimum temperatures are at their optimum for the growth and development of the plant, allowing it to express its yield potential.

With respect to the vermicomposting, it is observed that the highest efficiency in the productive parameters was obtained 90 days after the application of the product: plant weight (11.2 g); root weight (2.8 g); leaf weight (8.5 g) and root size (10.2 g).

As Ruiz (2011) states, vermicompost has a very high load of microorganisms, several million per gram of dry material, which generates a high enzymatic and bacterial load, which helps in the solubilization of nutrients in the soil, and can be used in the same way as compost. However, it is a higher quality fertilizer, the form of distribution is the same and it can be used on all crops. Vermicomposting has more nutrients, humus and micro-organisms per dry gram than compost, which makes it an excellent soil improver.

Endogenous earthworms contribute to the maintenance of fertility, as they build and maintain a structure based on resistant macro aggregates, and also release nutrients from plant residues and soil organic matter and finally, they physically protect the humus within their compact turricles. The main advantage of worm compost is that it increases the quality and presents humic and fulvic acids that improve soil conditions, making the soil retain moisture and stabilizing soil pH (Castillo-Briseño, 2010).

In a world of ever-increasing growth and demand for agricultural resources, the need to find efficient and sustainable solutions for crop improvement has become vitally important.

The Microbial Soil Conditioner is an innovative technology that transforms the way producers, both large and small, can approach farming and care for the soil.

It is a soil conditioner that activates beneficial microbiota, providing a boost to crop productivity. Its formula includes fulvic and humic acids, which allows for greater water absorption and nutrient retention, thus providing application efficiency with less dosage required. This innovative technology can be applied both foliar and soil-applied, further enhancing uptake and efficacy.

What differentiates the microbiological soil conditioner from other solutions is its ability to restore the soil microbiota, which facilitates the mobilization of nutrients, promoting a more effective recovery for future sowings. Importantly, this product is made from organic materials, ensuring environmentally friendly agriculture.

CONCLUSION

This is the first time that the microbial soil conditioner has been evaluated as an alternative biofertilizers. According to the results obtained, it is observed that this biofertilizers is efficient in promoting the growth of rice plants at a dose of 4L/ha, and it is also detailed that the efficiency in growth is observed 60 days after its application. **ACKNOWLEDGEMENTS**

The authors would like to thank the researcher Cristo Perez Cordero for his support and collaboration.

DECLARATIONS

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not applicable.
Conflict of interest
The authors declare that they have no competing interests.

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