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Vegetative phase of pepper plants on the combination of compost and biochar with the addition of mycorrhiza

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Abstract. Plant growth is strongly influenced by the availability of nutrients in the soil. One factor that influences the availability of nutrients in the soil is the availability of soil organic matter. Soil nutrient content such as C-organic, available nutrients, and soil microorganism diversity are indicators of soil fertility. This research was arranged using a completely randomized design. Data were collected directly in the field and also observations in the laboratory. This study aimed to determine the response of pepper plant growth to the vegetative phase with the application of compost-biochar-mycorrhizae. This study indicates that the best response is shown in the combination application treatment of compost, biochar with mycorrhizal fungi.

1. Introduction

Soil is an important factor in agricultural business activities because it becomes a growing medium for crops. Soil processing in the process of farming that needs to be considered is soil fertility, availability of nutrients, and water conditions. Plants need water, fertile soil, and rich in nutrients in the process of growth and development. The provision of nutrients and organic matter becomes an important aspect in improving the soil's physical, chemical, and biological properties.

The provision of organic fertilizer into the soil can also improve the soil structure becomes looser so that the root system can develop better and the process of absorption of nutrients runs more optimally [1]. Furthermore, [2] suggested that the exchange of nutrients, energy, and carbon between soil organic matter, soil environment, aquatic system, and the atmosphere is essential for agricultural productivity, water quality, and climate.

The provision of organic matter is very effective in increasing the status of nutrients in the soil. Sources of soil organic matter that can be used can be sourced from livestock waste and agricultural waste such as livestock feces. However, the application of composting on the land should be made continuously. Therefore, to overcome the problem, there needs to be technology to apply soil organic matter that can last long enough in the soil. One of the technologies that can be used is the use of biological charcoal or biochar with mycorrhiza.



Black carbon (C), or so-called bio-biochar, can overcome some limitations in carbon management. According to various studies, biochar is known to increase the humidity and fertility of agricultural land and can last thousands of years in the soil [3]. Biochar utilization is one of the prospective agricultural waste management efforts to optimize suboptimal lands and degraded land [4].

2. Methods

This research was carried out by direct application in the field. The research method used a randomized design of 4 treatments, three tests, and each treatment consisting of 2 plants for observation. The combination of treatment consists of 1) Control, 2) Biochar Nutrient Tube, 3) Mycorrhiza and 4) Biochar and Mycorrhiza nutrient tubes.

The process of biochar application is done by previously making biochar resemble a tube with a cavity in the middle of the tube. Furthermore, the biochar nutrient tube cavity is filled with compost to a source of nutrients. The application process of biochar nutrient tubes in the field is done by making biopore holes around plant rooting, and then biochar nutrient tubes are inserted into biopore holes. The data analysis uses various fingerprint tests (F) to determine the difference between treatments used BNT test 5%.

3. Results and discussion

3.1. Sprouting speed

The results obtained at the sprouting speed parameters showed no actual different results. Still, the best results were shown in the treatment of biochar, compost, and mycorrhiza with the addition of mycorrhiza with an average of 14.33 days after planting. The result shows that a combination of biochar, compost, and mycorrhiza on pepper plants can accelerate the appearance of buds (figure 1).

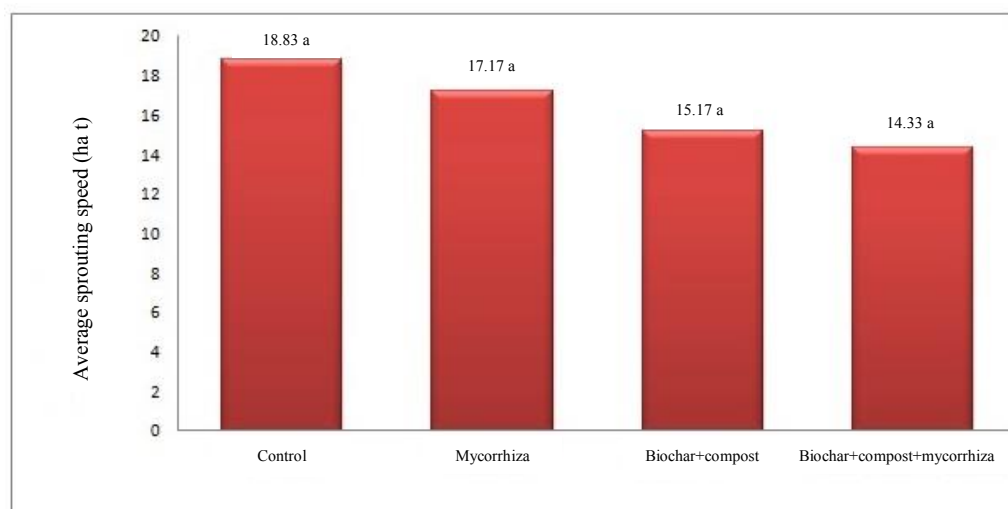


Figure 1. The average speed of sprouting on pepper plants.

It is due to the addition of organic matter in the crop in the form of biochar nutrients in nutrient tubes and mycorrhiza that play an essential role in the growth of pepper plants. Biochar plays an essential role in holding water and as a habitat for soil microorganisms. In addition, the addition of mycorrhiza also plays a role in helping plants absorb nutrients in the soil. The research results [5] concluded that the provision of biochar-based soils affects the growth and production of maize crops. Furthermore, research conducted by [6] concluded that Biochar acts as a bio activator provider of nitrogen fertilizers to increase the biomass of corn crops and nitrogen absorption in the leaves.

3.2. Number of buds

Based on the results obtained from the observation of the average number of buds for 120 days after planting listed in figure 2, the treatment of biochar, compost, and mycorrhiza leads to the highest number of buds with an average of 4.0 and biochar and compost treatment leads to the lowest number of buds with an average of 2.0.

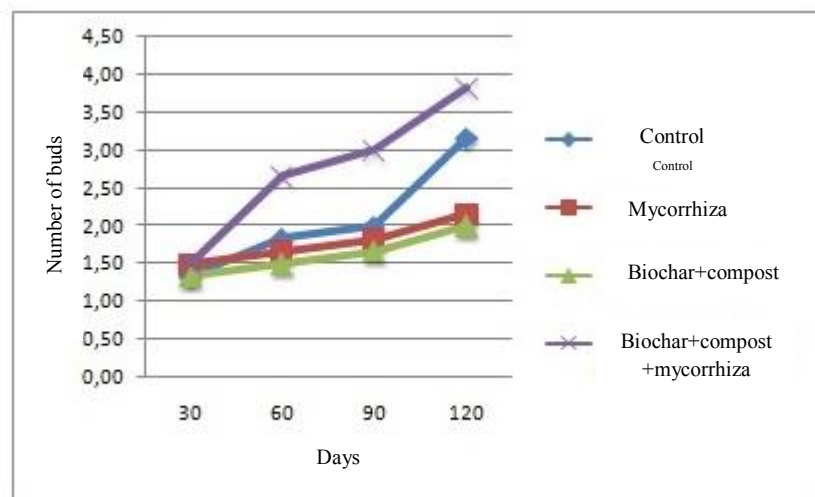


Figure 2. The average number of buds on pepper plants.

These results showed the treatment of biochar, compost, and mycorrhiza influenced the growth of pepper plants. In the available nutrient, tubes are used organic sources derived from agricultural waste and livestock waste processed into compost to be suitable for plant growth. It follows the opinion of [7], who said that the addition of organic materials in the form of biochar could increase plant growth. While mycorrhiza mushrooms can help improve the nutrient status of plants, increasing crop resistance to droughts, diseases, and other unfavorable conditions. Furthermore, the research results of [8] suggest that biochar administration can increase soil pH, C-organic, N-total, P-available, K exchange, flowering age, plant height, dry weight header, absorption of N and P.

3.3. Number of leaves

Based on the results obtained from the average growth of the number of leaves of pepper plants, the administration of mycoriza mushrooms and biochar nutrient tubes does not significantly influence (figure 3). The best results were shown in the treatment of biochar, compost, and mycorrhiza with an average of 9.50 strands. The condition is influenced by physiological activity in the young tissues of pepper plant cuttings caused by the nutrient content of organic nutrients such as nitrogen, and c-organic, which play an essential role in the vegetative growth of plants. The nitrogen element plays a role in supporting the vegetative growth of plants because the nitrogen element is an element of cell formation in plants. In line with the research results [9] suggested that the use of various doses of N fertilizer has a real influence on the parameters of plant height, the number of leaves, and the weight of fresh headers.

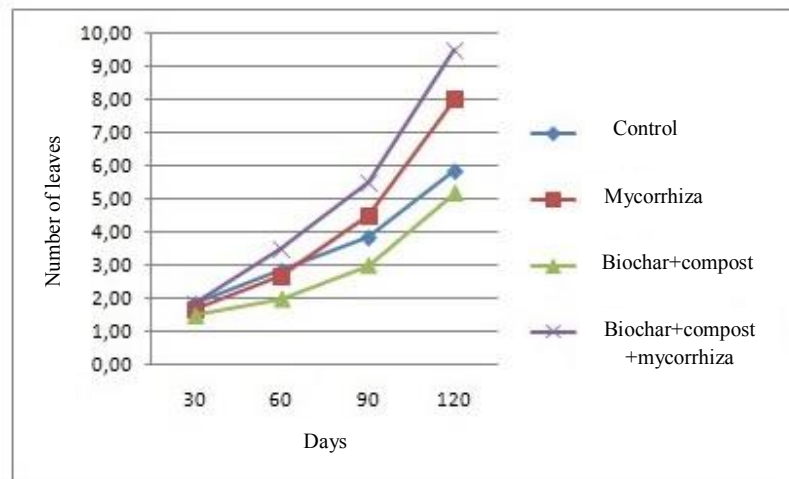


Figure 3. The average number of leaves on pepper plants.

3.4. Root length

The results obtained from the average measurement of the root length of pepper plants are presented in figure 4. Figure 4 shows the best root length measurement results in mycorrhiza treatment with an average of 19.93 cm and the lowest in biochar, compost, and mycorrhiza treatments with an average of 16.70 cm.

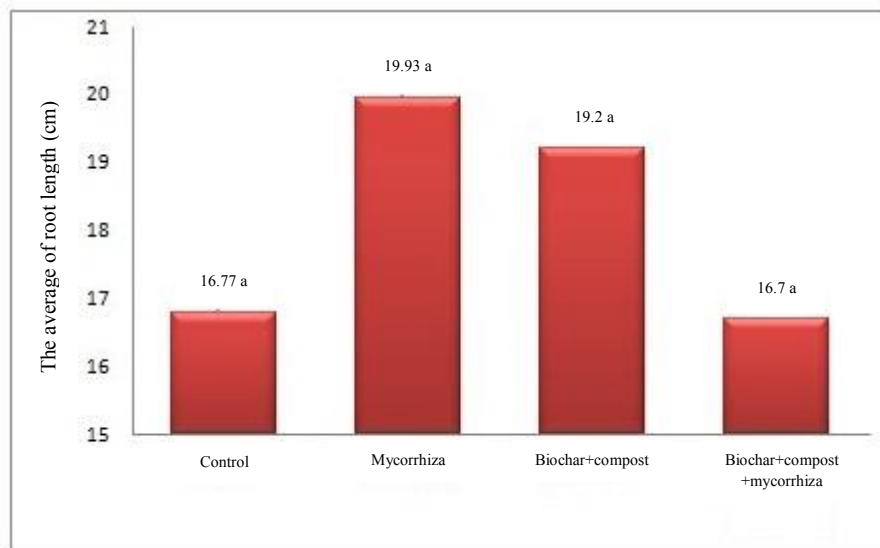


Figure 4. The average of root length on pepper plants.

These results showed that the administration of mycorrhiza influenced the length of the roots of pepper plants. Mycorrhiza mushrooms can make symbiotic well on the root system of plants to increase the root growth of pepper plants. Mycorrhiza fungal infection can increase the absorption of nutrients in plants and has been carried out by rooting pepper plants. It is in line with [10], which states that mycorrhiza can increase the absorption of elements P, Zn, Cu, NH_4 , K, Ca further utilized by plants in metabolic processes. Furthermore, it is also stated that the root with a mycorrhiza has a higher auxin that allows increased root growth. Furthermore, the research results conducted by [11] showed that the administration of mycorrhiza with a dose of 10 g has a good influence on the growth of palm plants.

4. Conclusion

Based on the research results, it can be concluded that the provision of a combination of biochar, compost, and mycorrhiza on pepper crops gives the best results on the parameters of sprouting speed, the number of buds, and the number of leaves. While at the parameters of the best root length on the treatment of mycorrhiza.

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