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Comparative Effectiveness of Biochar and Microplastic Amendments on Soil Fertility, Chlorophyll Content of Cereal Crops

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ABSTRACT

This study aims to explore the effect of biochar and microplastic on soil fertility and chlorophyll content of barley. The results obtained from the analysis of physicochemical parameters of the soil reveal an increase in soil alkalinity with biochar, reaching 9.92 however microplastic indicate a pH of 11.5 observed for PL1 and 8.48 for PL0,the pH was 11.5. Additionally, the electrical conductivity (EC) recorded a value of 464.01 µS/cm for biochar and 462.14µS/cm with microplastic. Regarding the total carbon content, the résults showed a no significant variation ranging from 1.31% for control to 1.44% for D2 of biochar , and a decrease with microplastic to 1.17% for PL2 in comparison with the control PL0 (1.55 %) . The plant response to microplastics and biochar showed a total chlorophyll content about 1.34 mg/g MF for the low dose PL1; however, for the PL2 dose, the value obtained is 1.46 mg/g MF. With biochar, total chlorophyll values increase from 1.40 mg/g MF for D0 to 1.49 mg/g MF for D2. The results obtained highlight substantial response to the application of biochar and microplastics on the physicochemical parameters of the soil and the chlorophyll content of barley.

Keywords: soil fertility, Chlorophyll T , biochar , microplastic.

1 Introduction

The Algerian semi-arid zones are affected by the problem of degradation of soil for this raison preserving soil quality is among the major challenges we face [1]. [2] reported that the use of biochar as a soil amendment is an effective and sustainable practice for pollution control and optimization of soil properties. Indeed, it is a promising strategy to reduce soil degradation; other authors have shown that microplastics present in the soil affect its fertility.This study aims to investigate the respons of soil to micoplastic and biochar. We hypothesize that biochar and microplastic is expected to provide a positive improvement in all the tested physicochemical parameters of the soil, which results in a positive in photosynthesis of Hordium plant used in this experiment.

2 Experimental

The experiment was conducted in plastic pots of (3 kg of soil capacity). Under controlled conditions (greenhouse).Three doses of biochar were applied (D0 = 0 g kg-1, D1 = 6 g kg-1 , and D2 = 10g kg-1),We used also three doses of microplastic 0.5g/kg of soil, and Dose PL2 = 1g/kg of soil . Each pot receving microplastic or biochar was sown with seven grains. Irrigation frequency was determined based on field capacity applied twice a week. Five replicates were used in each doses of both biochar and microplastic. At the end of the experiment that corresponds to wheat plant maturity (mid-June), the EC and pH of soil were measured using a multiparameter meter (model: Hanna HI9829) in a soil solution with a soil:water (w:v) ratio of 1:2.5 and 1:5, respectively. Soil organic carbon (SOC) was measured by the method of Walkley and Blak [3]. The total chloropjhyll was determined by method Burnison [4].

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3 Results and Discussion

The application of biochar caused an increase in soil pH at 9.92 , also we obtained 11.5with microplastic ; Concerning the EC this parameter recorded respectively a value of 454.01 µS/cm and 462.14µS/cm for biochar and microplastic . This EC and rise can beattributed to the presence of diverse organic and inorganic minerals in these two components [5]. The biochar amedment induced an increase of carbon content from 1.31% for control to 1.44% for D2 of biochar , but a decrease with microplastic to 1.17% for PL2 in comparison with the control PL0 (1.55 %). Biochar applications significantly increased SOC, which is largely consistent with former studies [6] . Biochar is rich in organic components and it' a amendment improve soil fertility [7]. The plant's response to microplastics showed a increase of toral chlorophyll PL1 noted 1.34 mg/g MF , however, with PL2, the content was 1.46 mg/g MF. With biochar, the values increased from 1.40 mg/g MF from D0 to 1.49 mg/g MF for D2. Biochar application was reported to increase chlorophyll contents in leaves of various crops, such as soybean Glycine max (L.) Merr [8].

4 Conclusions

In conclusion, the results reveal positive responses to the application of biochar and microplastics on the chlorophyll content of plants. These observations underline the importance of an interesting approach for use in agriculture. For the soil in this experiment only biochar is interesting.

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