

## ABSTRACT

Soil is recognized as a greenhouse gas sink due to its organic carbon content. Greenhouse gases are the cause of global warming, with one source being the respiration of microorganisms in the soil. High nitrogen (N) losses in agricultural land occur due to its ease of leaching and volatilization. Plants absorb N in the form of  $\text{NH}_4^+$  or  $\text{NO}_3^-$ . Using porous materials can store carbon, thereby reducing the rate of global warming and improving soil quality. The aim of this study is to determine the effect of using various types and doses of biochar capable of reducing  $\text{CO}_2$  emissions from respiration and increasing  $\text{NO}_3^-$  as well as enhancing microorganisms. This study was conducted in the Soil Agroecotechnology Laboratory, Faculty of Agriculture, Malikussaleh University, using a completely randomized factorial design (CRD) with two treatment factors. Factor 1 is the type of biochar (J) which includes (J1) rice husk biochar, (J2) bamboo biochar, and (J3) corn cob biochar, while Factor 2 is the dose of biochar (D1) 0 tons  $\text{ha}^{-1}$ , (D2) 10 tons  $\text{ha}^{-1}$ , (D3) 20 tons  $\text{ha}^{-1}$ , (D4) 30 tons  $\text{ha}^{-1}$ , and (D5) 40 tons  $\text{ha}^{-1}$ . There were 15 treatment combinations with 3 replications, resulting in 45 experimental units. The results showed rice husk biochar was able to suppress  $\text{CO}_2$  emissions from soil microorganism respiration at 4.08 kg  $\text{CO}_2$   $\text{ha}^{-1}$  hour  $\text{ha}^{-1}$ , increase soil nitrate at 8.14 ppm, increase soil microorganism populations at 86.24 x105 CFU  $\text{g}^{-1}$  soil, increase soil organic carbon at 2.76%, soil water content at 5.27% and soil pH at 5.23.

Keywords: *carbon, lignin, porous space, respiration, soil amendment*