

## ABSTRACT

The increase in demand for agricultural production has caused excess application of pesticides, which is an issue due to the ability of pesticide residues to penetrate into the tissues of vegetables. However, biochar has been used as adsorbent to reduce pesticides contaminants in soil. The objective is to determine the effects of biochar on pesticide uptake by plants and their combined effect on plant morphology and physiology and pesticide associated health risks. We examined biochemical responses on lettuce plants treated with different concentrations of rice straw biochar mixed into sandy loam soil (0%, 0.1%, 0.5%, and 1% w/w) under pesticide stress (5ml of 10mg/ml of cypermethrin and deltamethrin solution in acetone) which resulted in spiked concentration of 100mg/kg in each container. 12 treatments with 3 replications were designed, and a pot experiment was conducted. Pesticide residues were extracted using the QuEChERS technique and analyzed through GC-MS. Our results suggest that at different biochar concentrations, 0.5% caused an increase in plant growth and improved biochemical and physiological parameters. The biochar reduced the oxidative stress in plants, as was observed by the reduction in MDA concentration in plants. 0.5% biochar decreased MDA concentration by 53.7%. The contents of Ca, Mg, and Na were reduced by biochar application in all treated plants compared to control. The RCF and BCF of cypermethrin and deltamethrin in the soils amended with different concentrations of rice straw biochar declined progressively with the increasing biochar content. 1% biochar was more effective in reducing the uptake of both pesticides by plants. Risk assessment was analyzed through aHQ and CHQ. Low risk was found with both pesticide. Generally, our results demonstrated that biochar treatment enhances pesticide tolerance in lettuce seedlings. The results of the present research could be helpful to develop appropriate management procedures for improving crop yield and reducing pesticide content in plants. Further studies can be conducted using different pesticides and varying biochar feedstocks.