The Benefits of Biochar on Rice Growth and Yield in Tropical Riparian Wetland, South Sumatra, Indonesia

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ABSTRACT

Biochar improves soil quality. However, most biochar research has focused on aerobic soil conditions. The objective of this research was to evaluate the agronomic benefits of applying biochar on unfertilized rice crop, cultivated under transitional anaerobic soil conditions during early vegetative growth phase, and gradually drying out to fully aerobic at harvest time. This transitional condition is typical during the rice growing season of the tropical riparian wetlands in Indonesia. Biochar was applied in the form of fine powder at rates of 0, 0.4, 0.8, and 1.2 Mg.ha^{-1}; no inorganic fertilizer was applied. The research was conducted on a farmer's paddy field at Pemulutan Ulu Village, South Sumatra, Indonesia from July to November 2016. Results indicated that applying biochar at rates up to 1.2 Mg.ha^{-1} increased rice yield, but restrained shoot elongation rate and plant height. During the vegetative growth phase, applying biochar significantly increased the number of tillers, leaves, shoot dry weight, and root dry weight. Biochar significantly affected the following yield components: number of tillers, percentage of productive tiller, number of grains per panicle, panicle density, percentage of filled grain, and weight of 1,000 grains.

Keywords: Biochar, Rice, Soil quality, Anaerobic, Tropical climate, Riparian wetland

INTRODUCTION

Although biochar has been used for centuries to increase crop yields, interest in biochar has increased recently, particularly for its environmental, or carbon sequestration benefits. Recent research has identified several environmental and agricultural benefits of applying biochar, including carbon sequestration for reducing carbon emission into the atmosphere (Mašek et al., 2013; Mukherjee and Lal, 2013; Zhang and Ok, 2014; Jiang et al., 2016; Wang et al., 2016); phytoremediation of soil contaminants (Ahmad et al., 2014; Mohan et al., 2014; Wiszniewska et al., 2016); adjusting soil physicochemical and biochemical properties for agriculture (Herath et al., 2013; Githinji, 2014; Bai et al., 2015; Abujabhah et al., 2016; Bera et al., 2016; Haider et al., 2017); creating soil health by inducing growth of beneficial and