Effects of biochar and ground magnesium limestone application, with or without bio-fertilizer addition, on biochemical properties of an acid sulfate soil and rice yield

ABSTRACT

A study was conducted to evaluate the effects of applying rice husk biochar (RHB) or ground magnesium limestone (GML) in combination with bio-fertilizer on soil biochemical properties and the yield of rice planted on an acid sulfate soil. The RHB or GML plus bio-fertilizer were applied each at the rate of 4 t ha−1. Applying the amendments increased soil pH (>5.0) and improved soil biochemical properties with a concomitant reduction of Al and Fe that resulted in enhanced rice growth. Applying GML plus bio-fertilizer resulted in increased soil N content (0.20%), available P (34.38 mg kg−1), exchangeable Ca (2.97 cmolc kg−1) and exchangeable Mg (2.45 cmolc kg−1); all these enhanced rice nutrient uptake. The highest bacterial population of 8.34 log10 CFU g−1 soil was found in the same treatment. Applying GML and RHB alone, or in combination with bio-fertilizer, was found to enhance rice growth and the yield. The highest plant height (90.33 cm), leaf chlorophyll content (38.05), plant tiller numbers (16), filled grains (86%), number of panicles per plant (18), lengths of panicles (24.40 cm), grain (5.24 t ha−1), straw yield (10.20 t ha−1) and harvest index (0.51) were determined in the GML plus bio-fertilizer, followed by RHB plus bio-fertilizer treatment. Thus, GML applied in combination with bio-fertilizer is considered as a promising agronomic package to sustain the production of rice planted on acid sulfate soils.

Keyword: Phosphate-solubilizing bacteria; Soil biochemical properties; Organic acids; Al3+ toxicity; Fe2+ toxicity