Geophysical Research Abstracts
Vol. 18, EGU2016-12237, 2016
EGU General Assembly 2016

Rice production in relation to soil quality under different rice-based cropping systems

Linh Tran Ba (1,2), Steven Sleutel (1), Qui Nguyen Van (2), Guong Vo Thi (2), Khoa Le Van (2), and Wim Cornelis (1)

(1) Dept. of Soil Management, Ghent University, Ghent, Belgium (Wim.Cornelis@UGent.be), (2) Dept. of Soil Science, Can Tho University, CanTho City, Vietnam (tblinh@ctu.edu.vn)

Soil quality of shallow paddy soils may be improved by introducing upland crops and thus a more diverse crop cultivation pattern. Yet, the causal relationship between crop performance and enhanced soil traits in rice-upland crop rotations remains elusive. The objectives of this study were to (i) find correlations among soil properties under different rice-upland crop systems and link selected soil properties to rice growth and yield, (ii) present appropriate values of soil parameters for sustainable rice productivity in heavy clay soil, (iii) evaluate the effect of rotating rice with upland crops on rice yield and economic benefit in a long-term experiment. A rice-upland crop rotational field experiment in the Vietnamese Mekong delta was conducted for 10 years using a randomized complete block design with four treatments and four replications. Treatments were: (i) rice–rice–rice (control – conventional system as farmers' practice), (ii) rice–maize–rice, (iii) rice–mung bean–rice, and (iv) rice–mung bean–maize. Soil and plant sampling were performed after harvest of the rice crop at the end of the final winter–spring cropping season (i.e. year 10). Results show differences in rice growth and yield, and economic benefit as an effect of the crop rotation system. These differences were linked with changes in bulk density, soil porosity, soil aggregate stability index, soil penetration resistance, soil macro-porosity, soil organic carbon, acid hydrolysable soil C and soil nutrient elements, especially at soil depth of 20–30 cm. This is evidenced by the strong correlation ($P < 0.01$) between rice plant parameters, rice yield and soil properties such as bulk density, porosity, penetration resistance, soil organic carbon and Chydrolysable. It turned out that good rice root growth and rice yield corresponded to bulk density values lower than 1.3 Mg m-3, soil porosity higher than 50%, penetration resistance below 1.0 MPa, and soil organic carbon above 25 g kg-1. The optimal soil depth without restriction for rice root elongation was at least 25 cm from the soil surface. We suggest these values as indicative for optimal physical soil quality when growing rice in fine-textured alluvial soils and their definition as a first step towards presenting real threshold values.