Long-term changes in paddy soil fertility in Peninsular Malaysia during 50 years after the Green Revolution with special reference to their physiographic environments

ABSTRACT

The objective of this study was to investigate the current soil properties in lowland paddy fields in Peninsular Malaysia and to assess the long-term changes in the soil fertility status during50 years after the Green Revolution. Forty paddy fields were selected close to the study sites surveyed in 1965 and grouped based on six physiographic environments: the brackish swamp (including acid sulfate soils), the brackish alluvium, the freshwater swampand the riverine alluvium in the west coast, and the riverine alluvium and the beach ridges interspersed with swales in the east coast. Soil samples from the depth of 0–15 cm were analyzed for the physicochemical properties. Despite similar fertilizer application rates over Peninsular Malaysia, several differences were found in the current soil properties between different physiographic environments, such as 1) higher levels of clay fraction, 1.4 nm minerals, CEC, exchangeable bases and available Si as well as Mg- and Na-rich status in the brackish environments, 2) higher levels of available N in the riverine alluvium environment in the east coast , and 3) the excessive P accumulation in the acid sulfate soils. The long-term changes well appeared in the dramatic increase of P availability and the alleviation of soil acidity. In addition, the composition of exchangeable bases changed toward Ca-rich and Mg-low status. Large reduction in soil organic matter was found in the swamp environments while those in the riverine alluvium environment in the east coast were increased. It could be concluded that despite the successful increase in rice yield after the Green Revolution, the long-term changes in the paddy soil fertility showed positive and negative aspects depending on physiographic environments. Appropriate fertilizer application schemes taking into account different soil characteristics in different physiographic environments should be required to achieve both efficient, sustainable rice production and environmental conservation.

Keyword: Green revolution; Paddy soils fertility; Peninsular Malaysia; Phosphorus; Soil chemical properties