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Pedological Characteristics and Heavy Metals Contamination in Rice Production of the Paddy Soils in Taiwan

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Extensive planting rice on numerous alluviums and terraces in Taiwan has been done followed by the complete irrigation systems since the early and mid stages of the 20th century. Irrigation water and groundwater play important roles in controlling the soil hydrology, redoximorphology and element distributions. Redoximorphic features are consequently formed by the alternative wet and dry cycles, such as Fe soft masses, Fe and clay depletions and Fe-Mn nodules through the profiles of paddy soils. The saturated and reducing durations were specified associated with the definite redoximorphic features in the soils. In the case studies of rice-growing Ultisols on red earth terrace in northwestern Taiwan, the optimum durations of saturation and reduction were about 50% of the year in the formation of redoximorphic features. This anthraquic condition could promote the formation of the most contrasting redoximorphic features associated with plinthites. The Free Fe contents was generally much more than Mn in the soil solids, but the Mn concentration was much more than Fe in soil solutions. It is easier for Mn than Fe to correlate with the contemporary concentration in soil solution and redoximorphic features.

On one hand considered by soil quality and food security in rice, heavy metal contamination is the main issue in rice production of Taiwan. On the other hand by rice market status, changing the land use from paddy soils into non-waterlogged cropping has some problems, particularly under the pressure of Taiwan involved in World Trade Organization. Irrigation water for rice production in Taiwan have been contaminated by illegal discharges of industrial and livestock wastewater in affecting the paddy soil qualities by heavy metals (Cd, Cr, Cu, Ni, Pb and Zn). According to the regulation of pollutant in 'Soil and Groundwater Remediation Act of Taiwan', the total seriously contaminated area by heavy metals is more than 300 ha, especially for Cd contamination of rice in Taiwan. Due to the special profile morphology and hydrology of paddy soils, dilution by deep plowing and acid washing are two major remediation technologies applied on the contaminated sites with field scale. However, the recovery of soil fertilities and ecological functions is needed to be evaluated after remediation.