Geophysical Research Abstracts
Vol. 20, EGU2018-6878-2, 2018
EGU General Assembly 2018

Isotopic technique for salinity management in coastal Viet Nam

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In many coastal areas of Viet Nam, climate change is affecting seawater levels and intrusion impacting livelihood in this region. In the Hai Hau district in the Nam Dinh province in northern Viet Nam, rice yield has been declining in recent years due to increasing salinity in the soil. Farmers practiced a traditional rice cultivation method to produce high-value 'fragrance' rice that is exported to Vietnamese in France. This cultivation drains the rice field near harvesting. The land is then ploughed after harvesting and exposed to the sun for drying as a soil preparation practice for subsequent season. This practice also makes possible for saline water from the deeper soil to move up to the rooting zone affecting rice development.

A hydrogeological study was carried out with the aim to elucidate if the salinity is due to seawater intrusion or farmers' cultivation practice. Based on the stable isotopic composition of oxygen-18 (δ^{18}O) in the irrigation water and the local precipitation; as well as the pore-soil water chloride concentration within the root zone, and its relationship between concentrations of exchangeable cations in pore-soil water, the study revealed that the tide did not affect the groundwater table in the root zone, indicating that seawater was not intruding into the shallow aquifer in the study region. The change in oxygen-18 in pore-soil water during the meteoric year was similar to that of the local precipitation and in between the two rice seasons, however, the oxygen-18 composition in pore-soil water became more enriched compared to this signature during the rice cultivation period. Chloride concentration in pore-soil water also did not change much with time. The sodium exchangeable concentration in pore-soil water increased during the farming period, indicating that salinity in the water within the root zone of rice paddies in the study region was a result of the process of salt migration/diffusion from the sediment/soil pores and the Ca-Na cation exchange but not the result of salt intrusion. It appeared that the traditional irrigation practice draining all surface water before rice harvest and then cleaning up the field by cutting straw and burning it facilitated evaporation of soil water and maintains salinity within the root zone.

An alternative irrigation practice including not draining the irrigation water from the field, not clearing the straw after rice harvest was experimented. It is hypothesized that by this way the salinity in the pore-water could diffuse downwards by gravity thus reduces the concentration of salinity in water within the root zone. The new farming practice resulted in a slight increase (5%) in the yield of rice in the experimental field in subsequent seasons. The improvement of the rice yield was not so much because the rice variety used is a traditional type. However, to the local farmers this is sufficient for them to earn an amount sufficient to compensate for their fertilizer expenses and on the irrigation tax.