Stable isotopic composition of rice (*Oryza sativa* L.) grain: An indicator of growing season stress

RITIKA KAUSHAL[1] AND PROSENJIT GHOSH[1*2]

[1]Centre for Earth Sciences, Indian Institute of Science, Bangalore 560012, India (*Correspondence: pghosh@ceas.iisc.ernet.in)

[2]Divecha Centre for Climate Change, Bangalore 560012, India

Rice (*Oryza sativa* L.) grain organic matter cultivated below mean sea level in Kuttanad wetland, on the southwest coast of India, was investigated for oxygen and carbon isotope compositions ($\delta^{18}O$, $\delta^{13}C$). Rice is cultivated in this wetland during two seasons: wet and dry. River action supplies fresh water and promotes high relative humidity condition during wet season while during dry season the hydrological condition favours sea water intrusion and low relative humidity. The cereal plant is thus subjected to abiotic stresses of water salinity and relatively high vapour pressure deficit during the dry season. The study demonstrates the ability of stable isotope technique to capture information of the environmental conditions prevalent during the growing seasons.

Mature rice grains sampled were harvests of the wet season of 2012 and dry season of 2013 from rice fields located at the northern and southern boundary of Vembanad lake- the major water body of the wetland and seasonally affected by sea water intrusion. The average (±sd) $\delta^{18}O$ value for the rice grain bulk organic matter (OM) measured on the samples from harvest of wet season was 23.4±1.6‰ (n=12) as compared to 29.1±1.0‰ (n=12) measured for the dry season. $\delta^{13}C$ values of these samples recorded average (±sd) values of 28.7±0.22‰ for wet season as compared to -27.4±0.34‰ measured for the dry season. A mechanistic model [1] was used to resolve the contribution of source water $\delta^{18}O$ and relative humidity on the $\delta^{18}O$ of rice grain OM. The predicted values for $\delta^{18}O$ in rice OM matched well with the observed values and 56% of the observed variation was estimated to have been driven by change in relative humidity.

The seasonal relative humidity condition induced stress in the rice plants which was recorded both in the $\delta^{18}O$ and as drop in carbon isotope discrimination values.

[1] Barbour *et al*. (2004) *Oecologia*, **138**, 426–435.