

## **Assessment of water sources to plant growth in rice based cropping systems by stable water isotopes**

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Rice is one of the most water-consuming crops in the world. Understanding water source utilization of rice will help us to improve water use efficiency (WUE) in paddy management.

The objectives of our study are to evaluate the isotopic compositions of surface ponded water, soil water, irrigation water, groundwater, rain water and plant water and based on stable water isotope signatures to evaluate the contributions of various water sources to plant growth (wet rice, aerobic rice and maize) together with investigating the contribution of water from different soil horizons for plant growth in different maturity periods during wet and dry seasons. Finally we will compare the water balances and crop yields in both crops during both seasons and calculate the water use efficiencies. This will help to identify the most efficient water management systems in rice based cropping ecosystems using stable water isotopes.

Soil samples are collected from 9 different depths at up to 60 cm in vegetative, reproductive and matured periods of plant growth together with stem samples. Soil and plant samples are extracted by cryogenic vacuum extraction. Root samples are collected up to 60 cm depth from 10 cm intercepts leading calculation of root length density and dry weight. Groundwater, surface water, rain water and irrigation water are sampled weekly. All water samples are analyzed for hydrogen and oxygen isotope ratios ( $d18O$  and  $dD$ ) using Los Gatos Research DLT100. Rainfall records, ground water level, surface water level fluctuations and the amount of water irrigated in each field will be measured during the sampling period.

The direct inference approach which is based on comparing isotopic compositions ( $dD$  and  $d18O$ ) between plant stem water and soil water will be used to determine water sources taken up by plant. Multiple-source mass balance assessment can provide the estimated range of potential contributions of water from each soil depth to root water uptake of a crop. These evaluations will be used to determine the proportion of water from upper soil horizons and deep horizons for rice and maize in different maturity periods during wet and dry seasons. Finally we will estimate the influence of groundwater and surface water by irrigation water and/or by precipitation. First results of the sampling during the wet season 2015 will be presented.