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Physiological Responses of Lowland Rice Cultivars to a Water Saving Irrigation System

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Abstract

With increasing water scarcity and climate variability the demand for water saving crop production is growing. Irrigated rice is one of the largest consumers of fresh water resources.

In Senegal, rice is the most important cereal and its consumption is steadily increasing. In the Senegal River Delta and River zone irrigated rice is grown under Sahelian climatic conditions with an annual rainfall of less than 400 mm. Since irrigation water is pumped from the river to the fields, fuel is an important expense and a reduction of irrigation water would lead to a decline of production costs.

Saturated soil culture (SSC) is one option to reduce the irrigation water input. Soil is kept close to saturated conditions to reduce water losses due to evaporation, percolation and seepage compared to flooded fields. Former studies reported slight yield losses, but also water savings up to 50 %. So far little work has been done on physiological responses commonly associated with water deficits such as reduction in photosynthetic activity and transpiration.

For this study 10 varieties were selected representing the genetic variation in terms of duration, stress tolerance and water use patterns. For SSC, fields were kept under saturated conditions until panicle initiation followed by flooding until two weeks before harvest. Water inflow (irrigation, precipitation) and water loss (transpiration, evaporation, percolation) were determined, variety specific canopy properties, crop growth, photosynthesis, stomatal conductance, leaf chlorophyll content and leaf area were measured and compared to results obtained in fields irrigated traditional way. The aim of the study is the physiological characterisation of genotypic traits enhancing water saving management practices for irrigated rice. Experiments continue in bi-monthly staggered planting dates on two different sites to assess the seasonal variation in physiological and phenological responses to the water saving management practice. First results will be presented and the potentials and risks of saturated soil culture in the Sahel will be discussed.

Keywords: Climate change, genotype adaptation, water saving rice, water use efficiency