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# Whole-Plant Gas Exchange Characteristics of a Super Dwarf Rice Genotype

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**Abstract**

Gas exchange measurements are not only an effective tool to capture a plant's biological status *in vivo*, but in addition, they can be used to gain essential insights into numerous physiological mechanisms. Most frequently, these measures are carried out on single leaves clamped into a measuring cuvette in whole or in part, while the basic environmental factors are kept under control. However, a crucial feature of plant stands is a microclimatic gradient through consecutive horizontal canopy layers. The slope and degree of this gradient depend on the composition of the bulk atmosphere and its coupling to the canopy as well as on several characteristics of the canopy itself. Hence, the $CO_2$ and water fluxes measured on single leaf basis do not necessarily represent the full spectrum of canopy-atmosphere interactions, and possible feedback mechanisms of the $CO_2$ and water fluxes driven by the canopy itself are in fact neglected. With the aim of measuring gas exchange of rice on plant level in response to varying environmental conditions, we developed a measuring cuvette of sufficient size, which can be connected to control units of commercially available gas exchange systems. The system consists out of an air tight transparent acrylic glass tube with connections for incoming and outgoing air. All measurements are carried out with plants of a super dwarf rice variety that is of extremely small size and shows an excessive tillering behaviour, leading to a dense canopy structure with a distinct microclimate. Data about whole-plant responses to changes in the aerial environment will be presented together with the operation principles and the basic technical design of the system. Implications of the partly aerial and energetic decoupling of the plant from the environment for data interpretation will be highlighted. Furthermore, the presented data will be discussed in an agro-ecological context.

**Keywords:** Decoupling coefficient, gas exchange, rice

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