



Tropentag, September 17-19, 2013, Stuttgart-Hohenheim  
“Agricultural development within the rural-urban continuum”

## Effects of Light Quality and Direction on Growth and Development of Rice

NASIM FATTAHI, MARC SCHMIERER, FOLKARD ASCH

*University of Hohenheim, Inst. of Plant Production and Agroecology in the Tropics and Subtropics, Germany*

### Abstract

Future increase in food demand challenge agricultural research to explore alternative production methods that contribute to productivity, sustainability, and reduce environmental risks. Although successful methods have been developed to cultivate plants in artificial and controlled production systems, little is known about effects of light quality in combination with direction and distribution on the photobiology of rice.

LED-based light sources are easily dimmable and can thus be used to adjust light quantity in artificial plant production systems. Furthermore, due to their high scalability, they can be integrated into smaller units located inside or under the canopy in order to manipulate directional lighting. Our research focuses on studying the effects of the light quantity and quality on photobiology and morphology of rice genotypes. In a first step, we determined the light requirements of rice plants in a single plant growth system. Subsequently, the light quantity was split and was provided to the plants in equal shares from above and below. For the below canopy light source, effects of light quality were examined.

The experimental system consisted of planting tubes (15 cm diameter) lined on the inside with highly reflective foil. Each tube was sealed with a lid consisting of a ventilator with a heat sink and a single white LED. This combined system provides a continuous airflow to the plant and that cooling to the LED. The LEDs for below plant lighting were thermally coupled to heat sinks that were immersed into the nutrient solution. To maintain a constant root zone temperature, the nutrient solution in turn tempered with a water cooler.

Parameters examined were leaf appearance rate, number of tillers, leaf area, biomass, biomass partitioning (root/shoot, leaf/stem) and chlorophyll density under different light quantities and light directions.

The effects on rice photosynthetic efficiency as well as on growth and morphology will be discussed in relation to the light quality and illumination direction provided to the plants.

**Keywords:** Indirect radiation, LED, light quality, lighting direction, rice