Tropentag, September 17-19, 2018, Ghent

"Global food security and food safety:
The role of universities"

Effects of Day and Night Temperature on Rice Photosynthesis

Kristian Johnson, Sabine Stürz, Marc Schmierer, Folkard Asch

University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Germany

Abstract

It has been shown that the yield of rice (*Oryza sativa*) decreases in response to higher night temperatures. Projected temperature increases due to climate change are expected to be more pronounced at night. As the primary staple for more than half of the world's population, a decrease in rice yield could pose a serious threat to food security. However, the physiological response of rice to night temperature is not yet fully understood. Studies indicate both positive and negative effects of high night temperatures on CO_2 assimilation and growth in rice. It has also been shown that the physiology of rice during the day is also affected, as warmer nights lead to higher leaf conductance and net assimilation rates during the day. It is unclear if the day response is part of a mechanism to compensate for depleted carbohydrate pools within the leaves from night-time respiratory CO_2 losses. A day-time increase in net assimilation, comprised of assimilation, day respiration, and photorespiration, implies changes in the photosynthetic complex to either reduce CO_2 releasing processes or an increase in assimilation.

In the presented study, groups of 5-week-old IR64 rice plants were exposed to six different two-week long day and night temperature treatments in a growth chamber. After one week of adjustment to the temperature treatment, photosynthetic parameters, such as assimilation rate, stomatal and mesophyll conductance, and respiration and growth parameters, such as leaf area, biomass, tiller number were measured among sampled plants. During the temperature treatment, the youngest developed leaf on the main tiller was shaded for 40 hours, and on re-exposure to light assimilation was measured. In both temperature and shade treatments, leaf samples were taken to determine levels of non-structural carbohydrates and active Rubisco content.

Keywords: Climate change, mesophyllic conductance, night temperature, photosynthesis, photorespiration, respiration, rice

Contact Address: Folkard Asch, University of Hohenheim, Inst. of Agric. Sci. in the Tropics (Hans-Ruthenberg-Institute), Garbenstr. 13, 70599 Stuttgart, Germany, e-mail: fa@uni-hohenheim.de