

【Workshop 2】 Crop Production under Heat Stress
Responses of Rice Grain Setting and Filling
under High Temperature and High CO₂

Hidemitsu Sakai, Weiguo Cheng, Toshihiro Hasegawa

National Institute for Agro-Environmental Sciences, Japan

(hsakai@niaes.affrc.go.jp / Fax: +81-298-38-8199 / Phone: +81-298-38-8205)

Atmospheric CO₂ concentration ([CO₂]) has been increasing since the industrial revolution at the middle of eighteen century. IPCC reported that [CO₂] is expected to reach 540~970 ppm by the end of this century with global mean surface temperature increasing by 1.1-6.4 °C relative to 1980-1999 mean temperature. Crop production will be affected by projected changes in the global climate, such as increases in atmospheric [CO₂], increased surface temperatures, and more frequent occurrences of extreme climate events. According to IPCC assessment reports, crop productivity is projected to increase slightly at mid to high latitudes for local mean temperature increases of up to 1-3 °C depending on the crop, and then decrease beyond that in some regions. At lower latitudes, in which high portion of the total planted area of rice exists, crop productivity is projected to decrease for even small local temperature increases (1-2°C). Since CO₂ is a substrate of plant photosynthesis, increasing [CO₂], in general, will have a positive impact on crop production, by what is known as the CO₂ fertilization effect. On the other hand, negative impacts on crop production are projected due to increases in temperatures. Rice yield will be decreased due to shortened growth period, increased spikelet sterility, and decreased grain fertility. But, the mechanism and the extent of the effects of climate change on rice growth and yield still remain uncertain. Many experimental and modeling studies have been conducted to predict the impacts of these changes on rice production. To make an assessment with less uncertainty and an adaptation strategy to climate change, it is needed to further understand to the effects of high temperature and [CO₂] on rice, especially on its yield formation processes such as grain setting and filling. In this study, we will discuss the effects of high temperature (especially at night) and high [CO₂] on rice grain setting and filling by using results of some chamber experiments.