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Changes in the photosynthetic efficiency of sugarcane (*Saccharum sp.*) when fumigated with CO_2 and O_3

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Global CO_2 concentrations have been rising during the past few decades and it is expected that these levels will reach 550 ppm by next century. Together with rise in global CO_2 levels is the increase of surface O_3 due to increase in anthropogenic sources. Surface O_3 is regarded as a very serious air pollutant, causing damage to all forms of life. Crops are especially vulnerable to O_3 stress and significant loss to yields have been reported. In this study, we investigated the effect of elevated CO_2, O_3 and a combination of elevated CO2 and O3 on the light dependent photosynthetic reactions of sugarcane. Two sugarcane varieties, N31 and NCo376 were exposed to 750 ppm CO_2, 80 ppb O_3 and a combination of 750 ppm CO_2 and 80 ppb O_3 in open-top chambers. Chlorophyll a fluorescence analysis was used to investigate the effects on the light dependent photosynthetic reactions. Elevated CO_2, O_3 and the combination treatment, all effected the photosynthetic efficiency, but the two varieties responded differently to these conditions. Analysis of the OJIP kinetics indicated that elevated CO_2 resulted in an early decline in the ability of the plant to create a charge separation in the photosynthetic reaction centers of PSII of NCo376. Electron transport between PSII and PSI of NCo376 was also reduced, whereas these reactions of N31 reduced much later. The effect of O_3 was less dramatic, but the results did indicate that N31 had a higher tolerance level to O_3 compared to NCo376. A combination of 80 ppb O_3 and 750 ppb CO_2 does indicate that elevated levels of CO_2 can ameliorate the negative impacts of O_3 on the photosynthetic efficiency.

Biography

Jacques M Berner obtained his PhD degree in 2006 at the University of the Free State, Bloemfontein, South Africa. He worked for several years in the private sector, where he developed nutrient foliar applications and the incorporation of plant growth regulators into these products. At the end of 2007, he was appointed as a Lecturer in Plant Physiology at the North-West University, Potchefstroom, South Africa and was promoted to Senior Lecturer in 2015. He specializes in the use of chlorophyll a fluorescence as a tool to evaluate plant health. His current research activities involve the quantification of the effects of climate change and air pollution on crops.

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