

# High Temperature Induced Oxidative Stress Reduces CO<sub>2</sub> Fertilization Effect in Sensitive Rice Genotypes

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**Abstract**—Two contrasting rice cultivars namely Nagina 22 (heat tolerant check) and a popular variety, Swarna were subjected to ambient and high temperatures ( $3^{\circ}\text{C}\pm 1$ ) in combination with ambient and elevated CO<sub>2</sub> (570 $\pm$ 20 ppm) environments in open top chambers (OTCs) to assess the individual and combined effects of elevated temperature and CO<sub>2</sub> on panicle weight and grain quality. High temperature (HT) stress reduced the panicle weight, tiller no., brown rice yield, non-structural carbohydrates (NSC), organic carbon (C) concentration and carbon/nitrogen (C/N) ratio. However, all these traits showed reverse response to elevated CO<sub>2</sub> (EC) levels of air in both rice cultivars. Under combined effect of high temperature (HT) and elevated CO<sub>2</sub> (EC), the tolerant genotype, N22 was more responsive towards CO<sub>2</sub>. It was observed that a direct correlation exists between reactive oxygen species (ROS) and qualitative output of rice as the lipid peroxidation in Swarna was higher than N22. The tolerant cultivar N22 with better and efficient antioxidant enzyme system was found more stable under HT by keeping ROS at lower levels due to which both the qualitative and quantitative parameters improved under combined effect of HT and EC owing to its tolerance against heat stress. Thus, CO<sub>2</sub> fertilization effect is greatly influenced by HT which makes it necessary for high yielding varieties like Swarna to gain more stability under heat stress to harness the benefits of rising CO<sub>2</sub> in changing climatic scenarios.

**Keywords:** High temperature, elevated CO<sub>2</sub>, brown rice yield, non –structural carbohydrates, organic carbon, panicle weight, tiller no., reactive oxygen species, lipid peroxidation