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Nutrient partitioning of wheat (*Triticum aestivum* L.) grain is influenced by elevated CO_2 and heat stress

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Carbon dioxide concentration [CO_2] in the atmosphere has been progressively rising from approximately 280 µmol/mol during the pre-industrial era to a current average of approximately 410 µmol/mol and is predicted to increase by up to 500-1000 µmol/mol by the year 2100. Elevated atmospheric CO_2 (eCO_2) causes warmer temperatures and more frequent droughts, which will adversely affect wheat grain yield and quality, thus challenging the nutrient security of mankind. This study investigated how eCO_2 influences micronutrient concentration and its partitioning within the grain under different temperature regimes at the Australian Grains Free Air CO_2 Enrichment (AGFACE). The wheat cultivar, Zebu was grown under ambient CO_2 (a[CO_2]) (~389 µmol/mol) and eCO_2 (~550 ± 10% µmol/mol) at two different times of sowing (TOS), early TOS and late TOS to be exposed to different temperatures during reproductive growth. At each given condition, elemental concentrations of the grain were determined in the endosperm and aleurone layer separately. The concentrations of micronutrients were measured using ICP-AES and data were analyzed by Genstat 18th edition. Zn, Fe and Ca concentrations in both endosperm and aleurone layer were significantly suppressed by e[CO_2] at $P<0.05$ with predominant changes in Fe in the aleurone layer (early TOS, a[CO_2]; 118.62 mg/kg and e[CO_2]; 98.57 mg/kg) and endosperm (early TOS, a[CO_2]; 50.48 mg/kg and e[CO_2]; 45.27 mg/kg, late TOS a[CO_2]; 41.06 mg/kg and e[CO_2]; 39.47 mg/kg). Late sowing treatment significantly reduced nutrient concentration in the endosperm layer (Zn-19.6%; Fe-10.3%; Ca-18.9%) ($P<0.05$). The results of this study indicate that an elevated CO_2 level has significantly reduced the wheat grain quality, particularly in the partitioning of nutrients between the endosperm and aleurone layer.

Keywords: *wheat; elevated CO_2, heat stress, nutrient quality, aleurone layer*

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