
Leaf Proteome Responses of Wheat (*Triticum aestivum* L.) to Elevated Atmospheric Carbon Dioxide during Early Vegetative Growth

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The impact of rising atmospheric carbon dioxide [CO₂] on the proteome of the growing leaf blade was investigated using two winter wheat cultivars: Kukri and RAC875, in the early vegetative stage. Two wheat genotypes were grown at ambient (400 μmol mol⁻¹) and elevated (700 μmol mol⁻¹) [CO₂] in controlled environmental conditions. At 42 days after planting (DAP), total dry mass, carbon and nitrogen content, and gas exchange measurements were determined in both CO₂ treatments and data were analysed using SPSS statistical software version 23 (IBM, Armonk, NY, USA). Elevated [CO₂] increased the rate of photosynthesis and biomass production in Kukri by 16.4 % and 32.6 %, respectively, when compared with 20 % and 48% in RAC875. The nitrogen and protein concentrations in the expanding leaf blades of both cultivars determined through the CN analyzer were high, and RAC875 showed the highest nitrogen percentage (56.3%). Results of the comparative proteomics analysis carried out through liquid chromatography-mass spectrometry (LC-MS/MS) analysis showed that leaf proteome responses at elevated [CO₂] were genotype-dependent, and the proteome composition has been altered at elevated [CO₂]. Most of the differentially expressed proteins at elevated [CO₂] belonged to carbon metabolism, energy pathways, protein synthesis, and cell cycle functions. Additionally, several proteolytic enzymes involved in post-translational modifications of proteins, antioxidant enzymes, and molecular chaperones showed a noteworthy upregulation at elevated [CO₂] in both cultivars. These findings suggest that photosynthetic stimulation and lower stomatal conductance are not the only factors governing plant growth at elevated [CO₂]. In response to increased sugar supply to developing leaves at elevated [CO₂], other key regulatory processes such as cell cycle function, protein modifications, and cell redox homeostasis tend to be modified, significantly altering growth responses at the whole plant level.

Keywords: Carbon metabolism, Expanding leaf blade, Leaf proteome, Plant growth, Protein