28th Conference Asic 2021
From 28 June to 1 July 2021

Influence of the high atmospheric CO_2 concentration ↑[CO_2] and water deficit on leaf secondary metabolites concentrations in *Coffea arabica* L.

S5-P-05

Ingrid C.A. Catarino[1,2], Gustavo B. Monteiro[2], Luce M. B. Torres[2], Douglas S. Domingues[1], Danilo C. Centeno[3] , Emerson A. Silva[2]

[1]Group of Genomics and Transcriptomes in Plants, São Paulo State University, Rio Claro, SP, Brazil; [2]Research Center in Physiology and Biochemistry, Botany Institute, Sao Paulo, SP, Brazil; [3]Center for Natural and Human Sciences, Federal University of ABC, Sao Bernardo do Campo, SP, Brazil

e-mail: ingrid.catarino@unesp.br

Introduction

The increased atmospheric CO_2 concentration (↑[CO_2]atm) is not an isolated effect, being accompanied by increases in air temperature and changes in precipitation patterns. In coffee producing regions, drought is considered the main factor affecting growth and coffee production. Coffee has a broad chemical composition, highlighting caffeine and 5-chlorogenic acid (5-CQA), which act in plant defense responses and are important secondary compounds in the final beverage quality. The aim of this work was to evaluate the interaction between ↑[CO_2] and water deficit on photosynthesis and caffeine and 5-CQA in Arabica coffee.

Materials/Methods

C. arabica L. cv. Catuaí IAC 144 plants were grown in an Open Top Chamber facility at the Botany Institute, SP, Brazil, under ambient (≅400ppm – CO_2amb) and high (≅800ppm – CO_2high) atmospheric CO_2 concentration. Leaf water potential (Ψwf) and gas exchange were measured using a pressure bomb type Scholander and a portable Infra-Red Gas Analyzer respectively. 5-CQA and caffeine were analyzed using a High Performance Liquid Chromatography (HPLC/UV-DAD) system.

Conclusion/Perspectives

Higher [CO_2] had a positive effect on photosynthetic rates mitigating the possible effects of drought. Water deficit and ↑[CO_2] interaction influenced the accumulation of 5-CQA and caffeine. Field experiments will be carried out to evaluate the influence of these changes on coffee berries composition.

FAPESP Project number: 2018/08042-8

Results/Discussion

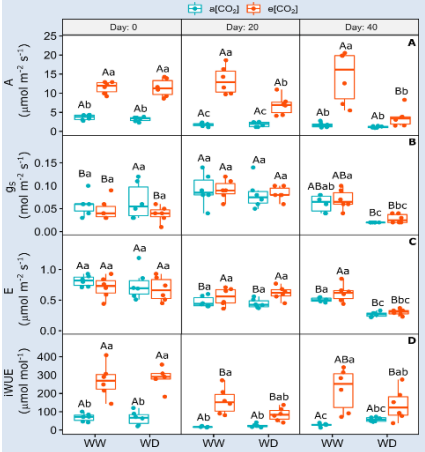

Figure 2. (**a**) Net CO_2 assimilation, (**b**) stomatal conductance, (**c**) transpiration rate and (**d**) intrinsic water use of *C. arabica* plants exposed to ambient [CO_2] under well-watered and water deficit (a[CO_2]+WW and a[CO_2]+WD) and elevated [CO_2] under well-watered and water deficit (e[CO_2]+WW and e[CO_2]+WD

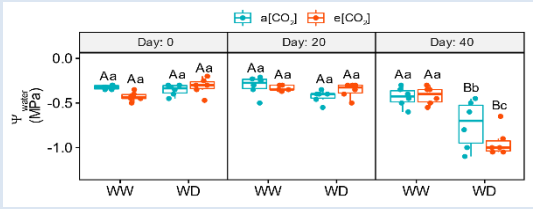

Figure 1: Leaf water potential of *C. arabica* plants exposed to ambient [CO_2] under well-watered and water deficit (a[CO_2]+WW and a[CO_2]+WD) and elevated [CO_2] under well-watered and water deficit (e[CO_2]+WW and e[CO_2]+WD)

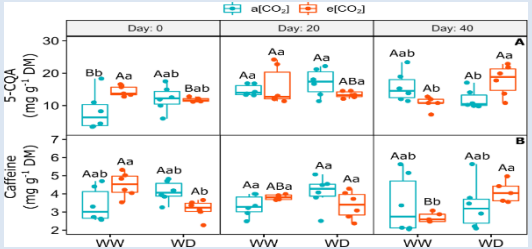

Figure 3: (**a**) Content of 5-O-caffeoylquinic acid and (**b**) caffeine in leaves of *C. arabica* plants exposed to ambient [CO_2] under well-watered and water deficit (a[CO_2]+WW and a[CO_2]+WD) and elevated [CO_2] under well-watered and water deficit (e[CO_2]+WW and e[CO_2]+WD)

Photosynthesis was greater in coffee plants grown under high CO_2 emissions, even under water deficit and when compared to other treatments. 5-CQA and caffeine increased in ↑[CO_2] combined and in water deficit over 40 days. The concentrations of 5-CQA also increased by ↑[CO_2] and under daily irrigation conditions, but decreased significantly in CO_2amb and water deficit treatment.