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SP1-27

Physiological Responses of *Coffea* spp. to Elevated Atmospheric CO_2: Impacts on Primary Production and Water Use Efficiency

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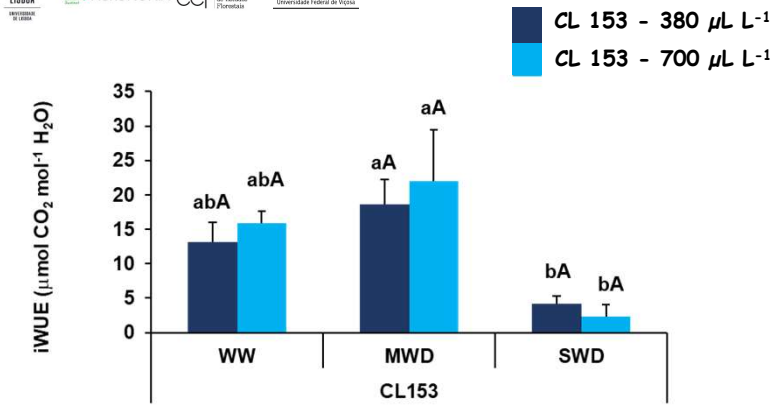
Rationale:

Water use efficiency (WUE) is a critical factor for the sustainability of primary production and the physiological performance of agricultural crops. The anticipated increase in atmospheric CO_2 concentration (eCO_2) may profoundly influence WUE-related processes in *Coffea* spp., affecting both the plant's water balance and C-assimilation.

Methods:

- *Coffea canephora* cv. Conilon (Clone 153)
- Grown under well-watered (WW) conditions for **7 years**
- [RH (70%), irradiance (*ca*. 750 µmol m^{-2} s^{-1}), photoperiod (12 h), temperature (25/20°C, day/night), and air [CO_2] (380 µL CO2 L^{-1}, aCO_2, or 700 µL CO2 L^{-1}, eCO_2)]
- Mild (MWD) (predawn water potential, Ψpd, -1.5 to -2.5 MPa) and severe (SWD - Ψpd < -3.0 MPa) water deficit.

The WUE (net C-assimilation per unit of water consumed through transpiration, Pn/E), was assessed through leaf gas exchanges.



Results:

Plants grown under eCO_2 showed a concomitant decline of E and rise in Pn, in WW and MWD plants, as compared with aCO2 plants, resulting in an increased WUE. Under SWD, WUE greatly declined at both air [CO2] due to strong stomatal closure that strongly limited Pn.

Conclusions & Perspectives:

Under moderate drought, eCO_2 had a positive effect on WUE by enhancing the balance between water loss and C-gain mainly due to greater Pn. However, climate change is expected to increase the frequency of extreme drought events, where near-complete stomatal closure and a drastic reduction in Pn will occur. In these severe conditions, eCO_2 alone will be unlikely to mitigate the negative impacts on WUE, despite the strengthening of plant acclimation mechanisms (1).

References:
1. Semedo et al. 2021. Tree Physiology, 41, 708-727. doi: 10.1093/treephys/tpaa158.

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