

Water Stress Effects on Leaf Photosynthesis and Diffusive Conductances of Three *Coffea* Species (*C. Arabica*, *C. Canephora*, *C. Liberica*)

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ABSTRACT

A comparative study of leaf water relations to photosynthetic rates was conducted on three economic coffee species (*arabica*, *canephora*, *liberica*) to investigate their CO₂ diffusive limitations on leaf photosynthesis under water stress conditions. Photosynthetic rates of *arabica* leaves reduced gradually with decreasing leaf water potentials, while in both *canephora* and *liberica* leaves there were sharp declines in photosynthetic rates as their leaves wilted due to dehydration. A 50% inhibition of normal photosynthetic rates was measured at leaf water potential of about -2.6 MPa, -1.7 MPa and -2.1 MPa in *arabica*, *canephora* and *liberica*, respectively. Decreases in photosynthesis of all three species were associated with lowered stomatal and mesophyll conductances by wilting their leaves, which could suggest a functional linkage between mesophyll photosynthesis and stomata. We also graphically estimated non-stomatal limitations on decreases in photosynthesis from leaf internal CO₂ concentration (C_i)-photosynthetic rate response curves measured with turgid and wilted leaves. In all species the inhibition of light-saturated photosynthesis at leaf water potentials around -1.0 MPa, measured at ambient CO₂ concentration, was equally attributable to stomatal and non-stomatal limitations, but the further inhibition below -2.0 MPa was caused solely by non-stomatal limitation which led to a lowered activity of mesophyll photosynthesis.