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Water-use efficiency of new *Coffea arabica* F1 hybrids undergoing different water availability in an agroforestry system

Sarzynski Thuan[1, 2, 3] (thuan.sarzynski@cirad.fr), Marraccini Pierre[1, 2, 4], Etienne Herve[1, 2], Nguyen Chang[3], Nguyen Hai[3], Nguyen Trung[3], Nguyen Kim[5], Nguyen Van[3], Lu Yen[3], Luu Quyen[6], Nguyen Hung[3], Rigal Clement[5, 7], Vaast Philippe[5, 8]

[1] *DIADE, CIRAD, Montpellier, France* ; [2] *DIADE, University Montpellier, CIRAD, IRD, Montpellier, France* ; [3] *NOMAFSI, Son La, Vietnam* ; [4] *AGI, Hanoi, Vietnam* ; [5] *ICRAF, Hanoi, Vietnam* ; [6] *NOMAFSI, Phu tho, Vietnam* ; [7] *ABSYS, CIRAD, Montpellier, France* ; [8] *Eco&Sols, CIRAD, Montpellier, France*

RATIONALE

Previous studies have shown that new F1 hybrids of *Coffea arabica* produce higher yield than commercial varieties in both full-sun and agroforestry systems (AFS). However, the physiological and molecular mechanisms controlling their improved performances are still largely unknown. Different water use strategies, such as a trade-off between maintaining photosynthesis while reducing water loss, have been described in drought resistant varieties. We hypothesize that a capacity to better regulate photosynthesis and water loss allow F1 hybrids to recover quicker from the dry season. To test this hypothesis, a field trial submitting these hybrids to different water regimes was set-up in the NOMAFSI station (Son La).

METHODS

As part of the H2020 BREEDCAFS European project, Starmaya, Centroamericano (H1) and Mundo Maya (H16) F1 hybrids, along as Marsellesa and a local Catimor pure lines used as controls, were planted (2018) in AFS with *Leucaena leucocephala* and subjected to three water treatments: rain-fed, water-suppressed and irrigated. The experiment followed a 3x4 design with the three treatments repeated in 4 blocks. Each block included a row of 8 plants by accession. Probes were installed in trunks to constantly monitor sap-flow. Photosynthesis, stomatal conductance, water potential, leaf area and dry matter content were also measured regularly. Plant reproductive and vegetative growth (fruit number, height, trunk diameter, number of nodes…) were periodically monitored since May 2019. Yield and fruit/leaf area ratio were assessed in 2020. Climate conditions and soil moisture were also monitored.

RESULTS

Irrigated plants had significantly higher leaf water potential, conductance and photosynthesis compared to those rain-fed and water-suppressed. For all agronomic traits, the lowest values were observed for control Catimor. For all accessions, sap-flow, photosynthesis, and conductance dropped down during the dry season in a similar way. However, daily sap-flow was higher for Catimor during the dry season but lower during the rainy season compared to other accessions. On the other hand, Marsellesa and H1 hybrid had a lower sap-flow during the dry season and higher sap-flow during the rainy season.

CONCLUSIONS & PERSPECTIVES

Differences in water use efficiency were observed among the tested accessions. However, no significant differences were observed when comparing photosynthesis and carbon allocation data. Larger differences among treatments and accessions are expected in the coming years. This should give us more insights about coffee F1-hybrids responses to water-stress and prolonged dry season.

References:

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