

## Effect of shading on performances of new Arabica coffee varieties in Northwest Vietnam

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### Rationale:

Coffee-agroforestry systems are known to provide numerous ecosystem services and socio-economic benefits compared to monoculture systems. However, most high-yielding coffee varieties have been bred and selected for optimal performances under full sun conditions, and perform poorly when intercropped with shade trees. Consequently, there is a need to select and test coffee varieties adapted to shaded environment to support the development of sustainable agroforestry systems more adapted to climate change. In line with this objective, we studied the performances of 4 modern Arabica coffee varieties under a shade gradient in Northwest Vietnam.

### Methods:

In 2019, coffee trees belonging to 4 varieties (Catimor, Marsellesa, Starmaya and Centroamericano) were planted in a random block design in 2 trials located in Son La Province, Vietnam. They were intercropped with various fruit trees including macadamia and plums. The present study was conducted in 2022 when coffee trees were already productive. Bud, flower, and fruit counting were carried out in 6 rounds from February to September 2022. Harvest was monitored between October 2022 and January 2023. Shade levels throughout the year were estimated using ShadeMotion to create 3D models of both trials.

### Results:

Under low (<15%) and medium (15-30%) shade conditions, Starmaya and Centroamericano exhibited better performances than Catimor and Marsellesa. They had more flowers, more fruits and ultimately higher yields. Additionally, they displayed stable yields across shade levels ranging from 0 to 30%. Conversely, Marsellesa yields were negatively correlated with shade levels, even under low shade conditions. Under high shade levels (>30%), all 4 varieties experienced a sharp yield decline.

### Conclusions & Perspectives:

The newly introduced Starmaya and Centroamericano hybrid varieties demonstrate higher productivity compared to the widely cultivated Catimor pure line variety. More importantly, this higher agronomic performance extends up to medium shade levels (30%). Promoting these hybrid varieties could therefore facilitate the adoption of agroforestry in the study area, providing that shade levels do not exceed 30%. This shade threshold should be considered in the design of agroforestry models to ensure optimal coffee yields. Conversely, Marsellesa appears to be the variety least suited to shade conditions and should only be recommended for monoculture systems.