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Solar radiation and productivity of coffee trees planted with rubber trees in Southern Brazil

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Introduction

The *Coffea arabica* species, originating from understory forests, tolerates shade well. However, its productivity, in addition to genetic expression, nutrition and health, is also the result of the efficiency in capturing and using photosynthetic radiation. Productivity is maximized when environmental conditions are adequate, especially in relation to the level of shade. In view of this, this study aimed to evaluate the incidence of photosynthetic solar radiation and the productivity of coffee trees grown in tree-based systems and in monoculture.

Materials/Methods

The study was carried out in Londrina, Parana, Southern Brazil (23°21'50.28"S; 51°10'11.89"W; 557 m). The climate of the region is typical Cfa, described as humid subtropical. The experiment consisted of two treatments: coffee trees (*Coffea arabica*) planted with rubber trees (*Hevea brasiliensis*) and coffee trees in monoculture. The rubber trees were planted in rows spaced 16 m apart, parallel to the coffee rows. Between each row of rubber trees, there were six rows of coffee trees.

Results/Discussion

The percentage of shade increased significantly over the years, going from 10.3% in the 5th year of planting to 33.9% in the 8th year of planting, due to the growth of the rubber trees (Figure 1). The productivity per coffee plant was statistically similar in the planted and monoculture systems during this period from the 5th to the 8th year of the experiment, evidencing a good adaptability of the coffee trees to these levels of shade (Figure 2). In heat-sensitive crops such as coffee, the shade provided by rubber trees creates a milder environment with more controlled temperature and humidity, which reduces thermal and water stress, especially in tropical and subtropical regions, where high temperatures and drought can compromise coffee production (Lin, 2007). This shading practice is a sustainable adaptation strategy to rising global temperatures, ensuring the productivity and health of coffee plants in a climate change scenario.

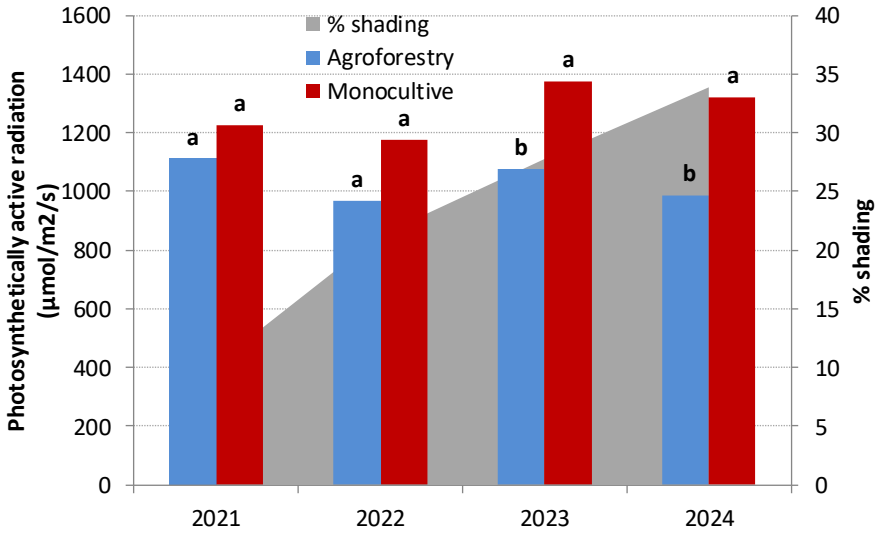

Figure 1: Mean annual photosynthetically active radiation (µmol/m2/s) in coffee trees in agroforestry systems with rubber trees and in monoculture. Londrina, Parana, Southern Brazil, 2021 to 2024.

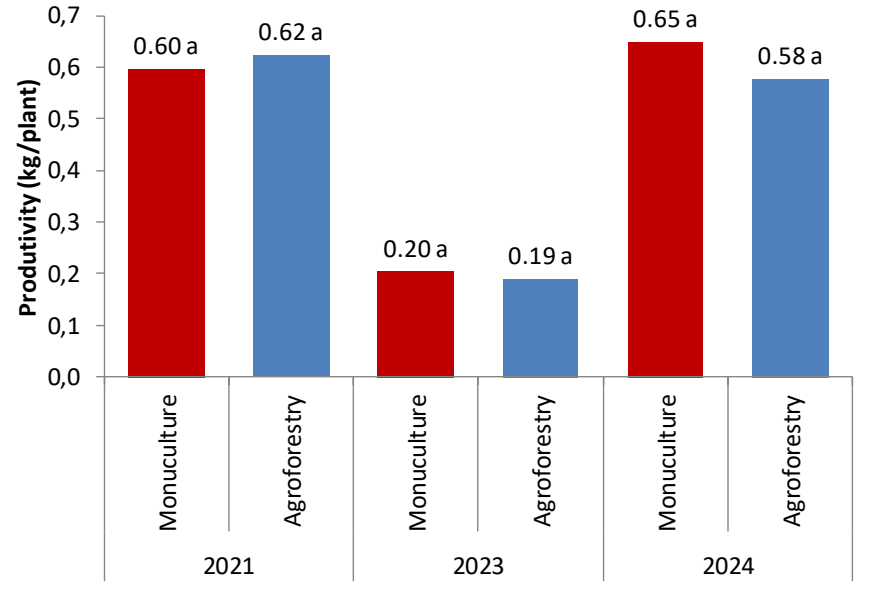

Figure 2: Coffee yield in agroforestry systems with rubber trees and in monocultive. Londrina, 2021, 2023 and 2024 Londrina, Parana, Southern Brazil, 2021 to 2024.

Conclusion/Perspectives

The planting of trees with rubber trees causes favorable changes in the microclimate of the trees, reducing air and soil temperatures and increasing humidity in both. This practice stands out as a sustainable strategy for adapting to climate change, helping to mitigate the impacts of rising global temperatures and extreme events, such as drought.

Reference: *LIN, B.B. Agroforestry management as an adaptive strategy against potential microclimate extremes in coffee agriculture. Agriculture and Forestry Meteorology, v.144, n.1, p.85-94, 2007.*