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Macaw palm-based cropping systems and their potential for the coffee zone of Minas Gerais, Brazil.

Master's Thesis

Agricultural Sciences in the Tropics and Subtropics

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Abstract

Acrocomia aculeata, also called macaw palm, is an oleaginous palm that gained a lot of interest in recent years as a sustainable alternative to oil palm (*Elaeis guineensis*). The oil from the fruits has a high nutritive value, contributing to a healthy human nutrition of the rural population. Macaw palm can be grown under wide climatic conditions and has a great potential for integration into silvopastoral and agrisilvicultural systems. In the southeast states of Brazil, like Minas Gerais, intercropping macaw palm with cash crops like coffee (*Coffea arabica*) could be a more diversified income source for smallholders. However, more research about possible cropping systems is needed.

The objective of the study was to compare different coffee cropping systems with macaw palm-coffee intercropped as one option and a silvopastoral system based on macaw palm as a second. The aim was to find out whether these systems are a valuable alternative and have positive features in terms of water availability, light availability, microclimate and productivity.

The study was conducted on two research stations of the Federal University of Viçosa, Minas Gerais, Brazil. Five cropping systems, (i) coffee monocrop, (ii) coffee intercropped with *Erythrina* shade trees and (iii) coffee intercropped with macaw palm (iv) macaw palm silvopastoral system and (v) macaw palm monocrop were compared. Microclimatic parameters, such as temperature and relative humidity, were monitored. The biomass and the leaf area of macaw palm and coffee were determined. Leaf samples of macaw palm and coffee were taken for $\delta^{13}C$ analysis.

Microclimate variability was reduced in the shaded coffee and shaded pasture. Relative humidity was thereby increased under shade. The light transmission ratio was highest in the unshaded coffee and lowest in the shaded coffee with Erythrina. Coffee in the Erythrina was equally shaded throughout the day, while coffee in the macaw palm plot was unequally shaded. In the silvopastoral system lowest PAR was observed in the three high planting density plots while the two lowest planting density plots had a higher light transmission ratio. Neither coffee nor macaw palm suffered from water stress and $\delta^{13}C$ did not differ. Only the full sun coffee showed slight water stress. Carbon sequestration was highest in the silvopastoral system with high planting density and lowest in the full sun coffee. Ground biomass in the silvopastoral system decreased with increasing planting density of the macaw palm. Average coffee yield from 2010 to 2018 did not differ, but high coffee yield was only biennial achieved in the shaded coffee. Land equivalent ratio was above one in the macaw palm coffee systems.

The macaw palm is a suitable component for agroforestry systems as it diversifies the production system and the systems are more efficient in terms of resource use.