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How Drought Affects Water Use Efficiency and Photosynthesis in the Neotropical Oilseed Palm *Acrocomia aculeata*

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Abstract

Drought affects a wide range of morphoanatomical, physiological and biochemical processes in plants and has a major impact on their growth and development. Hence, it is a substantial limiting factor for crop expansion, further being intensified in the future by global climate change. An immediate plant response to water deficit is the closure of stomata, so decreasing the leaf gas exchange and subsequently the photosynthetic rate.

This can lead in the long run to a decrease in biomass accumulation and yield. Water use efficiency (WUE) is the relationship between accumulated biomass or assimilated carbon and the amount of transpired water. It is so an important ecophysiological indicator to drought stress adaptation of plants, as plants with a high WUE are more resilient to water deficits. *Acrocomia aculeata*, endemic to semi-arid and arid regions of Central and South America, is an agricultural and industrial promising oilseed palm with a tolerance to prolonged drought up to six months. This study aimed to assess water use efficiency, stomatal conductance and photosynthetic rate of Acrocomia ecotypes originating from different climatic regions of Brazil in the dry and rainy season. The study was conducted at the Macaúba Active Germplasm Bank of the Universidade Federal de Viçosa in Araponga, MG, Brazil. Five ecotypes originating from Cerrado, Mata Atlântica and Caatinga regions were selected. Leaf gas exchange and relative leaf water status (RWC) were measured in September 2019 (dry season) and in January 2020 (rainy season). Additionally, climate data and soil moisture content were recorded. Photosynthetic rate and stomatal conductance were reduced in the dry season where humid adapted ecotypes were more affected than arid adapted ecotypes. WUE was 1.5–2 times higher under drought conditions, suggesting an efficient stomatal control of transpiration by *A. aculeata*. This is also reflected in a high RWC during the dry season, being above 85 % in both seasons, considering that soil moisture content was 0.156 m^3 m^{-3} and 0.261 m^3 m^{-3} in September and January, respectively. This suggests that *A. aculeata* is able to acclimate to drought events, however, ecotype differences need to be taken into account.

Keywords: *Acrocomia aculeata*, Brazil, drought, photosynthesis, water use efficiency

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