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“Filling gaps and removing traps
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Canopy Cover Evolution of Banana Plantations: Drought Effects, Diurnal Patterns and Leaf Area Index Relationships

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Abstract

Water shortage is considered the most limiting abiotic factor to banana production, but reliable physiological indicators for stress and irrigation necessity are lacking for banana plants. Canopy Cover (CC) can be used as an indicator of growth, but CC research in banana plantations is lacking. This paper is the first to study the effect of irrigation on CC in banana plantations. Two cultivars (cv), Mchare Huti Green (AA) (HG) and Cavendish-Grand Naine (AAA) (GN), were studied over a full crop cycle for two irrigation treatments: full irrigation (FI) as control, and deficit irrigation (DI) as drought. Soil moisture was measured daily in every cv-treatment plot using TDR sensors. CC was determined through monthly drone images obtained at hourly intervals (between 8 AM and 16 PM) of every cv-treatment plot. Linear mixed models were used to determine the effect of time and treatment on CC, CC growth curves were obtained through non-linear logistic regression. Monthly leaf area index (LAI) values were related to CC to obtain CC-LAI curves. Drought reduced growth rates (r) and CC_{max} values. CC_{max} values for FI were similar in both cultivars (89%), but time to reach CC_{max} was longer in HG (50 WAP) than in GN (32 WAP). CC differences between FI and DI ranged from 2.22% until 17.67% for HG, while differences ranged from -2.5% to 4.5% for GN. Soil moisture values differed significantly in the vegetative stage for HG, explaining this divergence. Diurnally, CC drops occurred on days characterised with a high evaporative demand. CC had a maximum in the morning, dropped to a minimum around noon, and climbed again in the afternoon, with drops being more significant in DI than FI plots, when moisture values differed significantly. Relating CC and LAI, showed CC-LAI curves followed an exponential curve reaching maxima CC at LAI 4 for both cvs. CC curves are cultivar dependent, and CC is reduced by a lack of soil moisture. Comparison with optimal CC curves may pinpoint stress periods. On a daily basis, relative CC drops cannot be used to assess drought stress, as its severity is more influenced by weather parameters.

Keywords: Agronomy, canopy cover, drought stress, growth model, leaf area index

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