University of Hohenheim

Institute of Agricultural Sciences in the Tropics (Hans-Ruthenberg-Institute)

Section: Management of Crop Water Stress in the Tropics and Subtropics

Effects of microclimate on field water dynamics in different land use systems of the Brazilian Cerrado

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II Abstract

The transformation of the Cerrado biome in Brazil into arable land left large areas degraded. In order to restore agricultural productivity, integrated systems with and without tree component were developed as a viable option for Brazilian farmers.

Measuring evapotranspiration is a fundamental method that allows to determine the water use of plants. Evapotranspiration is determined by soil and microclimatic factors. As the tree component of Integrated Crop Livestock Forestry (ICLF) productions systems will affect the microclimate, so does it influence the water balance of the system. The goal of this study was to determine to which extent the production systems of Continuous Pasture (CP), Integrated Crop Livestock (ICL) and ICLF vary in microclimate and evapotranspiration. Finally, the results were set into relation to the native vegetation of the Cerrado.

In this research, the microclimate was determined by the following parameters: wind speed, air temperature, relative air humidity, radiation and precipitation. Evaporation and evapotranspiration were measured using micro lysimeters.

Wind speed was lowest in the Cerrado biome due to the high tree density. A four meter spacing of the trees in the ICLF systems was not enough to have a significant impact on wind speed. Grass canopy density significantly affected the wind speed inside the grass canopy. Air temperature was lowest in the Cerrado but no significant differences were found between the other land-use systems. Relative air humidity was highest in the Cerrado biome but no significant differences were found between the other land-use systems. Tree canopy in the Cerrado was found to block between 85 and 90% of the incoming solar radiation. The tree rows in the ICLF systems blocked 40 - 60%. Cloudiness increased the percentage of radiation penetrating the tree canopy. Precipitation did not vary significantly between the systems but it was found that the *Eucalyptus* trees in the ICLF system have an interception capacity of 3 mm of rainwater.

Lysimeter measurements were not reliable for comparisons between the land-use systems. By comparing different distances to the tree rows in the ICLF system showed highest evapotranspiration values for the medium distance of 5 m (max. distance was 11 m). This could be linked to the combination of sufficient radiation and air movement in the grass canopy.

Several adjustments to the lysimetric method are suggested to improve future research.

Key words: Reference evapotranspiration, microclimate, micro lysimeter, integrated agricultural production system, Cerrado