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"Filling gaps and removing traps
for sustainable resource management"

Effects of Shading and Soil Moisture on *Brachiaria brizantha* Biomass in an Integrated Crop-Livestock-Forestry System

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Abstract

Components of integrated production systems may compromise each other in competition for resources such as water and light. A smart and sustainable management of these resources is key to an overall successful system performance but often basic information are missing of how components and resources interact. This study analysed the seasonal dynamics of photosynthetically active radiation (PAR), soil moisture and grass biomass for integrated Crop-Livestock-Forestry (ICLF) demonstration plots in Campo Grande-MS, Brazil.

Data were collected at three ICLF plots consisting of grass pasture (*Brachiaria brizantha* BRS cv. Piatã) lined with east-west orientated strips of 20 m high Eucalyptus trees (*Eucalyptus urograndis*) in 22 m distance. PAR (AccuPAR CP-80), soil moisture (DELTA T FDR) and grass biomass (moving cages) were sampled in each plot in a line of five sampling points between tree rows to represent the shading gradient.

During rainy season (Dec–Feb) the PAR gradient was extremely high ranging from on average 1300 μmol m^{-2} s^{-1} (centre positions) to only 180 μmol m^{-2} s^{-1} near trees. In contrast due to lower inclination all points receive more or less the same amount of PAR (500 μmol m^{-2} s^{-1}) during dry season (Jun–Aug). For soil moisture we measured a clear gradient from on average 29–32 Vol % at centre positions to 20–25 Vol % near the tree lines. Dry season revealed same pattern with on average 3–5 Vol % lower values across the gradient. Biomass distribution showed a clear gradient as well with twice as much DM in centre positions for both seasons, while DM was about halved during dry season.

Although we recorded a very high variation of PAR across the gradient between trees during rainy season, soil water content appears dominant affecting grass biomass growth according to correlation analysis. This relation was not surprisingly tightened during dry season when soil moisture contents approach wilting points more often. However, differences in energy budgets across the gradient and seasons resulting from radiation inputs are tremendous and should be considered in follow up analysis and management strategies of ICLF systems in relation to tree distances and height.

Keywords: Brazil, grass biomass, PAR, soil moisture

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