

Oil Palm and Rubber Tree Water Use Patterns: Effects of Topography and Flooding

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Abstract	<p>Oil palm and rubber plantations extend over large areas and encompass heterogeneous site conditions. In periods of high rainfall, plants in valleys and at riparian sites are more prone to flooding than plants at elevated topographic positions. We asked to what extent topographic position and flooding affect oil palm and rubber tree water use patterns and thereby influence spatial and temporal heterogeneity of transpiration. In an undulating terrain in the lowlands of Jambi, Indonesia, plantations of the two species were studied in plot pairs consisting of upland and adjacent valley plots. All upland plots were non-flooded, whereas the corresponding valley plots included non-flooded, longterm flooded, and short-term flooded conditions. Within each plot pair, sap flux densities in palms or trees were monitored simultaneously with thermal dissipation probes. In plot pairs with non-flooded valleys, sap flux densities of oil palms were only slightly different between the topographic positions, whereas sap flux densities of rubber trees were higher in the valley than at the according upland site. In pairs with long-term flooded valleys, sap flux densities in valleys were lower than at upland plots for both species, but the reduction was far less pronounced in oil palms than in rubber trees (-22 and -45% in maximum sap flux density, respectively). At these long-term flooded valley plots palm and tree water use also responded less sensitively to fluctuations in micrometeorological variables than at upland plots. In short-term flooded valley plots, sap flux densities of oil palm were hardly affected by flooding, but sap flux densities of rubber trees were reduced considerably. Topographic position and flooding thus affected water use patterns in both oil palms and rubber trees, but the changes in rubber trees were much more pronounced: compared to non-flooded upland sites, the different flooding conditions at valley sites amplified the observed heterogeneity of plot mean water use by a factor of 2.4 in oil palm and by a factor of 4.2 in rubber plantations. Such strong differences between species as well as the pronounced heterogeneity of water use across space and time may be of relevance for eco-hydrological assessments of tropical plantation landscapes.</p>
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