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Physiological and morphological responses of young mahogany (*Swietenia macrophylla* King) plants to drought

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ABSTRACT

Young mahogany (*Swietenia macrophylla* King) plants were grown under either well-watered (pre-dawn leaf water potential, Ψ_{pd}, ca. −0.40 MPa) or drought (Ψ_{pd}, ca. −3.52 MPa) conditions to examine some physiological strategies that allow the maintenance of leaf turgor. In well-watered plants, stomatal conductance (g_s) was nearly constant (440 mmol m^{-2} s^{-1}) between 7:00 and 13:00 h. This was accomplished by significant increases in transpiration (E) and apparent total hydraulic conductance (K_T), in which averages were higher at 13:00 h. From 13:00 to 17:00 h, g_s, E, and K_T decreased sharply, reaching their lower values at 17:00 h. In these plants, significant increases in height (116%), stem diameter (50%) and leaf area (200%) were registered over the experimental period (20 days). Analyses of linear regression between g_s or E and leaf-to-air vapor pressure deficit (Δ_w) were not significant. In water-stressed plants, g_s and E were higher at 7:00 h and lower from 9:00 to 17:00 h, while K_T was higher in early morning (7:00 h) and in late afternoon (17:00 h) than between 9:00 and 15:00 h. Moreover, both g_s and E decreased potentially ($P < 0.001$) with the diurnal increases on Δ_w. Drought also decreased leaf and leaflet numbers and reduced total leaf area, but had no effect on stem height and diameter. Leaf proline was higher (ca. 400%, between 13:00 and 15:00 h) in water-stressed plants, suggesting osmotic adjustment under drought. Twelve hours after resumption of irrigation, Ψ_{pd} was similar ($P > 0.05$) between well-watered and drought-stressed plants, suggesting an ability of plants to recover turgor after stress cessation. Altogether, our data support the hypothesis that young mahogany plants have the ability to satisfactorily tolerate or postpone drought.

1. Introduction

During the past few years, reforestation projects have become increasingly important in the Brazilian Amazon region. Among a large variety of woody species native to the Amazon basin and under high exploitation pressure, mahogany (*Swietenia macrophylla* King) receives special attention because of its high commercial value. However, this species is still poorly studied in relation to its management in plantations and its physiological responses to environmental stresses.

Much of the Amazon region is prone to relatively long periods of dry season, when rates of evapotranspiration, by far, exceed rainfall. Besides, deforestation is believed to have already altered the regional climate, increasing monthly mean air temperatures and altering rainfall patterns (Victoria et al., 1998; Marengo et al., 2000; Chagnon et al., 2004). The predicted increment on deforestation rates (Soares-Filho et al., 2006) as well as warmer temperatures and decreased precipitation during dry months, could manifest in longer and perhaps, more severe dry seasons for the Amazon region. Therefore, drought is an important stress factor limiting seedlings growth in the Amazon.

The effects of water deficit have been reported for a large number of angiosperms and gymnosperms, resulting on considerable changes in plant physiology, morphology and overall biochemical processes (Asada, 1999; Silva and Lemos Filho, 2001; Mittler, 2002; Dünisch et al., 2003; Pinheiro et al., 2004, 2005; Carvalho, 2005; Santos et al., 2006; Cernusak et al., 2007; Chaves et al., 2008). In terms of water relations, the mechanisms controlling water loss through stomata (transpiration) seem to be an efficient process to provide (or to maintain) leaf turgor under drought. This includes stomatal responses to soil water potential and fluctuating environmental conditions, in special to air

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