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土壤盐分对棉花功能叶气体交换参数和叶绿素荧光参数日变化的影响

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Diurnal variation of gas exchange and chlorophyll fluorescence parameters of cotton functional leaves under effects of soil salinity.

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摘要 2007—2008年在南京农业大学牌楼试验站进行盆栽试验，选择耐盐品种中棉所44和盐敏感品种苏棉12号为材料，试验设置5个土壤盐分水平（0、0.35%、0.60%、0.85%和1.00%），研究土壤盐分对棉花功能叶气体交换参数和叶绿素荧光参数日变化的影响.结果表明：随土壤盐分水平的升高，棉花功能叶中Na^+、Cl^-和Mg^{2+}含量升高，K^+和Ca^{2+}含量降低.低于0.35%盐分处理对叶片气体交换参数和叶绿素荧光参数的影响较小，高于0.35%的盐分处理显著降低了棉花功能叶的净光合速率(P_n)，提高了棉花功能叶对日间光辐射强度和温度的敏感程度，导致光温抑制现象加重，并改变了P_n和气孔导度(G_s)的日变化趋势，使其由单峰曲线逐渐变为持续下降趋势.随日间光辐射强度和温度的变化，棉花叶片最大光化学效率(F_v/F_m)、光系统Ⅱ（PSⅡ）量子产量（$\Phi_{PSⅡ}$）和光化学猝灭系数（q_P）的日变化趋势呈“V”型曲线，最低值出现在12:00—13:00，非光化学猝灭系数（q_N）的日变化趋势呈单峰曲线；盐分处理降低了棉花功能叶F_v/F_m、$\Phi_{PSⅡ}$和q_P，提高了q_N，且增大了其变化幅度.耐盐品种中棉所44功能叶片中较低的Na^+、Cl^-含量及相对较高的K^+、Ca^{2+}含量保证了PSⅡ的相对稳定性，相对较高的热耗散能力是其在盐胁迫下保持相对较高P_n的重要原因之一.

关键词： 棉花 土壤盐分 功能叶 气体交换参数 叶绿素荧光参数 日变化

Abstract： A two-year (2007-2008) pot experiment with cotton varieties Sumian 12 (salinity-sensitive) and Zhongmiansuo 44 (salinity-tolerance) was conducted at the Pailou experimental station of Nanjing Agricultural University to study the diurnal variation of the gas exchange and chlorophyll fluorescence parameters of cotton functional leaves under five levels (0, 0.35%, 0.60%, 0.85%, and 1.00%) of soil salinity. With the increase of soil salinity, the concentrations of Na^+, Cl^-, and Mg^{2+} in functional leaves increased, whereas the concentrations of K^+ and Ca^{2+} decreased. The salinity level <0.35% had little effects on the gas exchange and chlorophyll fluorescence parameters, but that >0.35% depressed the net photosynthetic rate (P_n) dramatically. At the salinity level >0.35%, the sensitivity of functional leaves to daytime photon flux density (PFD) and air temperature (T_a) enhanced, which in turn resulted in more severe photo- and temperature inhibition, and changed the diurnal variation patterns of P_n and stomatal conductance (G_s) from a one-peak curve to a constantly decreasing one. Along with the variations of daytime PED and T_a, the diurnal variation patterns of the maximum photochemical efficiency (F_v/F_m), quantum yield of electron transport ($\Phi_{PSⅡ}$), and photochemical quenching coefficient (q_P) of functional leaves presented a V-shaped curve, with the minimum value appeared at 12:00-13:00, while the non-photochemical quenching coefficient (q_N) showed a single-peak curve. Soil salinity decreased the F_v/F_m, $\Phi_{PSⅡ}$, and q_P significantly, but increased the q_N and enlarged its change trend. The comparatively low concentrations of Na^+ and Cl^- and the relatively high concentrations of $K^+$and Ca^{2+} in salt-tolerant Zhongmiansuo 44 functional leaves benefited the relative stability of PSⅡ, and the maintenance of a relatively high thermal dissipation capacity could be one of the reasons for a high level of P_n at high salinity level.

Key words： cotton (*Gossypium hirsutum*) soil salinity functional leaf gas exchange parameter chlorophyll fluorescence parameter diurnal variation

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