作物学报
Acta Agronomica Sinica

作物学报 » 2011, Vol. 37 » Issue (03) :521-528 DOI: 10.3724/SP.J.1006.2011.00521

干旱胁迫对玉米苗期生长和光合特性的影响

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Influence of Drought Stress on Plant Growth and Photosynthetic Traits in Maize Seedings

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摘要 以2个不同抗旱性玉米品种郑单958 (抗旱性强)和陕单902 (抗旱性弱)为材料，采用盆栽控水试验，设置轻度干旱，中度干旱，重度干旱和正常灌水处理，研究了干旱胁迫对2个玉米品种植株生长、气体交换和叶绿素荧光参数的影响。结果显示，干旱胁迫抑制2个玉米品种植株生长和相对生长速率，导致整株生物量显著下降。随着干旱胁迫程度加剧，叶片最大净光合速率(P_{nmax})、表观量子效率(AQY)、光饱和点(LSP)、气孔导度(G_s)、气孔限制值(L_s)、最大电子传递速率(ETR_m)、光能利用效率(α)、光系统II的实际量子产量(Φ_{PSII})和光化学猝灭系数(q_P)均下降，而胞间CO_2浓度(C_i)，光补偿点(LCP)和非光化学猝灭系数(q_N)均升高。可见，干旱胁迫下叶片光合能力和电子传递速率降低是2个玉米品种生物量减少的主要因素。但郑单958变化幅度小于陕单902，表明郑单958植株生长发育和光合特性比陕单902受干旱胁迫的影响小，较高的电子传递速率、较强的光能转化能力和较大的相对生长速率是郑单958适应干旱环境的重要生理特性。

关键词： 玉米 干旱胁迫 光响应 叶绿素荧光参数 植株生长

Abstract: The responses of plant growth, gas exchange and chlorophyll fluorescence parameters were studied in two different maize hybrids Zhengdan 958 (drought resistant) and Shaandan 902 (drought-sensitive) under three different drought stresses (mild drought, moderate drought, severe drought) and normal irrigation in a pot experiment. The results showed that drought stress inhibited plant growth and relative growth rate in the two hybrids, resulting in a significant decline in biomass. With the increasing of drought stress, the maximum leaf net photosynthetic rate (P_{nmax}), apparent quantum efficiency (AQY), light saturation point (LSP), stomatal conductance (G_s), stomatal limitation (L_s), maximum electron transport rate (ETR_m), photosynthetic efficiency (α), PSII actual quantum yield (Φ_{PSII}) and photochemical quenching (q_P) decreased, while the intercellular CO_2 concentration (C_i), light compensation point (LCP) and non-photochemical quenching (q_N) increased. But the change extents of all parameters were smaller in Zhengdan 958 than in Shaandan902. This finding indicated that drought stress could significantly decrease the biomass of two maize varieties, possibly caused by reduction in the photosynthetic efficiency of plants. The drought stress damaging effects on plant growth and photosynthesis were minimal on the Zhengdan 958 compared to Shaandan 902. Under drought stress the Zhengdan 958 maintained higher photosynthetic efficiency, stronger light energy transfer capacity and greater relative growth rate that may be the major physiological traits in the adaptive capacity to drought conditions.

Keywords: Maize Drought stress Light responses of photosynthesis Chlorophyll fluorescence parameters Plant growth

Received 2010-09-27; published 2011-01-17

Fund:

本研究由国家重点基础研究发展计划(973计划)项目(2009CB118604)，国家自然科学基金项目(30971722)和陕西省自然科学基金项目(2010JM3002)资助。

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引用本文:

张仁和, 薛吉全, 浦军, 赵兵, 张兴华, 郑友军, 卜令铎.干旱胁迫对玉米苗期生长和光合特性的影响[J] 作物学报, 2011,V37(03): 521-528

ZHANG Ren-He, XUE Ji-Quan, PU Jun, ZHAO Bing, ZHANG Xin-Hua, ZHENG You-Jun, BO Ling-Duo.Influence of Drought Stress on Plant Growth and Photosynthetic Traits in Maize Seedings[J] Acta Agron Sin, 2011,V37(03): 521-528