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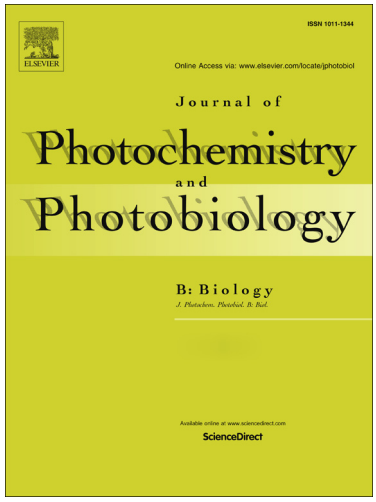

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Effects of Mutual Shading on the Regulation of Photosynthesis in Field-Grown Sorghum

Tao Li[a, b], Li-Na Liu[a], Chuang-Dao Jiang[a,*], Yu-Jun Liu[b], Lei Shi[a]

[a] *Key Laboratory of Plant Resources, Institute of Botany, the Chinese Academy of Sciences, Beijing 100093, China*

[b] *College of Biological Sciences and Biotechnology, Beijing Forestry University, Beijing 100083, China*

Abstract:

In the field, close planting inevitably causes mutual shading and depression of leaf photosynthesis. To clarify the regulative mechanisms of photosynthesis under these conditions, the effects of planting density on leaf structure, gas exchange and proteomics were carefully studied in field-grown sorghum. In the absence of mineral deficiency, (1) close planting induced a significant decrease in light intensity within populations, which further resulted in much lower stomatal density and other anatomical characteristics associated with shaded leaves; (2) sorghum grown at a high planting density had a lower net photosynthetic rate and stomatal conductance than those grown at a low planting density; (3) approximately 62 protein spots changed their expression levels under the high planting density conditions, and 22 proteins associated with photosynthesis were identified by mass spectrometry. Further analysis revealed the depression of photosynthesis caused by mutual shading involves the regulation of leaf structure, absorption and transportation of CO_2, photosynthetic electron transport, production of assimilatory power, and levels of enzymes related to the Calvin cycle. Additionally, heat shock protein and oxygen-evolving enhancer protein play important roles in photoprotection in field-grown sorghum. A model for the regulation of photosynthesis under mutual shading was suggested based on our

* Corresponding author. Tel.: +86 10 62836657. *E-mail address:* jcdao@ibcas.ac.cn (C.D. Jiang).