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Original article

Limitation of photosynthetic carbon metabolism by dark chilling in temperate and tropical soybean genotypes

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Abstract

In the experiments reported in this paper, we characterised the physiological and biochemical factors involved in the chilling-induced inhibition of photosynthetic carbon metabolism in soybean [*Glycine max* (L.) Merr.] genotypes of temperate and tropical adaptation. Plants of Maple Arrow (temperate genotype) and Java 29 (tropical genotype) were exposed to a single night at 8 °C. Dark chilling resulted in the inhibition of diurnal CO₂ assimilation rate and decreased stomatal conductance in both genotypes. Further analysis, however, revealed a difference in the response of the two genotypes. Stomatal limitation was largely responsible for the inhibition of CO₂ assimilation in Maple Arrow, whereas mesophyll limitation dominated the inhibition in Java 29. The results indicate that inhibition of stromal fructose-1,6-bisphosphatase (sFBPase; EC 3.1.3.11) activity and impaired electron transport capacity were responsible for the decrease in ribulose-1,5-bisphosphate (RuBP) regeneration capacity in Java 29. Sucrose-phosphate synthase (SPS; EC 2.4.1.14) activity was progressively inhibited during the light period in this genotype and might impose an additional constraint on photosynthesis. Maple Arrow appears to possess, at least with respect to photosynthetic carbon metabolism, physiological and biochemical characteristics that contribute towards its superior dark chilling tolerance.

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Keywords: Fructose-1,6-bisphosphatase; *Glycine max*; Night temperatures; Photosynthesis; Photosystem II; Rubisco; Sucrose-phosphate synthase
