# PHOTOSYNTHETIC COLD ACCLIMATION IN COTTON SEEDLINGS

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## Abstract

Temperatures between 10°C and 25°C substantially limit seedling growth and reversibly inhibit net assimilation (An) in cold-sensitive plants. Because An represents a number of component processes operating in a highly concerted manner, quantifying the cold sensitivities of each constituent would provide targets for improving cold tolerance. In the current study, Gossypium hirsutum (cotton) seedlings grown under sub-optimal temperatures exhibited substantial declines in plant growth, An, and nearly every thylakoid process assessed, relative to optimal conditions. In contrast, energy dissipation by photosystem II (PSII) increased under low temperature concomitant with a rise in carotenoid content, hydrogen peroxide production, and ascorbate peroxidase activity. Low temperature threshold experiments showed electron transport was more cold-sensitive than gross or net photosynthesis and acclimation of dark respiration (Rd) slightly enhanced cold tolerance of An for plants grown under low temperatures. [CO2] × temperature response experiments further revealed that carboxylation was more temperature sensitive than RuBP regeneration. It is concluded that 1) low temperature acclimation of An exists for G. hirsutum, primarily due to plasticity of Rd to growth temperature and 2) differences in cold sensitivity between carboxylation and RuBP regeneration favor reactive oxygen species production, thereby necessitating enhanced ROS scavenging and upstream energy dissipation by PSII.