SAM2-5

Biotechnology Of Crop Plants Based On Transgenic Phytochrome Genes

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The shade avoidance response of higher plants is a classic example of the phytochrome-mediated photomorphogenesis. The shade stress is one of the important concerns about crop productivity, as the plants under shade and the phytochrome in its Pr form are less productive than those grown in bright day light. By means of phytochrome photoreceptors, plants can sense reduction in the ratio of red (R) to far-red (FR) light when they are under shading stress due to their close neighbors or in the canopy. Suppression of the shade avoidance response by transgenic overexpression of phytochrome genes can improve crop yield through altering plant morphology in the desirable way. Our laboratory developed two types of phytochromeA mutants related to shade tolerance; namely, phosphorylation-blocked hyperactive phyA (Ser598Ala) mutant to confer shade resistance to the plants, and bathochromic phyA mutants with the Pr-absorption spectrum shifted to the longer wavelengths, thus perceiving the increased R:FR ratios and suppressing the shade avoidance responses. The expected phenotypes under shade conditions have been demonstrated in Arabidopsis thaliana seedlings and adult plants. Currently we are testing the phenotypic performances of these mutant phyA's, particularly Zoysia japonica, Agrostis and sweet potato species. We are also testing the phenotypic performance of the transgenic turf grass lines in our green houses and the GMO-approved test field in Seogwipo, Jeju, Korea..

This research was supported by a grant from KOSEF/MOST to the Environmental Biotechnology Research Center EBRC/GSNU and Biogreen 21 program