EFFORTS TO ENHANCE THE MOLECULAR ARCHITECTURE OF COTTON PHOTOSYSTEM II PROTEINS AS PROTECTION AGAINST HIGH TEMPERATURE STRESS

R.G. McDaniel
The University of Arizona
Tucson, AZ

Abstract

Experiments have been aimed at identifying two genes whose action is considered important in the continued function of cotton leaf chloroplast photosystem reaction II centers under environmental stress. Once these genes are identified, sequenced and cloned, they can be used to add extra copies to the cotton genome via transformation techniques. Because these gene products act to stabilize the PSII complex, as well as elicit a general rise in mRNA transcripts, the anticipated result of additional functional copies would be a net improvement in the environmental homeostasis of the cotton plant.

The protein product of the eIF-5A gene acts to stabilize charged initiator methionyl-tRNA associated with 80S ribosome complexes. Additional evidence indicates that this protein may elicit a general stabilization of mRNA. Recovery and repair of stress damaged photosystem II reaction centers should be accelerated as a result of these stabilizing effects of the eIF-5A gene product.

The eIF-5A protein is unique because it is the only functional protein known to contain the rare amino acid, hypusine. Likewise, the recently described nuclear encoded RNA polymerase sigma factor (rpoD) is known to act as a gene expression catalyst at the transcriptional level in eukaryotes. Because rpoD is positively photoregulated, this provides strong evidence that rpoD acts as a transcriptional activator of other photoregulated genes.

Since few copies of these genes appear to be present in the cotton genome, increasing their copy number by transformation should enhance the metabolic resilience of cotton chloroplasts which in turn would act to improve overall plant environmental stress tolerance. Initial steps toward the isolation and characterization of these two genes from cotton via polymerase chain reaction using primers based upon sequences of these genes as established in other plants will be described.

Acknowledgment

The financial support of Cotton Incorporated, and the technical support of Donna Harvey and Kathy Kaysen are gratefully acknowledged.

Reprinted from the *Proceedings of the Beltwide Cotton Conference*
Volume 2:1392-1392 (1998)
National Cotton Council, Memphis TN