COMPARATIVE STUDY OF FATTY ACID DESATURASE (*FAD*) GENE EXPRESSION DURING UPLAND AND PIMA COTTON LEAF EXPANSION

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Abstract

Cotton production faces many challenges as numerous climate models predict in the near future that cotton-growing regions will be even warmer and drier potentially leading to lower yields. Previous work showed that young main stem leaves of *Gossypium hirsutum* (upland cotton) had higher mid day leaf temperatures, lower stomatal conductance, higher photosynthetic thermal optima (as measured by chlorophyll *a* fluorescence) and higher proportions of saturated fatty acids (FA) in their chloroplast membrane and other lipids when compared to more mature leaves. In this project, we compare upland cotton with the more stress adapted *Gossypium barbadense* (pima cotton) grown in a common field plot to test the hypothesis that the expression levels of fatty acid desaturase (*FAD*) genes will increase as the leaves expand leading to decreased levels of lipid saturation. For example, *FAD2* enzymes convert 18:1 to 18:2 FA in phosphatidylcholine, whereas *FAD3, 7/8* enzymes convert 18:2 to 18:3 FA in phosphatidylcholine, phosphatidylglycerol and sulfoquinovosyldiacylglycerol. Preliminary genotyping analysis using RT-PCR and RNA-Seq showed the differential expression of *FAD*3-1 in pima cotton when comparing young leaves with more mature leaves, whereas there was no differential expression of *FAD*2, 3 or 7/8. Species to species comparisons showed there was differential expression of FAD2 when comparing young pima and upland leaves, but no difference in expression in FAD7/8. In summary, we suggest that alterations in *FAD* gene expression and subsequent adjustments in fatty acid saturation levels of key membrane lipids may partly explain differences in photosynthetic thermal tolerance between young and mature leaves.