2005 Beltwide Cotton Conferences, New Orleans, Louisiana - January 4 - 7, 2005

EVALUATION OF SUCROSE PHOSPHATE SYNTHASE TRANSGENIC COTTON LINES UNDER FIELD CONDITIONS IN WEST TEXAS

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Abstract

High Plains' cultivars are generally considered to have short fiber and low yields this may be due to environmental constraints, such as limited number of heat units and cool late season night temperatures. The use of genetic engineering to improve the adaptation of cultivars, could overcome the climatic limitations. Research conducted by Dr. Candace Haigler and Dr. Scott Holaday at Texas Tech University, suggests that sucrose phosphate synthase (SPS) to be a likely candidate for beneficial change. A spinach SPS gene under a constitutive promoter, 35S CaMV, was inserted into the cotton cultivar 'Coker 312-17' resulting in 32 independent fertile transformed lines.

Three of the twelve transgenic lines at the T_1 or T_2 generation, that exhibited elevated leaf and fiber SPS activity underwent preliminary testing in a Phytotron chamber (Duke Univ: 30/15°C day/night cycle) in 1999. The results of this experiment indicated the SPS transformed cotton lines had more cellulose deposition, increased fiber weight per seed, increased micronaire, and increased fiber maturity ratio over Coker 312-17(Haigler et al., 2000). These results prompted the need to analyze these lines in a field situation under several different environments to determine if the gene could bring added value at the farm level. Thus, in 2002 and 2003 replicated tests with twelve of the transgenic lines, nine null isolines and six commercial or experimental lines were initiated to evaluate the effect of the SPS gene. Both years were above average in heat units and length of season. Trials were conducted in West Texas and maturity, yield and selected fiber properties were evaluated.

The results indicate that the effects of the over expression of SPS in the lines evaluated under field conditions during this two year period was minimal with no effects on lint yield being evident. Very few significant differences were reported; however, in the traits of short fiber content (SFC) and fiber strength in 2002 and fiber length, fiber strength and SFC in 2003, there were significant differences in favor of the SPS lines. The improvements were small and of little, if any, commercial value. On going research at Texas Tech University has determined that the promoter 35S CaMV is not constitutive in fiber, but rather has high activity mainly at the transition between primary and secondary wall deposition. Additional research is needed to determine if similar genes, controlled by stronger or more constitutive promoters in both leaf and fiber, inserted into different genetic backgrounds and grown in cooler growing seasons could result in significant and economical improvements.