Annual Report for 2006
Cotton Inc. Texas State Support Project 04-525
Improving East Texas Cotton - New Alleles for Improved Performance
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Summary

Seedling Disease Resistance: We have completed 2 cycles of selection for rhizoctonia resistance and have initiated selection of individual plants with resistance to pythium, both through classical greenhouse screening methodology. The selection protocol has been applied to a series of lines released by TAES in 1987 and referred to as High Tannin lines. The original screening revealed variation in resistance to rhizoctonia and a single cycle of single plant selection following a 3X application of rhizoctonia pathogen showed meaningful increase in resistance. Variation exists for response of single plants to pythium infection but no HT populations were identified that showed levels of resistance greater than the Tamcot Sphinx resistant control.

We conduct our strain evaluations, approximately 400 strains in any given year, across irrigated and dry land sites in central and south Texas without the addition of seed treatments for the control of seedling diseases. This indirect selection method should provide some level of protection or at least the identification of extremely susceptible types that can be subsequently dropped form the program.

Drought Stress Tolerance: Polly Longenberger, CI Fellow, conducted field tests at Lubbock and College Station using Modulating Fluorescence to determine the effectiveness of this physiological technique in identifying drought tolerant material. Greenhouse experiments have been conducted at College Station also. Her efforts have been reported separately as a part of her Cotton Incorporated Fellow training and responsibilities. However, Polly has confirmed that MF will consistently differentiate between two of our lines, TAM 89E-51 and Tamcot 22, as drought stress susceptible and tolerant. These were identified from a large set that included entries from several germplasm pools within the United States and commercial cultivars. Polly is attempting to determine the breeding behavior of this trait through greenhouse studies using diallel analysis and progeny tests.

We conduct our strain evaluations across irrigated and dry land trials in central and south Texas and thus our strains are evaluated under moderate to severe drought stress each year. We also have a number of Extra Long Staple Upland (ELSU) strains that have exceptional UHM even under severe drought stress. For example, we evaluated 28 ELSU strains at Thrall in 2006 under a severe drought. The 28 ELSU lines averaged 1.24 UHM while the four control cultivars (FM 832, DPL 491, PSC 355, and Tamcot 22) averaged 1.03 UHM length. While this does not indicated drought tolerance, it does indicate that even severely stress plants can produce exceptional quality and thus we should be able to avoid length discounts in the future even when upland cotton is grown under severe drought.

Biotic Stress Resistance: Activities under this objective are collaborative with Marvin Harris and Allen Knutson. Those activities are reported by those PIs separately and in our combined report under core project 03-367. The work with Dr. Harris resulted in the development of some unique screening techniques but low levels of resistance to whitefly and aphids. That activity will be concluded during 2007. Allen Knutson has identified tentatively some exciting resistance to cotton

flea hopper, 60 to 80 % greater than the commercial checks. This resistance has been identified in some photoperiodic race stocks and will be confirmed prior to initiating breeding activities.

The CIL basic breeding nurseries are conducted at nine locations throughout central and south Texas and thus exposes our material to common and annual insects and diseases which provides the opportunity to discard material that is unusually susceptible to these pests while selecting for yield and quality

Objectives:

1. Develop methodology and quantify levels of resistance to seedling disease pathogens
2. Identify sources of resistance to seedling diseases, e.g., CRS, interspecific hybrid populations, existing germplasm pools.
3. Identify and incorporate resistance to insects
4. Identify phenotypes with resistance to abiotic stresses, especially drought
5. Increase levels of resistance using pedigree, backcross, and other population improvement breeding methods

Methodology and Plan of Work:

This TSSC project includes conventional breeding methods utilizing upland genotypes, CRS and tetraploid species. Plan of work includes the introgression of disease and drought resistance from any species into adapted phenotypes and utilization of the methodology for single plant evaluation and selection for resistance to seedling diseases and drought tolerance.

Objectives 1 and 2: Develop methodology and quantify levels of resistance to seedling disease pathogens; Identify sources of resistance to seedling diseases, e.g., CRS, interspecific hybrid populations, existing germplasm pools.

Activities under this project include the identification of resistance to seedling diseases (Ray Kennett), quantification of bacterial stress, selection of bb resistant/tolerant material, and development of techniques. Mr. Kennett has enhanced a protocol using single plant inoculation and appears to be making progress in selecting for resistance. He has completed 2 cycles of selection for rhizoctonia and is in the process of completing early stage work with pythium. The selection protocol has been applied to a series of lines released by TAES in 1987 and referred to as High Tannin lines. The original screening revealed variation in resistance to rhizoctonia and a single cycle of single plant selection following a 3X application or rhizoctonia pathogen showed meaningful increase in resistance (Figure 525-1). A second cycle of selection has been completed and data will be analyzed and available soon. Similar activity with pythium has been initiated. Variation exists for response of single plants to pythium infection but no HT populations were identified that showed levels of resistance greater than the Tamcot Sphinx resistant control (Figure 525-2). Several HT lines were as good as the resistant check and single plant selection is under way to determine if resistance can be improved.

The CIL conducts strain evaluations across irrigated and dryland trials in central and south Texas without the addition of seed treatments for the control of seedling diseases. This indirect selection method should provide some level of protection or at least the

identification of extremely susceptible types that can be subsequently dropped form the program.

Objective 3. Identify and incorporate resistance to insects

Activites under this objective are collaborative with Marvin Harris and Allen Knutson. Those activities are reported by those PIs separately and in our **combined report under core project 03-367.** The work with Dr. Harris resulted in the development of some unique screening techniques but low levels of resistance to whitefly and aphids. That activity will be concluded during 2007. Allen Knutson has identified tentatively some exciting resistance to cotton flea hopper, 60 to 80 % greater than the commercial checks. This resistance has been identified in some photoperiodic race stocks and will be confirmed prior to initiating breeding activities.

The CIL conducts strain performance trials in all cotton production regions of central and south Texas and thus utilizes natural infestation of insects during the selection process.

Objective 4. Identify phenotypes with resistance to abiotic stresses, especially drought

Polly Longenberger has established field plots at Lubbock and College Station and has taken MF reading at Lubbock. MF data were taken at College Station and Lubbock during the third quarter as well as adjunct greenhouse experiments. Her efforts will be reported separately as a part of her Cotton Incorporated Fellow training and responsibilities. Polly has confirmed that MF will consistently differentiate between two of our lines, TAM 89E-51 and Tamcot 22, as drought stress susceptible and tolerant. These were identified from a larger set that included entries from several germplasm pools within the United States and commercial cultivars. One issue that is emerging is that the MF protocol may identify any kind of stress, both abiotic and biotic, and not drought along. I'm not optimistic about this protocol's ability to identify single plants possessing drought stress resistance. Nonetheless, all of Polly's data are new and certainly will add to the scientific literature in breeding for stress tolerance.

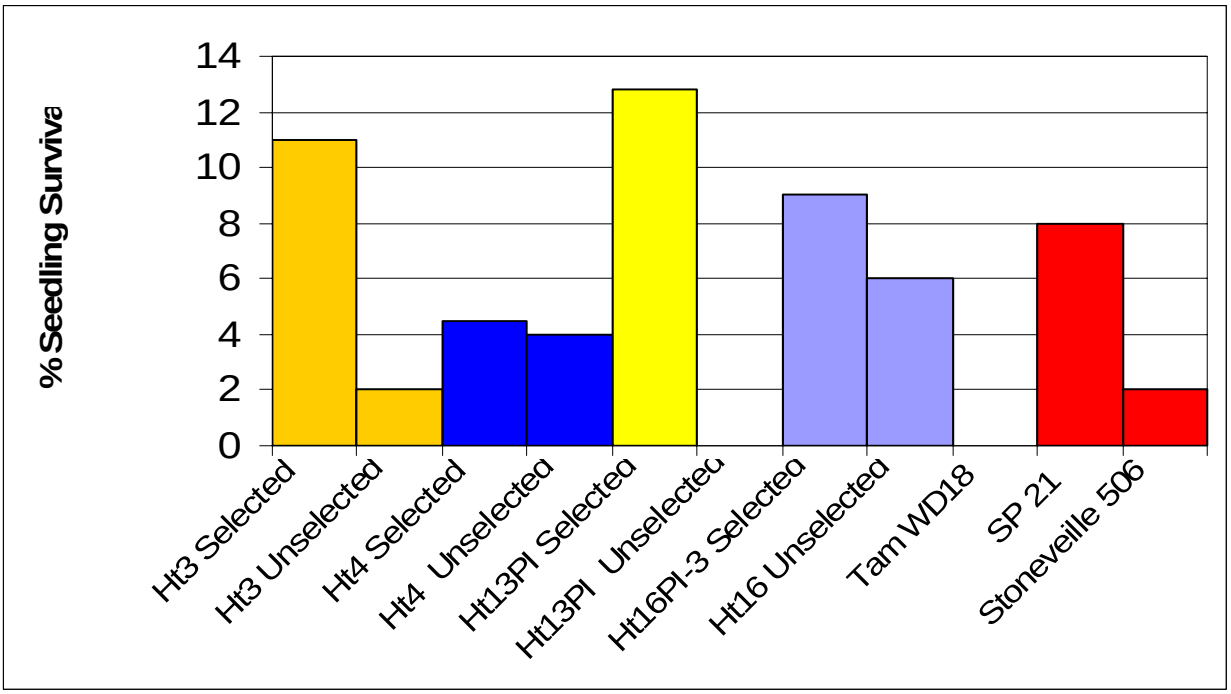

Figure 525-1. Seedling survival (%) of selected High Tannin GP lines after 1 cycle of selection for resistance to *Rhizoctonia solani.*

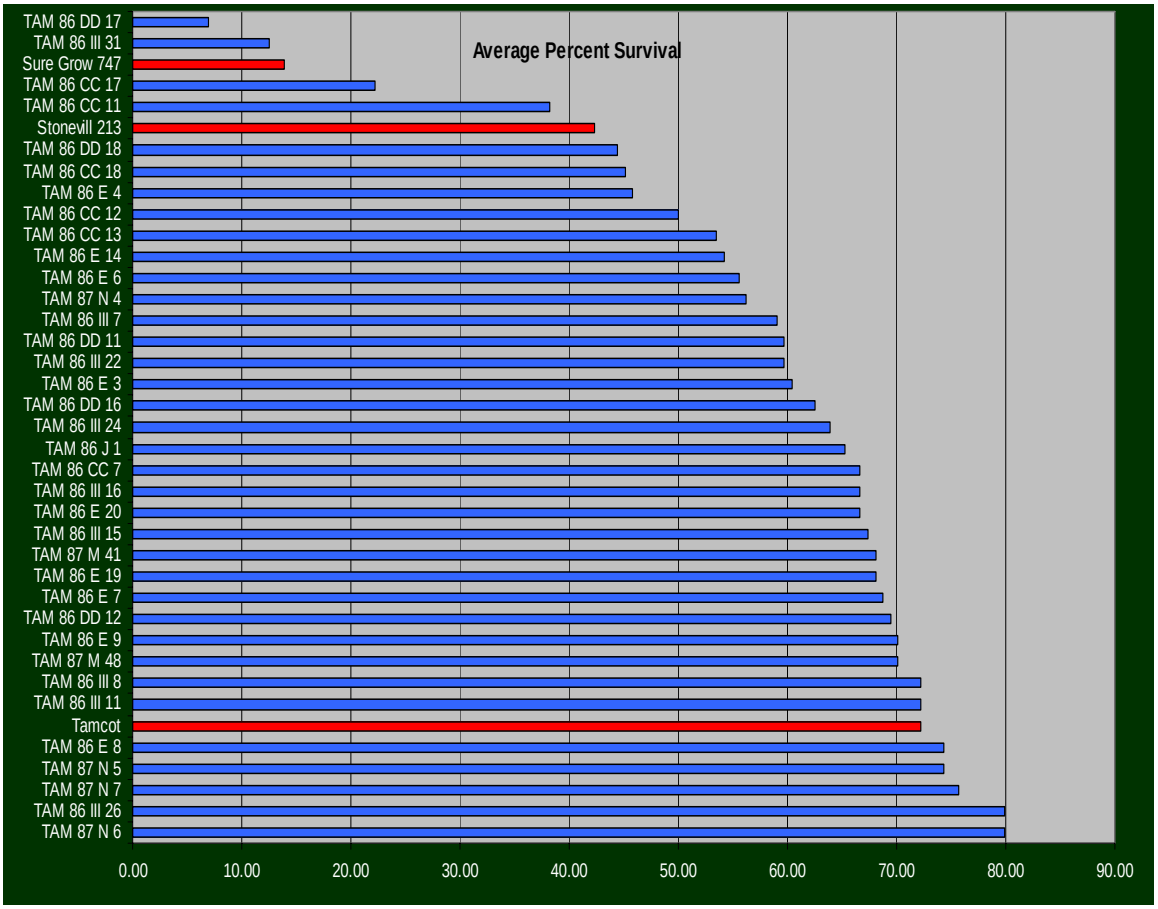

Figure 525-2. Survival of several high tannin lines and controls following inoculation with pythium spores. College Station, TX, 2006.