

2007 Annual Report
United States Germplasm Enhancement of Maize Project

Margaret Smith
Department of Plant Breeding and Genetics, Cornell University

Project Title: Anthracnose Stalk Rot Resistance from Exotic Maize Germplasm

Justification:

Anthracnose stalk rot (ASR), caused by *Colletotrichum graminicola* (Ces.) G.W. Wils., causes stalk rot problems and contributes to increased lodging in New York and throughout many U.S. maize-producing areas. The only economically feasible control of ASR is through resistant varieties and cultural practices that reduce disease incidence. Recent research has focused on exotic sources for improved ASR resistance, given the limited resistance available in temperate maize germplasm. This project aims to develop new maize inbreds with excellent resistance to ASR (derived from the tropical germplasm sources used) and good agronomic quality, yield potential, and temperate adaptation (derived from the proprietary temperate inbreds crossed to the exotic populations).

General Objective:

To develop temperate-adapted inbreds with both anthracnose stalk rot resistance and good yield potential from GEM germplasm.

Specific Objectives for Current Project Year:

- 1) Release four inbreds from three GEM populations.
- 2) Evaluate anthracnose stalk rot resistance of S1 families from a new population formed from the best non-stiff stalk inbreds derived from GEM work to date, and testcross selected S1s from this population.
- 3) Initiate stalk rot resistance and yield selection in experimental hybrids from one 75% temperate:25% tropical GEM population (CH05015:N1204) that has good stalk rot resistance and has shown desirable traits in other GEM projects.

Materials and Methods:

Objective 1: The results described herein represent the final year of a multi-year inbred development effort. Results of 1995 per se evaluations were used to select five 75% temperate : 25% exotic populations with potential for anthracnose stalk rot resistance. Results of 1996 testcross yield evaluations of these populations were used to select the four with the best yield potential. For each of these four populations, 50 S1 ears were grown out ear-to-row in summer 1997. Eight plants per family were self-pollinated, injected with approximately 500,000 conidia/plant of *Colletotrichum graminicola*, and selected for anthracnose stalk rot resistance by splitting and rating the lowermost eight stalk internodes at harvest. In 1998, selected S2 ears were grown out ear-to-row for another cycle of inbreeding and selection for resistance, and were testcrossed. For the S3 to the S5 generations (1999 through 2001), selected ears were grown out ear-to-row for inbreeding and selection for ASR resistance, and testcrosses from the families that gave rise to these selections were evaluated in yield trials in three New York locations. Yield and resistance data were used for selection. In summer 2002, S5 and S6 progenies were planted out ear-to-row for sib increase and testcrossing. Twenty-seven lines and testcrosses of each to two testers (one public line cross and one Holden's tester) were planted in two replications at

Aurora NY in summer 2003 for stalk rot evaluation as described above. Most of these testcrosses also had sufficient seed for yield evaluation at three New York locations. These same studies were repeated in summer 2004 and 2005 for all the progenies where seed supply was adequate. Yield trial results and both per se and testcross ASR resistance ratings were used to select four inbreds for seed increase in 2006.

Objective 2: Population development was initiated from the best new non-stiff stalk inbreds developed through Objective 1 by making all possible F1 crosses among seven GEM-derived inbreds from three different GEM populations (five from FS8B(T):N1802 and two each from AR01150:N0406 and GOQUEEN:N1603). The resulting F1s were random mated in winter 2005-2006 and again in summer 2006. Selfing was done in winter 2006-2007 to generate S1 families for initial stalk rot screening and testcrossing in summer 2007.

Objective 3: Two 75% temperate : 25% tropical GEM populations (CH05015:N1204 and UR10001:N1702) were identified as having performed well in our original ASR evaluations in 1995 and as being derived from GEM germplasm that has proven useful for other traits (CH05015 has shown promise for yield potential and aflatoxin resistance and UR10001 has shown promise for yield potential and corn borer resistance). From each of these populations, 150 seeds were sown at high density (about 40,000 plants/acre) in 2005 and individual plants with good nick and reasonable flowering date were self pollinated to generate S1 families. In 2006, 44 S1 families from CH05015:N1204 and 60 from UR10001:N1702 were grown in two separate blocks. In one block, per se ASR rating and selfing were done on families with reasonable agronomic performance. In the second block, testcrosses were made to an ASR-susceptible tester (B37) for ASR evaluations and to an elite tester (LH198) for yield trials. Progenies of S1 by tester crosses from CH05015:N1204 were evaluated in two replications for ASR resistance in Aurora NY (B37 tester) and in three replications at two NY locations for yield potential (LH198 tester) in summer 2007. Progenies from UR10001:N1702 will be evaluated in a subsequent project year.

Progress to Date:

Objective 1:

Populations selected based on per se anthracnose stalk rot resistance (evaluated in 1995) and testcross yield potential (evaluated in 1996) were FS8B(T):N1802, CH04030:S0906, AR01150:N0406, and GOQUEEN:N1603. From these populations, a total of 27 lines were selected based on per se anthracnose stalk rot resistance and testcross yield potential. Of these, 18 remained in testing through 2004 and 14 looked promising enough to include in seed increases in the 2005 nursery while they were being tested for a final year. Four were ultimately chosen based on ASR resistance and yield potential for seed increase and release: NY195 from CH04030:S0906, NY212 and NY215 from FS8(B)T:N1802, and NY266 from AR01150:N0406. An official release notice for these four inbreds is currently in preparation for submission to the Journal of Plant Registrations.

Objective 2:

In 2005, all possible crosses were made among the lines chosen to contribute to the new non-stiff stalk GEM-related synthetic. The goal of this effort is to allow recombination among a diverse group of the most promising non-stiff stalk inbreds derived from our GEM work to date, and then be able to extract a new set of inbreds with excellent stalk rot resistance and improved yield potential and standability. The lines included in this new synthetic are FS8B(T):N1802-derived

inbreds NY212 and NY215 and unreleased lines 222, 259, and 263 from this same population; AR01150:N0406-derived inbred NY266 and unreleased line 218; and GOQUEEN:N1603-derived lines 233 and 239. Two generations of random mating were done in this material and then 115 S1 families generated in winter 2006-2007. These S1s were evaluated for ASR resistance in single row, unreplicated plots in Aurora 2007, and simultaneously testcrossed to B37 (for ASR evaluation) and LH198 (for yield evaluation). Testcrosses to the ASR-susceptible B37 and the LH198 testers have been harvested. Stalk splitting and ASR ratings are just being completed on the S1 families at this time; data will be summarized for the 2008 GEM update.

Objective 3:

We initiated inbreeding and selection for anthracnose stalk rot resistance and yield potential in two new GEM populations (CH05015:N1204 and UR10001:N1702). S1 families from each population were self-pollinated and inoculated in 2006 to select ASR-resistant families and to select the most resistant plants within these families. From the 60 UR10001:N1702 S1s, 29 were selected as having good ASR resistance. Their testcrosses and S2 progenies will be evaluated in a future project year. From the 44 CH05015:N1204 S1s evaluated, 26 were selected as having good ASR resistance. Testcrosses to B37 from 23 of these S1s had sufficient seed for ASR evaluation in summer 2007 (two replications at Aurora NY). Testcrosses to LH198 from 25 of the 26 S1s had sufficient seed for yield evaluations in summer 2007 (two NY locations with three replications per location). Stalk splitting and ASR ratings are just being completed at this time and harvest data have just been collected. These data will be analyzed and summarized for the 2008 GEM update.

Summary of Accomplishments:

The major accomplishment for this project to date is the development of four new GEM-derived inbreds with good ASR resistance, both per se and in testcross combinations. Resistance in the best of these materials is comparable to or better than that available in currently released U.S. inbreds. These inbreds also have reasonable yield potential, maturity, and standability in testcross combinations. In addition, selection has been initiated in one new GEM-derived synthetic population and two new GEM populations to begin producing new ASR resistant inbreds from this project.