

2006 NCR-167 Report

South Dakota State University

The South Dakota State University corn project continued to conduct applied research in corn breeding in 2005, with emphasis on development of population and specialty corn germplasm adapted to South Dakota environments. Our program goals are to conduct applied research in stress environments, train graduate students, and explore the potential for open-pollinated corn varieties and specialty corn production in South Dakota.

- 1.) For yellow corn development, several yellow inbred testcrosses yielded superior at the Southeast Research (Beresford) Station in terms of yield and lodging. Yields for the check hybrids averaged 7.98 Mg/ha, while the superior yellow inbred testcrosses averaged 9.15 Mg/ha. Superior testcross yields at our Northeast Research (Watertown) Station averaged 8.62 Mg/ha compared to the check average of 7.84 Mg/ha. At our Brookings location, several yellow inbred testcrosses were also promising, but failed to out-yield the check hybrids.
- 2.) We also extensively tested and evaluated white corn germplasm. Our goal is to develop white corn inbred lines and populations adapted to southern and central South Dakota. White hybrid yield trials were conducted at our Brookings, Watertown, and Beresford locations. While the inbred testcrosses did not yield superior to the check hybrids, several white inbred testcrosses show promise and are useful for genetic stock.
- 3.) Our goal is to select adapted corn hybrids and to develop inbreds for low-phosphorous and low-nitrogen content for South Dakota producers. Three replications of 10 hybrids from various private companies were planted at three locations (Beresford, Watertown, Brookings) in 2004 and 2005. Each replicated entry was planted at two population densities. We hand-harvested 10 plants per plot and weighed them for a tonnage value. Each sample was then weighed after drying and processed for P and N concentration analysis. The initial data suggests that genetic variation may exist. However, data analysis is not complete.
- 4.) Much effort went into open-pollinated corn research. Having a low-cost alternative and re-directing public breeding efforts will significantly impact sustainable agriculture in the North Central Region. We began a collaborative program

with North Dakota State University in extensively testing and developing new open-pollinated varieties that are competitive with commercial hybrids. Preliminary yield results show that several open-pollinated varietal crosses were superior in terms of yield and lodging.

- 5.) In our efforts to achieve our primary goals, we currently have two graduate students. Pravin Gautam, our M.S. student, is researching commercial hybrids for P and N concentration (see above). Yusheng Wu, our PhD student, began to establish F2 populations in our 2005 nursery with the intent of locating genes relevant to high amylose content via QTL analysis. He is performing lab functions involving DNA extractions to determine the polymorphisms between the high amylose inbred lines and has currently found appropriate markers for several chromosomes.

IMPACT

Although corn companies produce seed and sell hybrids to farmers, development of corn lines, and yield and grain quality enhancement by the public sector is invaluable for South Dakota. Public scientists conduct relevant research and enhance germplasm that can be marketed by the private corn companies. Over-feeding crude protein and minerals in the diets of all ruminants will result in loss of nitrogen and phosphorous to the environment in urine and feces, respectively. This will negatively impact water resources and also represent an economic loss to livestock producers. Open-pollinated corn research would likely benefit organic and sustainable farmers and producers who grow corn solely to feed their livestock. Germplasm that is not genetically modified, yet contains imperative genetic traits for yield and quality, will be beneficial to producers. This project has released many white inbred lines, several of which are actively used in the development of white corn hybrids targeted to South Dakota and the surrounding region. With improved quality traits, growers could obtain substantial incentive premiums and strengthen their economic viability.