South Dakota State University
2003 NCR-167 Report

Title: Corn Breeding, Genetics and Utilization

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Introduction:

South Dakota State University's corn breeding and genetics program primary foci are to conduct applied research in corn breeding and to train graduate students. Specific objectives that we would like to achieve are to: 1) develop and release inbred lines and improved populations that can be used to develop hybrids for livestock feed, grain production or other value added products. Emphasis will be placed on yield, adaptation, stress tolerance, and pest resistance, 2) evaluate and select corn adapted to South Dakota for phosphorous and nitrogen content to be used as a compliment/supplement to DDGs/co-product feed, 3) develop open-pollinated corn varieties, populations, and synthetics for sustainable agricultural operations (i.e. organic farmers) and conventional farming and, 4) continue to develop white corn as an alternative crop.

Accomplishments:

The corn breeding program at South Dakota State University continues to make good progress in different areas of corn germplasm development. For yellow corn development, approximately 300 early generation lines and 200 advanced lines were planted in our 2003 breeding nursery. We also advanced approximately 300 white corn lines. Based on evaluation for stress tolerance, disease resistance, lodging, and overall plant health, approximately 250 yellow inbred lines and 200 white inbred lines were selected. Within the selected materials, plants were advanced and crossed to testers for yield evaluation next year.

In 2002, a recurrent selection project using two well adapted synthetic populations (SDS16 and SDS17) was begun to develop inbred lines and a high yielding varietal hybrid between the two populations. We completed the second phase of this project, which entailed evaluation and selection of superior individuals and developing new populations.

Increased ethanol production will mean increased distillers grain (DG), which is a feed source to livestock. Phosphorous (P) and nitrogen (N) content in DG is approximately three times greater than the content found in corn grain, resulting in losses to the environment. As a result, the phosphorous and nitrogen requirement must be balanced when feeding DGs to livestock. Our goal was 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 this spring. However, due to unforeseen complications, relevant data was unobtainable. We aim to extensively test these hybrids and our own inbred lines in 2004 for P and N content. A recurrent selection project was also undertaken this past growing season for the development of silage populations. A graduate student, Pravin Gautam, started his Master's program with us this fall and will be herein actively involved in this study.

There is renewed interest, especially in low-yielding environments, in open-pollinated corn cultivars. We were awarded a grant through the North Central Regional SARE program to examine the economic and agronomic potential of open-pollinated corn varieties in 2002-3. This effort involved cooperation from producers, university extension personnel, and public corn breeders in South Dakota, North Dakota, Iowa, Minnesota, and Wisconsin. Based on preliminary 2002 data economic feasibility could be demonstrated. This year, the South Dakota State University corn project once again evaluated three replications of a NC+ hybrid check, a variety of choice, plus three open-pollinated populations adapted to our region (including one developed by our program) at three locations. The Dekalb hybrid check out-yielded the open-pollinated populations by approximately 20%. These results are not inconsistent from prior findings. In terms of economic feasibility, however, open-pollinated populations when compared to commercial hybrids under high-stress and low-yielding farming conditions may prove to be a profitable alternative.

We expect to analyze the economic feasibility of growing these populations before identifying the most promising one (s). Differences in input costs and yield revenues will be calculated over all the locations (in South Dakota, North Dakota, Wisconsin, Iowa, and Minnesota), and determinations will then be made as to whether any of these populations would be profitable for farmers to utilize in their operations.

In addition, the North Dakota State University corn breeder developed four open-pollinated populations adapted to the northern region. We felt the Northeast Research Station and the Brookings Agronomy farm would provide suitable climates for evaluation. Three replications of a Dekalb hybrid check and four open-pollinated populations developed by North Dakota were evaluated for yield, plant population, lodging, and overall agronomic health. The results from this study were fairly comparable to those of the SARE studies performed over the past few years.

South Dakota open-pollinated populations were extensively developed this past summer by the recurrent selection method and 500 new crosses were created by hybridization. Several small projects were also conducted. We received materials from Cornell University, developed for corn borer resistance. These lines were evaluated for, lodging, resistance, and overall plant health. Those that showed adaptability and had good agronomic characteristics will be used to develop new populations next year. In 2004, we will also continue to develop a green flint corn that may have potential for the Corn Palace murals.