ABSTRACT
NELSON, PAUL THOMAS. Evaluation of elite exotic maize inbreds for use in long-term temperate breeding. (Under the direction of Major M. Goodman.)

The U.S. maize (*Zea mays L.*) germplasm base is narrow. While maize is a very diverse species, that diversity is not represented in U.S. maize production acreage. Most elite U.S. maize inbreds can be traced back to a small pool of inbreds that were developed decades ago. Increased genetic diversity can be obtained through breeding with exotic germplasm, especially tropical-exotic sources. However, setbacks are often encountered when working with tropical germplasm due to adaptation barriers. Furthermore, the pool of available tropical germplasm is large and diverse, making choices of tropical parents difficult. The maize breeding program at North Carolina State University has begun a large-scale screening effort to evaluate elite exotic maize inbreds, most of which are tropical-exotic in origin. The purpose of this research was to: 1) generate comparative yield-trial data for over 100 elite exotic maize inbreds, 2) determine the relative effectiveness of various testcross regimes, 3) identify sources of gray leaf spot (GLS) resistance among these elite exotic inbreds, and 4) promote the use of exotic maize germplasm to broaden the genetic base of U.S. maize.

Over 100 elite exotic maize inbreds were obtained from various international breeding programs. They were tested in replicated yield trials in North Carolina as 50%-exotic testcrosses by crossing them to a broad-base U.S. tester of Stiff Stalk (SS) × non-Stiff Stalk (NSS) origin. The more promising lines additionally entered 25%-tropical testcrosses with SS and NSS testers and were further evaluated in yield-trials. A dozen tropical inbred lines performed well overall—CML10, CML108, CML157Q, CML258, CML264, CML274, CML277, CML341, CML343, CML373, Tzi8, and Tzi9. Inbred lines CML157Q, CML343, CML373, and Tzi9 did not show significant line × tester interaction. Furthermore, it was determined that testcrossing to a single broad-based tester will suffice for initial screening purposes, allowing for elimination of the poorest performing lines. Testcrossing to additional SS and NSS testers may be of value when determining where the better performing materials will fit into a breeding program. It was further determined that most tropical lines can effectively be evaluated at the 50%-tropical level because many of the problems typically
associated unadapted tropical material were minimized through a single testcross to an adapted tester.

Each of the exotic lines was screened for GLS resistance either as inbreds per se, as testcrosses, or both. Many of the inbreds showed high levels of GLS resistance, including several lines that have good yield potential. These lines include CML108, CML258, CML274, CML277, CML343, and Tzi16.

The results presented in this thesis provide temperate breeders with information on a sizable pool of potentially useful exotic maize inbred lines. These lines certainly deserve further attention in breeding efforts to broaden the U.S. maize germplasm base. Many are already being used at North Carolina State University in both exotic × temperate and exotic × exotic breeding crosses and populations.