HOLLEY, RANDALL N. Potential Use of Tropical Hybrid Maize Derivatives. (Under the direction of Dr. M. M. Goodman).

ABSTRACT

In 1975 a group of nine 100% tropical hybrids were crossed in a half diallel with selfs. Progeny from each cross were sib mated for six generations with selection for earliness, low plant and ear height, tassel and silk nick, lodging resistance, and prolificacy. Selection continued through two generations of selfing. All generations were grown in Raleigh, N.C. The resulting inbred lines were used in three studies: an evaluation of yield potential of 100% tropical inbreds in hybrid combination with Corn-Belt germplasm, an evaluation of stalk quality and stalk rot resistance of the lines, as inbreds, and in hybrid combination with Corn-Belt germplasm, and an examination of the genetic factors controlling resistance to Helminthosporium maydis [=Bipolaris maydis].

In 1983, thirty-four selected inbred lines were crossed onto two Corn-Belt single cross testers, (A632Ht x B73) and (Mo17 x (H95 x H993). The experimental hybrids were divided into two groups by tester and combined with eight commercial check hybrids to form two experiments. The experiments were grown at three locations in 1984 and 1985, with three replications at each location. Data recorded included grain weight, % grain moisture, stalk lodging, root lodging, and ear and plant height.

The stalk rot study involved two pathogens,
Colletotrichum graminicola and Diplodia zea, and included inbred line evaluation at one location in 1984, and 50% tropical hybrid evaluation at two locations in 1985. The pathogens were evaluated separately, with four replications of each pathogen, location combination. The tester used in forming the 50% tropical hybrids was A632Ht x B73. Two row plots were used, with artificial inoculation of all plants approximately one month after flowering. The first row was evaluated for internode discoloration approximately six weeks after inoculation, and the second was used to record the percentage stalk lodging late in the season. In addition, the two sets of 50% tropical hybrids used in the yield trial study were planted at one location for two years and rated for late season lodging resistance under uninoculated conditions.

The genetic control of resistance to Helminthosporium maydis was evaluated in greenhouse and field tests. In the greenhouse studies a mixture of race 0 isolates were used to artificially inoculate all plants. Plants in the field were artificially inoculated, but natural infestation predominated. Based on initial inbred line evaluations three tropical inbreds were selected for extensive study. The three lines were topcrossed to known susceptible (B73) and resistant (NC250) lines, and intercrossed with each other. F\textsubscript{1} and F\textsubscript{2} generation progeny from each of the crosses were rated for disease resistance. In addition, F\textsubscript{2} families of the B73 topcrosses were evaluated.
Within a 10 year period, inbred lines were derived from 100% tropical germplasm that in hybrid combination with elite U.S. materials are agronomically competitive with commercial U.S. hybrids. The inbreds are adapted to the southern U.S. and flower about a week later than B73. Plant height and grain moisture of the experimental hybrids were all within the range of the commercial checks. About 25% of the experimental hybrids had yields comparable to the commercial checks. Most of the tropical inbreds were inferior to elite U.S. inbreds in terms of stalk quality and stalk rot resistance, but there were several lines equal, or superior to, the checks. As a group the tropical materials were resistance to *D. zea* and susceptible to *C. graminicola*. However, differences in rind strength appeared to be the predominant factor determining lodging resistance. The importance of rind strength was reflected in high rank correlations of entry means for percent lodging over different pathogen tests. Inbred line evaluations of internode discoloration were not reflective of lodging resistance in hybrid combination.

Examination of resistance to *Helminthosporium maydis* from tropical germplasm indicated several different types of simply inherited resistance are available. Two of the three inbred lines studied appear to carry resistance that is controlled by 3 to 5 genes with additive gene action. The third inbred studied appeared to have resistance that is controlled by 3 to 5 recessive genes. A clear
determination regarding the number of genes involved and
the number of genes that different resistance sources have
in common was limited by the presence of background and/or
epistatic effects.