

NCR-167 2004 Missouri Station Report, January-December 2004

L. L. Darrah

- **Annual progress report:**

D. B. Willmot resigned from USDA-ARS in March 2004 to return to private industry (Agilent Technologies) and his position was abolished.

L. L. Darrah went on terminal leave at the end of October 2004 and officially retired 21 January 2005. Recruitment of a Research Leader/Research Geneticist is underway, but may not result in a corn quantitative geneticist/breeder.

Added genetic diversity among commercial corn hybrids may further increase yields and safeguard against past vulnerability. Ten corn populations, created from Chinese and/or U.S. inbreds or strains, were evaluated by using a diallel mating design by the corn quantitative genetics project in the Plant Genetics Research Unit, Columbia, MO. Grain yield specific combining ability was greatest in the cross Chinese Mix 2 × Mo17(H14)C5. Because of the high yield potential and other moderate to good agronomic traits of the cross combination, Chinese Mix 2 was identified as the most likely candidate population for continued selection. Its large specific combining ability effect with Mo17 (Lancaster type) materials, which are commonly known in breeding programs, shows potential for further improvement.

- **Major accomplishments over the life of the project (new project beginning in OCT03):**

Added genetic diversity among commercial corn hybrids may further increase yields and safeguard against past vulnerability. Ten corn populations, created from Chinese and/or U.S. inbreds or strains, were evaluated by using a diallel mating design by the corn quantitative genetics project in the Plant Genetics Research Unit, Columbia, MO. Grain yield specific combining ability was greatest in the cross Chinese Mix 2 × Mo17(H14)C5. Because of the high yield potential and other moderate to good agronomic traits of the cross combination, Chinese Mix 2 was identified as the most likely candidate population for continued selection. Its large specific combining ability effect with Mo17 (Lancaster type) materials, which are commonly known in breeding programs, shows potential for further improvement.

- **Prior project (ending SEP03) major accomplishments include:**

Corn rind penetrometer resistance has been used to measure stalk strength and improve stalk lodging resistance, and quantitative trait loci (QTLs) have been identified for both rind penetrometer resistance and second-generation European corn borer resistance. Phenotypic recurrent selection increases the frequency of favorable alleles over cycles of selection. Several studies have indicated that marker-assisted selection is also a potentially valuable selection tool. We compared the efficiency of phenotypic selection vs. marker-assisted selection for rind penetrometer resistance and second-generation European corn borer resistance. Marker-assisted selection for high and low rind penetrometer resistance was effective in the three populations studied. Phenotypic selection for both high and low rind penetrometer resistance was more effective than marker-assisted selection in two of the populations. However, in a third

population, marker-assisted selection for high rind penetrometer resistance using QTL effects from the same population was more effective than phenotypic selection, and using QTL effects from an independent population was just as effective as phenotypic selection. Marker-assisted selection for resistance and susceptibility to second-generation European corn borer using QTL effects from the same population was effective in increasing susceptibility, but not in increasing resistance. Marker-assisted selection using QTL effects from an independent population was effective in both directions of selection. Thus, marker-assisted selection was effective in selecting for both resistance and susceptibility to second-generation European corn borer. These results demonstrated that marker assisted selection can be an effective selection tool for both rind penetrometer resistance and second-generation European corn borer resistance. These results also validate the locations and effects of QTL for rind penetrometer resistance and second-generation European corn borer resistance identified in earlier studies.

White food-grade corn is used mainly for dry corn meal and grits products. Seed producers, corn millers, and farmers use agronomic performance data to select hybrids adapted for growing in specific regions of the U.S. Smaller seed companies have benefitted by having their products tested in a much wider area than could be accomplished by the company itself. Late maturity, white food-grade corn performance and grain quality testing was conducted from 1977 to 2002. During 26 years of testing, 715 hybrids from public and private sources were evaluated. Early maturity, white food-grade corn performance and grain quality testing was done from 1984 to 2002. During 19 years of testing, 387 hybrids from public and private sources were evaluated. Testing was supported by the North American Millers' Association and participating seed companies. Because of an insufficient number of entries to justify growing the late and early maturity tests, they were discontinued in 2003.

- **Publications or manuscripts accepted for publication:**

David B. Willmot, Bruce E. Hibbard, B. Dean Barry, A. Q. Antonio, and L. L. Darrah. 2004. Registration of Mo48 and Mo49 maize germplasm lines with resistance to European corn borer. *Crop Sci.* Accepted 25JUN04.

David B. Willmot, Bruce E. Hibbard, Larry L. Darrah, Linda M. Pollak, Kevin Montgomery, Richard C. Pratt, Craig A. Abel, James A. Hawk, Tecele Weldekidan, and John E. Foster. 2004. Effect of environment on resistance to the European corn borer (Lepidoptera: Crambidae) in maize. *J. Econ. Entomol.* Accepted 1JUL04.

- **Manuscripts with ARS approval submitted for publication:**

M. A. Glover, D. B. Willmot, L. L. Darrah, and X. Zhu. 2005. Diallel analysis of Chinese and U.S. maize germplasm. Submitted to *Crop Science* 16AUG04.

- **Theses:**

None.

17 August 2004