

NCR-167 Year 2003 Annual Report
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The Texas A&M University corn breeding and genetics program at College Station conduct research activities focused on:

- Understanding the genetic basis for tolerance and resistance to abiotic and biotic stresses and developing maize lines and populations with resistance and/or tolerance. Especial attention is devoted to drought and heat tolerance and aflatoxin resistance.
- The characterization of exotic tropical and subtropical material and its introgression and combination with temperate germplasm.
- The development of maize inbreds and populations with improved quality and processing properties for foods, feeds and industrial products.
- The development of Quality Protein Maize (QPM) lines, hybrids and populations adapted to temperate areas, improved nutritional properties and competitive yield.

Summary of Activities

During the 2003 season we have continued the evaluation, characterization and selection of corn germplasm with different origins and genetic backgrounds to develop inbred lines with superior grain quality, reduced susceptibility to aflatoxin, adaptation to Texas, and tolerance to abiotic stresses. We have conducted multilocation testing across the major corn production regions of Texas and evaluated germplasm under drought stress and inoculation with *Aspergillus flavus*, fungi responsible of aflatoxin contamination in corn. Approximately 1000 experimental hybrids and testcrosses were evaluated across several Texas environments to identify the most adapted germplasm to the local conditions. Different traits (yield, maturity, moisture, test weight, lodging, ear and plant height, cob and grain color, texture, disease resistance, etc.) were recorded. We have selected the best material in these trials considering its overall performance, local adaptation, and quality. In these evaluations we have collaborated with other public programs and agencies, international centers, and private seed companies.

Inbred lines and their hybrids were evaluated under *A. flavus* inoculation in three locations in South and Central Texas during 2003. The most promising inbreds for reducing the risk of aflatoxin in Texas growing conditions are CML269, CML176, CML78, and Tx807 among the white grained lines, and TxX69's, CML323, Tx772, and CML288 among the yellow grained lines. Most of these inbreds have subtropical or tropical origin and hard endosperm. Their hybrids were less susceptible to aflatoxin than commercial hybrids.

During year 2003 we had two nurseries, one during the regular season (summer) at College Station (4,500 plots) and one off-season (winter) at Weslaco (4,000 plots). An approximate of 1000 inbred lines representing a wide range of maturities (early, intermediate and late), adaptation (tropical, subtropical and temperate), color (white, yellow, orange), quality (lysine content), and kernel characteristics (flint, dent) were screened in these nurseries. Traits such as early vigor, maturity, adaptation, plant and ear height, grain color, cob color, texture, disease

resistance, and ear characteristics were recorded and ultimately used to classify and select the most promising germplasm for our program objectives.

Introduced exotic white and yellow lines were characterized for adaptation, heterotic response, nutritional value, tolerance to abiotic stresses, and response to aflatoxin accumulation. Selected introductions were crossed with temperate corn lines to produce hybrids and breeding populations with different degrees of exotic material that were tested across subtropical to temperate environments under different water regimes (rainfed, full and limited irrigation). Overall, we have observed that temperate inbreds from northern areas provide high yield, stalk quality, known heterotic response, and early vigor while tropical and subtropical germplasm from southern areas provides resistance and/or tolerance to biotic and abiotic stresses (e.g., less aflatoxin, drought and heat tolerance) and kernel quality (more flinty endosperm texture).

In QPM, we have continued the line recycling of the best white and yellow QPM selections and the conversion of elite standard temperate lines to QPM. Our goal is to develop temperate adapted QPM germplasm and define heterotic groups. High lysine hybrid trials conducted across Texas locations. Although, in general, the new QPM hybrids yield less than commercial hybrids, they were less susceptible to aflatoxin and more adapted to temperate areas than old QPM hybrids showing maturities and plant heights similar to commercial hybrids. The first generation of QPM lines adapted to Southern US have been developed and released (Tx807, Tx811, Tx802). New generations of lines more adapted to temperate areas are in advance stages of development.

Current Personnel

- F. Javier Betrán, Project Leader
- Kerry Mayfield, Research Assistant and M.S. Student (Adaptation)
- Sandeep Bhatnagar, Ph.D. Student (Quality Protein Maize)
- Dennis Transue, Ph.D. Student (Introgression of exotic germplasm)
- Rosan Ganunga, Ph.D. Student (Abiotic stresses & Sub-Saharan Africa)
- Dan Makumbi, Ph.D. Student (Abiotic stresses & Sub-Saharan Africa)
- Francis Maideni, Ph.D. Student (Abiotic stresses & Sub-Saharan Africa)
- Rosan Ganunga, Ph.D. Student (Abiotic stresses & Sub-Saharan Africa)
- Melanie L. Edwards, Ph.D. Student (Aflatoxin resistance)
- Brett Ochs, MS. Student (Adaptation and Introgression)
- Halima Atta, Ph.D. Student (Quality Protein Maize)

Parental Lines and Germplasm Releases

We released three parental inbred lines (Tx110, Tx114, and Tx772) and 4 germplasm lines (Tx745, Tx714, Tx32 and Tx770) during 2003.

Publications

Peer reviewed, refereed journal articles

F.J. Betrán, D. Beck, M. Bänziger, G. Edmeades. 2003. Genetic analysis of inbred and hybrid grain yield under stress and nonstress environments in tropical maize. *Crop Sci* 43:807-817.

F.J. Betrán, J.M. Ribaut, D. Beck, and D. Gonzalez de Leon. 2003. Genetic diversity, specific combining ability and heterosis in tropical maize under stress and non-stress environments. *Crop Sci.* 43:797-806.

F.J. Betrán, D. Beck, G. Edmeades, M. Bänziger. 2003. Secondary Traits in Parental Inbreds and Hybrids under Stress and Non-stress Environments in Tropical Maize. *Field Crops Research* 83: 51-65.

S. Bhatnagar*, F.J. Betrán, and D. Transue. 2003. Agronomic performance, aflatoxin accumulation and protein quality of subtropical and tropical QPM hybrids in southern USA. *Maydica* 48: 113-124.

F.J. Betrán, A. Bockholt, F. Fojt III, L. Rooney. 2003. Registration of Tx811 Maize Parental Line. *Crop Sci.* 43: 1893-1894.

F.J. Betrán, A. Bockholt, F. Fojt III, G. Odvody. 2003. Registration of Tx807 Maize Parental Line. *Crop Sci.* 43: 1892-1893.

F.J. Betrán, A. Bockholt, F. Fojt III, R. Waniska. 2003. Registration of Tx802 Maize Parental Line. *Crop Sci.* 43: 1891-1892.

Conference or Symposium proceedings

F. J. Betrán, Tom Isakeit, Gary Odvody, and Kerry Mayfield. 2003. Identification, development and characterization of corn germplasm to reduce aflatoxin contamination. Aflatoxin/Fumonisin Workshop 2003, October 13-15, 2003, Savannah, GE.

F. J. Betrán, Tom Isakeit, Gary Odvody, Sandeep Bhatnagar, and Kerry Mayfield. 2003. Aflatoxin Accumulation and Associated Traits in Maize Inbreds and Their Testcrosses. Aflatoxin/Fumonisin Workshop 2003, October 13-15, 2003, Savannah, GE.

Kerry Mayfield, Bryan Jones, Leslie Lutz, Adam Blackwelder, T. Isakeit, Gary Odvody, and Javier Betrán. 2003. Aflatoxin accumulation in maize inbreds and hybrids. Aflatoxin & Fumonisin Workshop 2003, October 13-15, 2003, Savannah, GE.

F.J. Betrán, K. Mayfield, T. Isakeit, and M. Menz. 2004. Breeding exotic maize germplasm. Proceedings of the Arnel R. Hallauer International Plant Breeding Symposium. Mexico D.F., Mexico 2003.

Abstracts

F. Maideni, C. Magorokosho, R. Ganunga, D. Makumbi, K. Mayfield, and F.J. Betrán. 2003. Comparative performance of single and three-way white maize hybrids. *In Agronomy Abstracts*. Denver, CO.

M.L. Edwards, K. Mayfield, T. Isakeit, G. Odvody, and F.J. Betrán. 2003. Repeatability of aflatoxin trials in white and yellow maize. *In Agronomy Abstracts*. Denver, CO.

S. Bhatnagar, P. Scott, K. Mayfield, and F.J. Betrán. 2003. Agronomic and quality evaluations of high lysine maize hybrids. *In Agronomy Abstracts*. Denver, CO.

K. Mayfield, D. Pietsch, J.M. Owen, and F.J. Betrán. 2003. Classification and characterization of Texas corn locations based on yellow hybrid evaluations. *In Agronomy Abstracts*. Denver, CO.

D.K. Transue, S. Bhatnagar, K. Mayfield, and F.J. Betrán. 2003. Diallel analysis among temperate and subtropical white inbred testers: agronomic performance, heterotic response, and aflatoxin accumulation. *In Agronomy Abstracts*. Denver, CO.

D.K. Transue, S. Bhatnagar, D. Pietsch, J. Owen, K. Mayfield, and F.J. Betrán. 2003. Maize single cross hybrids between yellow temperate and subtropical and tropical inbreds. *In Agronomy Abstracts*. Denver, CO.