

2004 NCR-167 Annual Station Report
Iowa State University
Calendar Year 2003

Summary of Accomplishments

The cooperative federal-state maize breeding program at Iowa State University continues to evolve. We now have all of our vacancies filled with the hiring of Dr. Jode W. Edwards by the USDA-ARS. Dr. Edwards officially begins on February 9, 2004. His addition significantly enhances our ability to conduct corn breeding research, quantitative genetic experiments, applying statistics to breeding problems, and applying molecular tools to plant breeding questions.

Recurrent Selection. We have been able to maintain several recurrent selection programs. The most significant ones will be summarized as to their status. We intermated selections to form the populations BS11(5-S₁)C9, BS11(10-S₁)C9, BS11(20-S₁)C9, and BS11(30-S₁)C9. These recurrently selection programs involve a constant selection intensity (20%) and we intermate 5, 10, 20, and 30 progenies, respectively in each program. In 2004, we will evaluate S₁-lines from C9 and complete C10 in the winter of 2004. After that we will embark on an evaluation of selection progress. We intermated selections in 2003 to form BSSS(R)C16 and BSCB1(R)C16, one of our long term selection programs initiated in 1949. S₂-progenies BS13(S)C10 were evaluated in 2003 and selections will be intermated to form BS13(S)C11 in 2004. This completes the 18th cycle of selection in this program counting the 7 cycles of half-sib selection done with IA13 as a tester. Reciprocal full-sib families were evaluated from BS11(FR)C15 and BS10(F)C15 in 2003. Selections will be intermated in 2004 to form BS11(FR)C16 and BS10(FR)C16. Selections were intermated in 2003 to form the BS21(R)C9 and BS22(R)C9 populations. We also have ongoing reciprocal selection programs in BS31 (FS8A(T)) and BS32 (FS8B(T)) and in BS28 (Leaming) and BS29 (Midland).

Research Projects. Since much of the research projects are conducted by students, they are probably best summarized in that manner.

Lori Hinze finished her Ph.D. dissertation on a molecular evaluation of the 16 progenitors of BSSS and the 12 progenitors of BSCB1 as well as the C0, C1, C3, C6, C9, C12, and C15 populations of BSSS(R) and BSCB1(R). Data were collected for 105 SSR loci. Manuscripts are in preparation.

James Rouse continues his analysis of a data set with 300 SSR loci on the progenitors of BSSS and BSCB1 as well as all of the elite inbred lines that we have derived from these germplasm sources. The purpose is to identify progenitor contributions to elite inbred lines and to determine how selection funnels diversity.

Buppa Kongsamai is in the final stages of completing her dissertation on marker assisted selection project. She is currently writing manuscripts.

Chris Rasmussen completed his M.S. theses on an evaluation design II crosses of 7 BSSS related populations with 5 non-BSSS related populations. Reciprocals were also included in the design.

2004 NCR-167 Annual Station Report
Iowa State University
Calendar Year 2003

Clint Turnbull is collecting the second year of data on the evaluation of 10 cycles of S₂-progeny selection in BS13. Clint is currently serving in the military in Iraq.

Elizabeth Popowski is studying the inheritance of lysine, methionine, and tryptophan in either the BS11 or BS31 genetic backgrounds. She will also be studying the repeatability of various lab assays for measuring amino acid content. Liz has one year of data and will collect another in 2004.

Aaron Lorenz is studying the inheritance of phytic acid in the BS11 and BS31 genetic backgrounds. He will get his first year of data in 2004.

Brandon Wardyn is studying inbreeding depression in the BSCB1(R)C13 populations. Our goals (among others) is to estimate σ_A^2 , σ_D^2 , D_1 , D_2^* , and H^* . We will be using a novel design that will allow us to directly estimate the homozygous dominance effects (d_{ii}) which contribute directly to inbreeding depression. Brandon has designed the experiments and is currently packaging seed for evaluation in 2004.

Tom Scheffler is conducting an extension of Chris Rasmussen project that will involve the populations per se, the population crosses, and the population crosses and per se selfs.

Nicholas Bowser is studying the effect of treating seeds on data from small plot experiments. One of the goals is to determine if seed treatment is necessary in small plot experiments.

Germplasm Released

The following inbred lines were released in 2003:

Line	Pedigree
B116	B97/B99)-047-1-1-1-1-1-1-1-B-B (02SARH:BREED:0197)
B117	B97/B99)-024-1-1-2-1-1-1-1-B-B (02SARH:BREED:0185)
B118	B97/B99)-024-1-1-2-1-2-1-1-B-B (02SARH:BREED:0191)
B119	BS13(S)C7)-0008-1-1-1-1-1-1-B-B (02SARH:BREED:0157)
B120	BSCB1(R)C12)-6826-1-1-1-1-1-1-B-B (02SARH:BREED:0167)
B121	BSCB1(R)C12)-0120-1-1-1-1-1-1-B-B (02SARH:BREED:0173)
B122	BSKRL2(HI)C0-7203-3-2-01-01-03-B-B (02SKRL:B4:8620)
B123	BSKRL2(HI)C0-7314-2-1-01-01-01-B-B (02SKRL:B4:8635)
B124	BSKRL2(HI)C0-7370-2-2-02-01-02-B-B (02SKRL:B4:8650)
B125	BSKRL2(HI)C0-7383-3-2-01-01-03-B-B (02SKRL:B4:8665)

Personnel (2003)

Arnel R. Hallauer	Project Leader (Emeritus)
Kendall R. Lamkey	Project Leader

**2004 NCR-167 Annual Station Report
Iowa State University
Calendar Year 2003**

Paul R. White	Technician
Lori Hinze	Ph.D. Student (Markers/RRS)
James Rouse	Ph.D. Student (Markers/selection)
Buppa Kongsamai	Ph.D. Student (MAS)
Chris Rasmussen	M.S. Student (Heterosis/Population Cross Performance)
Clint Turnbull	Ph.D. Student (Evaluation 10 Cycles S ₂ selection)
Elizabeth Popowski	M.S. Student (Amino Acid Inheritance)
Brandon Wardyn	Ph.D. Student (Inbreeding depression/variance components)
Tom Scheffler	Ph.D. Student (Inbreeding depression/Pop cross performance)
Aaron Lorenz	M.S. Student (Phytic Acid)
Nick Bowser	M.S. Student (Seed treatment study)

Collaborators

Dr. Michael Lee (ISU)
Dr. M. Paul Scott (USDA-ARS)
Dr. Linda Pollak (USDA-ARS)
Dr. Mike Blanco (USDA-ARS)
Dr. Walter Goldstein (MFAI)
Dr. Charlie Sing (University of Michigan)
Dr. O.S. Smith (Pioneer)
Dr. M. Cooper (Pioneer)

Publications

Hinze, L. L. and K. R. Lamkey. 2003. Absence of epistasis for grain yield in elite maize hybrids. *Crop Sci.* 43:46-56.

Labate, J. A., K. R. Lamkey, S. E. Mitchell, S. Kresovich, H. Sullivan, J. S. C. Smith. 2003. Molecular and historical aspects of Corn Belt dent diversity. *Crop Sci.* 43:80-91.

Hagdorn, S., K.R. Lamkey, M. Frisch, P.E.O. Guimarães, A.E. Melchinger. 2003. Molecular Genetic Diversity among Progenitors and Derived Elite Lines of BSSS and BSCB1 Maize Populations. *Crop Sci.* 43:474-482.

Edwards, J.W. and K.R. Lamkey. 2003. Dominance and genetic drift: Predicted effects of population subdivision in the BS13(S)C0 maize population. *Crop Sci.* 43:2006-2017.

Grants

We received a grant to conduct a collaborative project with Pioneer Hi-Bred International (Drs. O.S. Smith, M. Cooper, and D. Podlich) and the University of Michigan (Dr. C. F. Sing). The title of the grant is “*Combinatorial Partitioning Method analysis of Pioneer’s MARS data for improved detection of quantitative trait loci.*” The goal of this project is to develop and evaluate novel methods for detecting epistasis in QTL datasets. We hired Dr. Yudong (Mike) Zhang at Iowa State University as a postdoc to run the project. Dr. Zhang started on January 22, 2004.