Summaries of Arkansas Cotton Research
2006

Edited by Derrick M. Oosterhuis

ARKANSAS AGRICULTURAL EXPERIMENT STATION
Division of Agriculture
University of Arkansas System
October 2007

Research Series 552
CONTRIBUTORS

Baker, William H., Associate Professor, School of Agriculture, Arkansas State University, Jonesboro
Bibi, Androniki C., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bourland, Fred M., Director, Northeast Research and Extension Center, Keiser
Carroll, Stephen D., Program Associate III, Soil Testing and Research Lab, Marianna
Capps, Chuck D., Pest Management Technical Support Specialist, Southeast Research and Extension Center, Monticello
Cates, Eddie, Consultant, Cates Consulting, Lepanto
Cochran, Mark J., Associate Vice President, Arkansas Agricultural Experiment Station, Fayetteville
Colwell, C. Kyle, Seasonal Agricultural Technician, Cooperative Extension Service, Little Rock
Danforth, Diana M., Program Associate III, Department of Agricultural Economics and Agribusiness, Fayetteville
Edmund, Richard, Technical Representative, DuPont Agricultural Products, Little Rock
Espinoza, Leo, Extension Agronomist - Soils, Cooperative Extension Service, Little Rock
Evans, Edwin E., Farm Manager, Soil Testing and Research Lab, Marianna
Farr, Chuck, Mid-South Ag Consultants, Crawfordsville
Francis, Paul B., Professor, Agronomy Department, University of Arkansas at Monticello, Monticello
Franks, Robin, District Sales Manager, Netafim USA, Fresno, Calif.
Gonias, Evangelos D., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Goodson, Robert, County Extension Agent - Agriculture, Phillips County, Helena
Griffin, Bob, Consultant, Griffin Consulting, Jonesboro
Griffith, Griff M., Graduate Research Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Groves, Frank E., Cotton Research Verification Program Coordinator, Southeast Research and Extension Center, Monticello
Hardke, Jarrod T., Seasonal Agricultural Technician, Cooperative Extension Service, Little Rock
Herron, Cindy G., Research Specialist, Soil Testing and Research Laboratory, Marianna
Hogan, Robert, Jr., Extension Economist, Northeast Research and Extension Center, Keiser
Ismanov, M., Program Technician, Cotton Branch Station, Marianna
Jones, D.C., Program Director, Cotton Incorporated, Gary, N.C.
Kantartzi, Stella, Post-doctoral associate, Crop, Soil, and Environmental Sciences Department, Fayetteville
Kaufman, Kenny, A., Research Specialist, Southeast Research and Extension Center, Monticello
Kawakami, Eduardo M., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Kennedy, Claude, Resident Director, Cotton Branch Station, Marianna
Kirkpatrick, Terry L., Professor, Southwest Research and Extension Center, Hope
Leland, Jarrod E., Research Entomologist, USDA-ARS, Southern Insect Management Research Unit, Stoneville, Miss.
Loka, Dimitra, Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Lorenz, Gus M., III, Extension Entomologist, Cooperative Extension Service, Little Rock
Lund, Jennifer, Program Technician, Department of Agronomy and Entomology, Arkansas State University, Jonesboro
McClelland, Marilyn R., Research Associate, Crop, Soil, and Environmental Sciences Department, Fayetteville
McConnell, J. Scott, Associate Professor, Crop, Soil, and Environmental Sciences Department, Monticello
Monge, Juan A., Technical Assistant II, Department of Agricultural Economics and Agribusiness, Fayetteville
Mozaffari, Morteza, Research Assistant Professor, Soil Testing and Research Laboratory, Marianna
Norsworthy, Jason K., Assistant Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Oliver, Lawrence R., University Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Oosterhuis, Derrick M., Distinguished Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Plunkett, Donald, County Extension Agent, Jefferson County, Pine Bluff
Robertson, William C., Extension Agronomist - Cotton, Crop, Soil, and Environmental Sciences Department, Little Rock
Sangepogu, T.J., Program Technician, Arkansas State University, Jonesboro
Scott, Robert C., Extension Weed Specialist/Associate Professor, Little Rock
Shelton, Craig, graduate assistant, Cooperative Extension Service, Little Rock
Slaton, Nathan A., Associate Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Smith, Kenneth L., Extension Weed Specialist/Professor, Southeast Research and Extension Center, Monticello
Stark, C. Robert, Associate Professor, Agricultural Economics Department, University of Arkansas at Monticello, Monticello
Steinkraus, Donald C., Professor, Department of Entomology, Fayetteville
Stewart, James McD., University Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Still, Joshua A., Graduate Assistant, Plant Pathology Department, Fayetteville
Studebaker, Glenn E., Extension Entomologist, Northeast Research and Extension Center, Keiser
Teague, Tina G., Professor, Department of Agronomy and Entomology, Arkansas State University, Jonesboro
Tiwari, Rashmi, Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Ulloa, Mauricio, Research Scientist, USDA, Shafter, Calif
Varvil, J., Program Technician, Soil Testing and Research Laboratory, Marianna
Wailes, Eric J., Professor, Department of Agricultural Economics and Agribusiness, Fayetteville
Warnock, Mary, Professor, School of Human Environmental Sciences, Fayetteville
Watkins, K. Bradley, Research Assistant Professor, Department of Agricultural Economics, Stuttgart
CONTENTS

Contributors .................................................................................................................. 2
Preface ........................................................................................................................... 12
Arkansas Cotton Research Group ........................................................................... 14
Acknowledgments ....................................................................................................... 14
Cotton Incorporated and the Arkansas State Cotton Support Committee ............ 16

SUMMARIES OF ARKANSAS COTTON RESEARCH 2005

University of Arkansas Cotton Breeding Program - 2006 Progress Report
Fred M. Bourland ....................................................................................................... 21

Development of the COTVAR Variety Selection Program
Fred M. Bourland and D.C. Jones ............................................................................ 24

Radiation Use Efficiency of Cotton in Two Contrasting Environments
Evangelos D. Gonias, Derrick M. Oosterhuis, and Androniki C. Bibi ....................... 27

Effect of Plant Growth Regulators on Radiation Use Efficiency of Cotton
Evangelos D. Gonias, Derrick M. Oosterhuis, and Androniki C. Bibi ....................... 31

Physiological Response of Okra- and Normal-Leaf Cotton Isolines at Two Temperature Regimes
Evangelos D. Gonias, Derrick M. Oosterhuis, and Androniki C. Bibi ....................... 34

Effect of High Night Temperatures on Cotton Gas Exchange and Carbohydrates
Dimitra Loka and Derrick M. Oosterhuis ................................................................. 37
Comparison of Boll Internal Temperatures with Ambient Temperatures for Calculation of Heat Units to Determine Defoliation Timing

Derrick M. Oosterhuis, Evangelos D. Gonias, and Androniki C. Bibi

Effect of the Plant Growth Regulator BM86 on Polyamines and Seed Set Efficiency of Cotton During the Reproductive Stage

Androniki C. Bibi, Derrick M. Oosterhuis, and Evangelos D. Gonias

Polyamines in Cotton Ovaries as Affected by Nodal Position and Canopy Temperature

Androniki C. Bibi, Derrick M. Oosterhuis, and Evangelos D. Gonias

Exogenous Application of Putrescine on Cotton Ovaries under Two Temperature Regimes

Androniki C. Bibi, Derrick M. Oosterhuis, and Evangelos D. Gonias

Effect of 1-MCP on the Growth and Yield of Cotton

Eduardo M. Kawakami, Derrick M. Oosterhuis, Evangelos D. Gonias, and Androniki C. Bibi

Effect of 1-MCP on the Physiology and Growth of Drought-Stressed Cotton Plants

Eduardo M. Kawakami and Derrick M. Oosterhuis

Management of Late-Planted Cotton

William C. Robertson, Frank E. Groves, and Robert Hogan, Jr.

Optimizing Revenue Through Defoliation Timing Using COTMAN

William C. Robertson, Frank E. Groves, and Robert Hogan, Jr.
Evaluation of Drip Irrigation for Cotton in Arkansas
William C. Robertson, Frank E. Groves, Robert Hogan, Jr.,
Leo Espinoza, M. Ismanov, and Robin Franks .............................. 73

Effect of Potassium Fertilization on Seedcotton Yield
Morteza Mozaffari, Nathan A. Slaton, Edwin Evans,
J. Varvil, Fred M. Bourland, and Claude Kennedy....................... 78

Effect of Phosphorus Fertilization and Cultivar on Seedcotton Yield
Morteza Mozaffari, Nathan A. Slaton, Edwin Evans,
J. Varvil, Fred M. Bourland, and Claude Kennedy....................... 82

Sidedress Application of Nitrogen and Pre-Sidedress Soil Nitrate Test Can Improve Nitrogen Management for Cotton
Morteza Mozaffari, Nathan A. Slaton, Cindy G. Herron,
Stephen D. Carroll, and Fred M. Bourland.................................. 86

Long-Term Irrigation Methods and Nitrogen Fertilization Rates in Cotton Production: The Last Three Years of the McConnell-Mitchell Plots
J. Scott McConnell, Kenny A. Kaufman,
Paul B. Francis, and C. Robert Stark....................................... 90

Weed Management Needs in Arkansas Cotton
Jason K. Norsworthy, Kenneth L. Smith,
Robert C. Scott, and Marilyn R. McClelland.............................. 101

Confirmation of Glyphosate-Resistant Palmer Amaranth in Arkansas
Jason K. Norsworthy, Griff M. Griffith, Kenneth L. Smith,
Robert C. Scott, and Lawrence R. Oliver................................. 105

Managing Glyphosate-Resistant Horseweed in Conservation-Tillage Cotton Production: Final Summary and Recommendations
Marilyn R. McClelland, Kenneth L. Smith,
and Jason K. Norsworthy....................................................... 108

Genetic Diversity of A-Genome Cotton
Stella Kantartzi, Mauricio Ulloa, and James M. Stewart............. 112
Molecular Diversity and Determination of Possible Natural Hybridization among the Australian Arid-Zone *Gossypium* Species (*G. australe*, *G. bickii*, and *G. nelsonii*)
Rashmi Tiwari and James M. Stewart .................................................. 117

Host Response to Reniform Nematode Infection in Resistant and Susceptible *Gossypium arboreum* Accessions
Carlos A. Avila and James M. Stewart ............................................. 123

Ecology and Over-Wintering Ability of *Rotylenchulus reniformis* on Cotton in Arkansas
Joshua A. Still and Terry L. Kirkpatrick ........................................... 128

Efficacy of At-Planting Insecticides Against Thrips in Cotton in Northeast Arkansas
Glenn E. Studebaker ........................................................................ 132

Performance of Widestrike Cotton in Arkansas, 2006
Gus M. Lorenz III, Kyle Colwell, Jarrod Hardke, and Craig Shelton ................................................................. 135

Mid-Season Plant Bug Thresholds in Arkansas, 2006
Jarrod T. Hardke, Gus M. Lorenz III, Kyle Colwell, Craig Shelton, Chuck Farr, Bob Griffin, Eddie Cates, Chuck Capps ........................................................................ 140

Early-Season Plant Bug Thresholds in Arkansas, 2006
Jarrod T. Hardke, Gus M. Lorenz III, Kyle Colwell, Craig Shelton, Chuck Farr, Bob Griffin, Eddie Cates, and Chuck Capps ........................................................................ 146

Efficacy of Selected Compounds for Two-Spotted Spider Mite (*Tetranychus urticae*) Control in Arkansas, 2006
Kyle Colwell, Gus Lorenz, III, Craig Shelton, Jarrod Hardke, and Robert Goodson .................................................. 153

Rynaxypyr™: A Novel Insecticide for Control of Heliothines in Conventional and Bollgard Cotton
Jarrod T. Hardke, Gus M. Lorenz, III, Kyle Colwell, Craig Shelton, and Richard Edmund .................. 156
Economic Impacts of Termination Timing for Irrigation and Plant Bug Control
Juan J. Monge, Tina Gray Teague, Mark J. Cochran, and Diana M. Danforth ............................................................ 161

Control of the Tarnished Plant Bug (Lygus lineolaris) in Mid-South Cotton Using the Entomopathogenic Fungus (Beauveria bassiana) and the Insect Growth Regulator Diamond®
Jennifer Lund, Tina G. Teague, Donald C. Steinkraus, and Jarrod E. Leland ............................................................... 169

Control of the Tarnished Plant Bug (Lygus lineolaris) in Cotton Using the Entomopathogenic Fungus Beauveria bassiana, the Insect Growth Regulator Novaluron, and Early-Season Trap Crop Practices
Jennifer Lund, Tina G. Teague, T.J. Sangepogu, Donald C. Steinkraus, and Jarrod E. Leland ............................................. 176

Summary of Arkansas Representative Panel Farm Project
Robert Hogan, Jr., K. Bradley Watkins, and Eric Wailes ........... 184

An Economic Analysis Comparing Harvest Aid Programs in Arkansas
Robert Hogan, Jr. and William C. Robertson ......................... 190

Utilization of COTMAN to Enhance Profitability of Cotton in Arkansas
William C. Robertson, Gus M. Lorenz, III, Diana M. Danforth, and Robert Hogan, Jr. ............................ 195

An Overview of the Arkansas Cotton Research Verification Program
Frank E. Groves, William C. Robertson, and Robert Hogan, Jr. .................................................................................. 198

The Influence of COTMAN on the Arkansas Cotton Research Verification Program
Frank E. Groves and Don Plunkett ............................................ 201
Cotton as an Innovative Fabric for Firefighter Protective Clothing
Mary M. Warnock................................................................. 204

A Comparison of Image Indices for Cotton Biomass Estimation
William H. Baker................................................................. 210

Appendix I
Student Theses and Dissertations Related to
Cotton Research in Progress in 2006...................................... 214

Appendix II
Research and Extension 2006 Cotton Publications.............. 216
PREFACE

An average of 1,045 lb lint/acre for Arkansas in 2006 was the second highest yield recorded for the state. The highest was in 2004 in which an average of 1,114 lb lint/acre was produced. Arkansas producers have harvested in excess of 1,000 lb lint/acre the last three seasons. These per-acre yields are surpassed only by those of Arizona and California. A record 2.525 million bales of cotton were picked from 1.16 million acres. Arkansas ranked second in the nation for total cotton production for the second year in a row behind Texas.

In 2006, early planting began in earnest by the middle of April. Dry conditions became a limiting factor as planting continued through April. As a result, cotton emergence was not uniform. Cool temperatures and wet conditions at the end of April delayed planting in most fields. Replanting was common for 1 May-planted cotton. By late-May, temperatures rebounded and remained above average for the season (Fig. 1). Most of the state endured droughty conditions while the extreme northeast area of the Delta received timely rainfalls. Irrigation typically began in mid-June and continued through late-August. Fruit retention was extremely high, while insect pressure was considered to be light in 2006. Frequent irrigation and rising fuel prices were responsible for making the 2006 cotton crop one of the most expensive ever produced in Arkansas. Although daytime temperatures were high during boll fill, excessive nighttime temperatures were not experienced. Nighttime temperatures were lower than the long-term average (see Fig. 1) and this may have contributed to the high yields.

Many of the Cotton Research Verification fields had over 85% retention at cutout. Growing conditions improved after cutout, resulting in a more vigorous plant than normally encountered at boll maturation, thus the boll opening process was slowed. The value of COTMAN was realized by many producers as a decision aid for defoliation timing. Although the crop had reached 850 heat units beyond physiological cutout and boll slicing revealed a mature crop, many fields were only 20 to 35% open. Defoliation was initiated and fields were harvested 10 to 14 days before those fields defoliated at 50 to 60% open.

Bill Robertson and Derrick Oosterhuis
Fig. 1. Weekly maximum and minimum temperatures and rainfall for 2006 compared with the long-term 35-year averages in eastern Arkansas.
ARKANSAS COTTON RESEARCH GROUP
2006/2007

The University of Arkansas Cotton Group is composed of a steering committee and three sub-committees representing production, genetics, and pest management. The group contains appropriate representatives in all the major disciplines as well as representatives from the Cooperative Extension Service, the Farm Bureau, the Agricultural Council of Arkansas, and the State Cotton Support Committee.

The objective of the Arkansas Cotton Group is to coordinate efforts to improve cotton production and keep Arkansas producers abreast of all new developments in research.

Steering Committee: Don Alexander, Fred M. Bourland, Frank Groves, Gus Lorenz, Gene Martin, Robert McGinnis, Derrick M. Oosterhuis (Chmn.), Bill Robertson, Craig Rothrock, James M. Stewart, and David Wildy.

Pest Management: Terry L. Kirkpatrick, Gus Lorenz, Randy Luttrell, Jason Norsworthy, Bill Robertson, Craig Rothrock (Chmn.), Kenneth L. Smith, Don Steinkraus, Glenn Studebaker, and Tina Teague.

Production: Sreekala Bajwa, Kelly Bryant, Mark Cochran, Leo Espinoza, Dennis Gardisser, Frank Groves, Robert Hogan, Gus M. Lorenz, J. Scott McConnell, Morteza Mozaffari, Jason Norsworthy, Derrick M. Oosterhuis (Chmn.), Lucas Parsch, Bill Robertson, Daniel Stephenson, and Phil Tacker.

Genetics: Fred M. Bourland, Hal Lewis, Bill Robertson, and James M. Stewart (Chmn.).

ACKNOWLEDGMENTS

The organizing committee would like to express appreciation to Marci Milus for help in typing this special report and formatting it for publication.
COTTON INCORPORATED AND
THE ARKANSAS STATE SUPPORT COMMITTEE

The Summaries of Arkansas Cotton Research 2006 has been published with funds supplied by the Arkansas State Support Committee through Cotton Incorporated.

Cotton Incorporated’s mission is to increase the demand for cotton and improve the profitability of cotton production through promotion and research. The Arkansas State Support Committee is comprised of the Arkansas Directors and Alternates of the Cotton Board and the Cotton Incorporated Board, and others whom they invite, including representatives of Certified Producer Organizations in Arkansas. Advisors to the Committee include certain staff members of the University of Arkansas, the Cotton Board, and Cotton Incorporated. Seven and one-half percent of the grower contributions to the total Cotton Incorporated budget are allocated to the State Support Committees of the cotton-producing states. The sum allocated to Arkansas is proportional to the states’ contribution to the total U.S. production and value of cotton fiber over the past five years.

The Cotton Research and Promotion Act is a federal marketing law. The Cotton Board, based in Memphis, Tennessee, administers the act, and contracts implementation of the program with Cotton Incorporated, a private company with its world headquarters in Cary, North Carolina. Cotton Incorporated also maintains offices in New York City, Los Angeles, Mexico City, Osaka, Singapore, and Shanghai. Both the Cotton Board and Cotton Incorporated are not-for-profit companies with elected boards. Cotton Incorporated’s board is comprised of cotton growers, while that of the Cotton Board is comprised of both cotton importers and growers. The budgets of both organizations are reviewed annually by the U.S. Secretary of Agriculture.

Cotton production research in Arkansas is supported in part by Cotton Incorporated directly from its national research budget and also by funding from the Arkansas State Support Committee from its formula funds (Table 1). Several of the projects described in this series of research publications, including publication costs, are supported wholly or partly by these means.
<table>
<thead>
<tr>
<th>Projects</th>
<th>Researcher</th>
<th>Short title</th>
<th>$ Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>02-291AR</td>
<td>Oosterhuis</td>
<td>Cotton Research Summaries</td>
<td>$6,500</td>
</tr>
<tr>
<td>04-439AR</td>
<td>Kirkpatrick</td>
<td>Reniform nematode biology-Ark.</td>
<td>$18,488</td>
</tr>
<tr>
<td>04-440AR</td>
<td>Oosterhuis</td>
<td>Temperature effects on yield</td>
<td>$18,000</td>
</tr>
<tr>
<td>04-442AR</td>
<td>Oosterhuis</td>
<td>PGR effects on Bt translocation</td>
<td>$2,950</td>
</tr>
<tr>
<td>04-443AR</td>
<td>Oosterhuis</td>
<td>Early-season low temperatures</td>
<td>$15,300</td>
</tr>
<tr>
<td>04-444AR</td>
<td>Robertson</td>
<td>Late-planted cotton</td>
<td>$16,790</td>
</tr>
<tr>
<td>04-445AR</td>
<td>Robertson</td>
<td>Technology transfer</td>
<td>$25,130</td>
</tr>
<tr>
<td>04-447AR</td>
<td>Smith</td>
<td>Glyphosate-resistant horseweed</td>
<td>$18,661</td>
</tr>
<tr>
<td>04-470AR</td>
<td>Bourland</td>
<td>Yield components</td>
<td>$26,130</td>
</tr>
<tr>
<td>04-476AR</td>
<td>Baker</td>
<td>Remote sensing - stress</td>
<td>$23,814</td>
</tr>
<tr>
<td>04-477AR</td>
<td>Robertson</td>
<td>Sub-surface drip irrigation</td>
<td>$15,570</td>
</tr>
<tr>
<td>04-491AR</td>
<td>Lorenz</td>
<td>Stink bugs in BGII cultivars</td>
<td>$13,000</td>
</tr>
<tr>
<td>04-492AR</td>
<td>Teague</td>
<td>Irrigation X insects</td>
<td>$19,823</td>
</tr>
<tr>
<td>05-630AR</td>
<td>Cochran</td>
<td>Profitable N &amp; K fertilization</td>
<td>$34,114</td>
</tr>
<tr>
<td>05-631AR</td>
<td>Baker</td>
<td>Remote sensing - scouting</td>
<td>$8,549</td>
</tr>
<tr>
<td>05-632AR</td>
<td>Savage</td>
<td>Liberty-Link vs. Roundup Flex</td>
<td>$16,000</td>
</tr>
<tr>
<td>05-634AR</td>
<td>Robertson</td>
<td>Defoliation timing</td>
<td>$19,140</td>
</tr>
<tr>
<td>06-797AR</td>
<td>Lorenz</td>
<td>Plant bug thresholds</td>
<td>$21,520</td>
</tr>
<tr>
<td>TOTAL</td>
<td></td>
<td></td>
<td><strong>$319,479</strong></td>
</tr>
</tbody>
</table>