This publication is available on the Internet at www.uark.edu/depts/agripub/publications

Additional printed copies of this publication can be obtained free of charge from Communication Services, 110 Agriculture Building, University of Arkansas, Fayetteville, AR 72701.
CONTRIBUTORS

Agudelo, P., Graduate Assistant, Plant Pathology Department, Fayetteville
Arevalo, L.M., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Avila, C.A., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Baker, W.H., Northeast Research and Extension Center, Keiser
Barham, J.D., Research Specialist, Southwest Research and Extension Center, Hope
Barrentine, J.L., Professor and Head, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bateman, R.J., Extension Associate III, Southwest Research and Extension Center, Hope
Bibi, A.C., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bourland, F.M., Director Northeast Research and Extension Center, Keiser
Branson, J., Rice Research Specialist, Rice Branch Station, Stuttgart
Brown, R.S., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bryant, K.J., Area Extension Specialist-Farm Management, Southeast Research and Extension Center, Monticello
Burgos, N.R., Assistant Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Burke, T., Research Specialist, Crop, Soil, and Environmental Sciences Department, Fayetteville
Capps, C.D., Pest Management Technical Support Specialist, Southeast Research and Extension Center, Monticello
Coker, D.L., Research Specialist, Crop, Soil, and Environmental Sciences Department, Fayetteville
Edmund, R., DuPont Field Representative, DuPont Agricultural Products, Little Rock
Dighe, N.D., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Evans, E.R., Farm Foreman, Soil Testing and Research Lab, Marianna
Feng, C., Professional Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Glover, R.E., Research Specialist, Northeast Research and Extension Center, Keiser
Gonias, E.D., Graduate Assistant, Crop, Soil, and Environmental Sciences, Fayetteville
Greene, J.K., Extension Entomologists, Southeast Research and Extension Center, Monticello
Groves, F.E., Research Specialist, Southeast Branch Experiment Station, Rohwer
Rothrock, C.S., Professor, Department of Plant Pathology, Fayetteville
Slaton, N.A., Assistant Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Smith K.L., Extension Weed Scientist, Southeast Research and Extension Center, Monticello
Smith, P.R., Extension Program Technician Pest Management, University of Arkansas Cooperative Extension Service, Little Rock
Sparks, O.C., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Stauber, L.G., Seed Agronomist, Diana Growseed, Marion
Stewart, J. M., Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Stewart, J., Agricultural Engineer, Engineering Department, Arkansas State University, Jonesboro
Studebaker, G., Entomologist, Northeast Research and Extension Center, Keiser
Tacker, P.L., Agricultural Engineer, University of Arkansas Cooperative Extension Service, Little Rock
Talbert, R.E., Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Tingle, C., Agronomist, Northeast Research and Extension Center, Keiser
Van Tol, N. B., Research Associate, West Tennessee Experiment Station, Jackson, Tennessee
Vories, E.D., Professor, Department of Biological and Agricultural Engineering, Northeast Research and Extension Center, Keiser
Williams, K.R., County Extension Agent, Cooperative Extension Service, Hamburg
Worlow, J.M., Research Assistant, Arkansas State University, Jonesboro
CONTENTS
Contributors.................................................................................................2
Preface............................................................................................................12
Arkansas Cotton Research Group.................................................................14
Acknowledgments........................................................................................14
Cotton Incorporated and the Arkansas State Cotton Support Committee.................................................15

SUMMARIES OF ARKANSAS COTTON RESEARCH 2003
University of Arkansas Cotton Breeding Program-
2003 Progress Report
F. M. Bourland....................................................................................................19

Development of Molecular Markers to Distinguish
Cytoplasm Substitution Lines of Cotton
T. Burke and J. McD. Stewart............................................................................23

Performance of Bollgard II Arkansas, 2003
P.R. Smith, G. M. Lorenz, D.R. Johnson, W.H. Robertson, and
D. Plunkett........................................................................................................29

Varietal Responses of Cotton to Nitrogen Fertilization
J.S. McConnell, B.A. Myers, and M. Mozaffari..............................................33

Economic Effect of Late Irrigation on Arkansas Cotton
R. Hogan, Jr., E.D. Vories, J.K. Greene, J. Stewart, W.H.
Robertson, and P.L. Tacker.............................................................................37

Long-Term Irrigation Methods and Nitrogen Fertilization Rates in Cotton Production: The Last Three Years of the
McConnell-Mitchell Plots
J.S. McConnell, B.A. Myers, and M. Mozaffari.............................................43

Comparisons of Foliar Nitrogen Fertilization Strategies
and Methods for Cotton
J.S. McConnell, B.A. Myers, and M. Mozaffari............................................50
AAES Research Series 521

Phosphorus Fertilization Studies for Cotton Production in Arkansas
    M. Mozaffari, N.A. Slaton, J.S. McConnell, E. Evans, and C.E. Kennedy..........................57

Improving Cotton Irrigation Scheduling in Arkansas
    E.D. Vories, P.L. Tacker, and R.E. Glover............................62

Soil Compaction Modeling in Cotton
    S. Kulkarni.................................................................68

GIS and Hydraulic Modeling Applications for Runoff and Sediment Reductions in Cotton
    L.G. Stauber, W.H. Baker, and J.M. Worlow..........................71

Yield and Petiole Potassium Levels of Two Modern Cotton Cultivars as Influenced by Potassium Fertilization
    M. Mozaffari, J.S. McConnell, N.A. Slaton, E. Evans, F.M. Bourland, and C.E. Kennedy...........75

Critical Petiole Potassium Levels as Related to Physiological Responses of Chamber-Grown Cotton to Potassium Deficiency
    D.L. Coker, D.M. Oosterhuis, M. Arevalo, and M. Mozaffari..............................81

The Physiological Response of Cotton to High Temperatures for Germplasm Screening
    A.C. Bibi, D.M. Oosterhuis, and F.M. Bourland..................................87

Evaluation of Different Techniques for Quantifying the Physiological Response of Cotton under High Temperature
    A.C. Bibi, D.M. Oosterhuis, and F.M. Bourland..............................94
Increased Plant Protein, Insect Mortality and Yield with 
Chaperone™

D.M. Oostehuis and R.S. Brown...............................................101

Effect of Foliar Chaperone™ Applications under Elevated 
Temperature on the Protein Concentrations and 
Physiological Responses of Cotton

R.S. Brown and D.M. Oosterhuis.............................................108

Effect of Trimax™ Insecticide Application Under Water-
Deficit Stress Conditions on the Lint Yield and Physiology 
of Field-Grown Cotton

D.M. Oosterhuis, R.S. Brown, and E.D. Gonias.......................114

Yield and Physiological Response of Modern versus 
Obsolete Cultivars Grown under Water-Deficit 
Conditions

R.S. Brown, D.M. Oosterhuis, M. Arevalo, and A.C.Bibi........120

Effect of Night Temperatures on Boll Growth and Yield 

Cotton Plant Response to Trimax™ Insecticide and 
Increasing Temperature

E.D. Gonias, D.M. Oosterhuis, and R.S. Brown......................135

Yield, Growth, and Physiology of Trimax™-Treated 
Cotton

E.D. Gonias, D.M. Oosterhuis, A.C. Bibi, and R.S. Brown.....139

Cotton Growth and Development after Application of 
Envvoke (trifloxysulfuron) in Cotton

J.L. Barrentine, O.C. Sparks, and M.R. McClelland............145
Update on Glyphosate-Resistant Horseweed in Arkansas Cotton

Cotton Response to Trifloxysulfuron in Arkansas
K.L. Smith, J. Branson, M. Kelly, M.R. McClelland, J.L. Barrentine, and O.C. Sparks..............................................................155

The Effect of Glyphosate and Insecticide Tank Mixtures on Cotton Bollworm (Helicoverpa zea) and selected weed species
O.C. Sparks, J.L. Barrentine, N.R. Burgos, and M.R. McClelland..............................................................159

Effect of Palmer Amaranth (Amaranthus palmer) Seedbank Density on the Performance of Pendimethalin™ and Fluometuron™
O.C. Sparks, J.L. Barrentine, N.R. Burgos, and M.R. McClelland..............................................................167

Examination of the Role of Fungal Cell Wall-Degrading Enzymes in Plant Fungal Resistance
B. Hendrix and J. McD. Stewart..................................................173

A cDNA-AFLP Profile of Cotton Genes in Response to Drought Stress
C. Feng and J. McD. Stewart....................................................176

Transfer of Reniform Nematode Resistance from Diploid Cotton Species to Tetraploid Cultivated Cotton
C.A. Avila, J. McD. Stewart, and R.T. Robbins.........................183

Interaction Between the Reniform Nematode and Thielaviopsis basicola on Cotton
C.S. Rothrock, W.S. Monfort, T.L. Kirkpatrick, and K.R. Williams..............................................................187
Reniform Nematode Control in Cotton with Nematicides
T.L. Kirkpatrick, J.D. Barham, and R.J. Bateman......................192

Glycoproteins in the Gelatinous Matrix of Reniform Nematode
P. Agudelo, R.T. Robbins, J.B. Murphy, and J.McD. Stewart.196

Efficacy of Selected Insecticides for Plant-Bug Control in Arkansas, 2003
R. Johnson, G.M. Lorenz, P.R. Smith, W.H. Robertson, J.K. Greene, C. D. Capps, D. Plunkett, B. Harmon, and R.Edmund.................................................................200

Efficacy of Selected Insecticides for Control of Heliothines in Arkansas, 2003
R. Johnson, G.M. Lorenz, P.R. Smith, W.H. Robertson, J.K. Greene, C. D. Capps, and D. Plunkett..........................205

Temik™(Aldicarb) Side-Dress Combinations, 2003
G.M. Lorenz, P.R. Smith, and W.H. Robertson.........................210

Performance of Diamond (Novaluron) for Control of Heliothines and Plant Bugs, 2003
P.R. Smith, G. M. Lorenz, W.H. Robertson, D. Plunkett, D.R. Johnson, and R. Edmund.........................................................213

Treatment Threshold for Stink Bugs, 2003
J.K. Greene and C.D. Capps..................................................219

Pheromone Trapping of Stink Bugs, 2003
J.K. Greene and C.D. Capps..................................................223

Efficacy of Selected Insecticides for Control of Stink Bugs, 2003
J.K. Greene and C.D. Capps..................................................227
J.K. Greene, C.D. Capps, G.M. Lorenz, P. R. Smith, D.R. Johnson, and G. Studebaker.................................................................233

Simulating Insect Injury with Emphasis on Stink Bugs, 2003
J.K. Greene and C.D. Capps..........................................................239

Control Options for Thrips in Southeast Arkansas, 2003
C.D. Capps, J.K. Greene, G.M. Lorenz, P.R. Smith, D.R. Johnson, and G. Studebaker.......................................................................245

Effect of Boll Age on Stink Bug Feeding and Yield Loss, 2003
J.K. Greene and C.D. Capps..........................................................251

An Economic Comparison of Transgenic and Non-Transgenic Cotton Production Systems in Arkansas
K.J. Bryant, J.K. Greene, C.D. Capps, F.E. Groves, C. Tingle, G. Studebaker, F.M. Bourland, B. Nichols, and J. Reeves..............252

*Bt* Cotton Performance in Arkansas in 2003: An Economic Evaluation
K.J. Bryant, J.K. Greene, G.M. Lorenz, B. Robertson, and G. Studebaker.........................................................................................261

Economic Evaluation of Early-Season Insect Control in Cotton
K.J. Bryant, G.L. Lentz, and N.B. Van Tol........................................266
Risk-Returns of Cotton and Soybean Enterprises for Mississippi County, Arkansas: A Comparison of Alternative Marketing Strategies Within a Whole Farm Framework
G. Rodriguez, A. McKenzie, and L. Parsch...............................270

Regulation of Fiber Cell Initiation by Early-Season Temperature in American Upland Cotton
H. Lewis..................................................................................276

Appendix I
Student Theses and Dissertations Related to Cotton in Progress in 2003.......................................................................284

Appendix II
Research and Extension 2003 Cotton Publications.................286
PREFACE

Despite an inauspicious start to the season, the 2003 cotton crop in Arkansas was a bumper crop with record yields of 916 lb lint/acre from 945,000 acres harvested. The high yield for the state matched the five-year irrigated average for the state. Three-bale cotton yields were common in portions of southeast Arkansas.

The season started off with an early planting window in mid-April, but thereafter conditions deteriorated with cool wet weather, and poor emergence, and slow seedling development. Northeast Arkansas suffered the most from flooding conditions—at one point the rainfall was measured in feet! As one farmer in Crittenden County stated “it can’t get any wetter, just deeper.” By the last week in May most of south Arkansas was planted. Poinsett County was particularly hard hit with approximately 60% of the cotton being planted the last week in May. Approximately half of the acreage in northeast Arkansas was in need of replanting. Seedling disease, hard rains, and blowing sand resulted in much of the above mentioned replants. Weed pressures of pigweed seem to continue to build upon of the previous year. Resistant horse weed was verified in Mississippi and Poinsett counties. The resistance was reported as far south as Lee County. Once the crop was planted, rainfall patterns were very timely for the most part. Both daytime and nighttime temperatures were very favorable, with few nights exceeding 74°F and day temperatures seldom reaching 100°F.

Early-season pests were light and insect pressures were not excessive. Mid-and late-season insect pests were more plentiful. Plant bugs were extremely difficult to manage. Fall armyworm numbers were high by seasons’ end. Bollworms appeared to be more common in Bollgard cotton. Bollgard II cotton performed well in university testing with regard to improved insect-pest control. Boll weevil eradication efforts were conducted statewide for the first time as fall diapause began in Mississippi and eastern Craighead Counties. The controversy of this effort will likely continue for some time.

Generally speaking, all the harvest-aid products worked well. Cottonseed was of good quality for planting purposes. The micronaire was a lot higher than expected, considering the lateness of the crop, with almost twenty-five percent of the bales classed with a micronaire value of 5 or greater. Fiber qualities of newer varieties were improved to some degree with regard to micronaire, although fiber length (staple) has not changed greatly over the last few years. As textile mills continue to move overseas in response to cheap labor it is important for us to furnish this changing market with the quality they expect. Pounds of lint per acre are certainly important, but the quality of the lint we produce can and does impact the bottom line.

Derrick Oosterhuis and William Robertson.
Weekly Maximum and Minimum Temperature and Rainfall Compared with 32-average
1 April-30 September
West Memphis, Arkansas, 2003

Fig. 1. Weekly maximum and minimum temperatures and rainfall for 2002 compared with the long-term 31-year averages at West Memphis.
ARKANSAS COTTON RESEARCH GROUP
2003/2004

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: Fred M. Bourland, Gus Lorenz, Gene Martin, Robert McGinnis, Derrick M. Oosterhuis (Chm.), Donald Plunkett, Bill Robertson, Craig Rothrock, James McD. Stewart, Cecil Williams, David Wildy, and Jerry Williams

Pest Management: Jeremy K. Greene, Donald R. Johnson, Terry L. Kirkpatrick, Tim Kring, Gus Lorenz, Bill Robertson, Craig Rothrock (Chm.), Kenneth L. Smith, Don Steinkraus, Glenn Studebaker, Tina Teague, Chris Tingle, Phil Tugwell, and Seth Young

Production: Kelly Bryant, Mark Cochran, Leo Esponoza, Dennis Gardisser, Gus M. Lorenz, J. Scott McConnell, Morteza Mozaffari, Derrick M. Oosterhuis (Chm.), Lucas Parsch, Donald Plunkett, Bill Robertson, Phil Tacker, Chris Tingle, and Earl D. Vories

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

ACKNOWLEDGMENTS

The organizing committee would like to express appreciation to Paula Ehrle 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 2003 has been published with funds supplied by the Arkansas State Support Committee through Cotton Incorporated.

The principal purpose of Cotton Incorporated is to increase the profitability of cotton production by building demand for U.S. cotton. The Arkansas State Support Committee of Cotton Incorporated is a board whose voting members are cotton growers from Arkansas. Advisory members include representatives of Arkansas’ certified producer organizations, the University of Arkansas, the Cotton Board, and Cotton Incorporated. Five percent of Cotton Incorporated’s total budget is allocated for research and promotional activities, as determined by the State Support Committees of the cotton-producing states. The sum allotted to Arkansas’ State Support Committee is proportional to Arkansas’ contribution to the total U.S. cotton fiber production and value in the five years previous to the budget.

The Cotton Research and Promotion Act is a federal marketing law. The objective of the act is to develop a program for building demand and markets for U.S. cotton. The Cotton Board, based in Memphis, Tennessee, was created to administer the act and is empowered to contract within an organization with the capacity to develop such a program. Cotton Incorporated, with its main offices in Cary, North Carolina, the center of the U.S. textile industry, is the contracting agency. Cotton Incorporated also maintains offices in Osaka, Japan; Mexico City; Shanghai, China; and Singapore, Malaysia, to foster international sales. Both the Cotton Board and Cotton Incorporated are non-profit entities with governing boards comprised of cotton growers and cotton importers. The budgets of both organizations are annually reviewed and approved by the U.S. Secretary of Agriculture.

Cotton production research is supported, in part, in Arkansas both by Cotton Incorporated (directly from its national budget) and by the Arkansas State Support Committee (from its formula funds). Several of the projects described in this research series publication, including publication costs, are supported wholly or in part by these means.
<table>
<thead>
<tr>
<th>Projects</th>
<th>Researcher</th>
<th>Short title</th>
<th>$ Funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cottonseed</td>
<td>Staff</td>
<td>Cottonseed improvement</td>
<td>5,000</td>
</tr>
<tr>
<td>01-60AR</td>
<td>Robertson</td>
<td>Herbicide drift</td>
<td>12,000</td>
</tr>
<tr>
<td>02-191AR</td>
<td>Greene</td>
<td>Stink bug threshold</td>
<td>15,500</td>
</tr>
<tr>
<td>02-192AR</td>
<td>Guy</td>
<td>Large-plot variety trials</td>
<td>10,000</td>
</tr>
<tr>
<td>02-193AR</td>
<td>Kring</td>
<td>New aphid thresholds</td>
<td>11,787</td>
</tr>
<tr>
<td>02-291AR</td>
<td>Oosterhuis</td>
<td>Research summaries</td>
<td>6,500</td>
</tr>
<tr>
<td>03-349AR</td>
<td>Teague</td>
<td>Stress Indices</td>
<td>14,400</td>
</tr>
<tr>
<td>04-439AR</td>
<td>Kirkpatrick</td>
<td>Reniform nematodes</td>
<td>18,488</td>
</tr>
<tr>
<td>04-440AR</td>
<td>Oosterhuis</td>
<td>Mid-season high temp.</td>
<td>18,000</td>
</tr>
<tr>
<td>04-441AR</td>
<td>Oosterhuis</td>
<td>Nitrogen status</td>
<td>1,300</td>
</tr>
<tr>
<td>04-442AR</td>
<td>Oosterhuis</td>
<td>PGR x BT x Location</td>
<td>2,950</td>
</tr>
<tr>
<td>04-443AR</td>
<td>Oosterhuis</td>
<td>Early-season low temp.</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>04-446AR</td>
<td>Robertson</td>
<td>Defoliation timing</td>
<td>19,140</td>
</tr>
<tr>
<td>04-447AR</td>
<td>Talbert</td>
<td>Marestail management</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</td>
<td>23,814</td>
</tr>
<tr>
<td>04-477AR</td>
<td>Robertson</td>
<td>Sub-surface drip</td>
<td>15,570</td>
</tr>
<tr>
<td>04-491AR</td>
<td>Greene</td>
<td>Stink bugs in BG 11</td>
<td>13,000</td>
</tr>
<tr>
<td>04-492AR</td>
<td>Teague</td>
<td>Irrigation x insects</td>
<td>19,283</td>
</tr>
</tbody>
</table>

-------------

Total: $309,283

SUMMARIES OF ARKANSAS COTTON RESEARCH IN 2003