Summaries of Arkansas Cotton Research 2004

Edited by Derrick M. Oosterhuis

ARKANSAS AGRICULTURAL EXPERIMENT STATION
Division of Agriculture University of Arkansas System
October 2005 Research Series 533
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, Ark. 72701.
CONTRIBUTORS

Ali, M. Ibrahim, Program Associate, Entomology Department, Fayetteville
Allen, Kerry C., Graduate Student, Entomology Department, Fayetteville
Arevalo, L. Milenka, Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Avila, Carlos A., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bajwa, Sreekala G., Assistant Professor, Department of Biological and Agricultural Engineering, Fayetteville
Ballantyne, Paul, Program Technician, Cooperative Extension Service, Little Rock
Barrentine, James L., Professor/Head, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bibi, Androniki C., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bourland, Fred M., Director, Northeast Research and Extension Center, Keiser
Brown, Robert S., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Bryant, Kelly J., Director, Southeast Research and Extension Center, Monticello
Capps, Chuck D., Pest Management Technical Support Specialist, Southeast Research and Extension Center, Monticello
Chapell, Adam, Graduate Assistant, Entomology Department, Fayetteville
Colwell, C. Kyle, Seasonal Agricultural Technician, Cooperative Extension Service, Little Rock
Cordell, Matt, Cotton Program Associate, Cooperative Extension Service, Little Rock
Doherty, Ryan C., Program Technician, Southeast Research and Extension Center, Monticello
Edmund, Richard, DuPont Agricultural Products, Little Rock
Espinoza, Leo, Extension Agronomist - Soils, Cooperative Extension Service, Little Rock
Evans, Edwin E., Farm Foreman, Soil Testing and Research Lab, Marianna
Fowler, Larry A., Farm Manager, Delta Branch Station, Clarksdale
Gonias, Evangelos D., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Greene, Jeremy K., Extension Entomologist, Southeast Research and Extension Center, Monticello
Griffith, Griff M., Graduate Research Specialist, Crop, Soil, and Environmental Sciences Department, Fayetteville
Groves, Frank E., Cotton Research Verification Program Coordinator, Southeast Research and Extension Center, Monticello
Hardke, Jarrod, Seasonal Agricultural Technician, Cooperative Extension Service, Little Rock
Hattenhauer, Katy, Program Technician, Soil Testing and Research Lab, Marianna
Head, G., Researcher, Monsanto Co., St. Louis, Mo.
Hendrix, Bill, Research Specialist, Crop, Soil, and Environmental Sciences Department, Fayetteville
Hogan, Robert, Jr., Extension Economist, Northeast Research and Extension Center, Keiser
Kay, Sasha, Graduate Student, Entomology Department, Fayetteville
Kelley, Monica, Program Technician, Southeast Research and Extension Center, Monticello
Kennedy, Claude, Resident Director, Cotton Branch Station, Marianna
Kirkpatrick, Terry L., Professor, Southwest Research and Extension Center, Hope
Kring, Tim J., Professor, Entomology Department, Fayetteville
Lorenz, Gus M., III, Extension Entomologist, Cooperative Extension Service, Little Rock
Luttrell, R.G., Professor, Entomology Department, Fayetteville
McConnell, J. Scott, Associate Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
McClelland, Marilyn R., Research Associate, Crop, Soil, and Environmental Sciences Department, Fayetteville
McClelland, Marilyn R., Research Associate, Crop, Soil, and Environmental Sciences Department, Fayetteville
McMichael, Bobbie L., USDA Scientist, Lubbock, Texas
Meir, Jason R., Program Technician, Southeast Research and Extension Center, Monticello
Miley, Woody N., Professional Agronomist, Little Rock
Mills, Nathan B., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Monfort, W. Scott, Graduate Assistant, Plant Pathology Department, Fayetteville
Mozaffari, Morteza, Research Assistant Professor, Soil Testing and Research Lab, Marianna
Mullins, W., Researcher, Monsanto Co., St. Louis, Mo.
Oosterhuis, Derrick M., Distinguished Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Patterson, J., Agricultural Consultant, R.A. Pickens and Son Co., Pickens
Plunkett, Donald E., Cotton Verification Coordinator, Cooperative Extension Service, Little Rock
Rauls, Jason A., Cooperative Extension Agent-Agriculture, University of Arkansas Cooperative Extension Service, Monticello
Robbins, Robert T., Professor, Plant Pathology Department, Fayetteville
Robertson, William C., Extension Agronomist - Cotton, Crop, Soil, and Environmental Sciences Department, Little Rock
Rothrock, Craig S., Professor, Plant Pathology Department, Fayetteville
Slaton, Nathan A., Associate Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Smith, Kenneth L., Extension Weed Scientist, Southeast Research and Extension Center, Monticello
Sparks, Oscar C., Graduate Assistant, Crop, Soil, and Environmental Sciences Department, Fayetteville
Steinkraus, Donald C., Professor, Entomology Department, Fayetteville
Stewart, James McD., Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Stewart, Jason, Instructor, College of Engineering, Arkansas State University, Jonesboro
Studebaker, Glenn E., Extension Entomologist, Northeast Research and Extension Center, Keiser
Talbert, Ronald E., University Professor, Crop, Soil, and Environmental Sciences Department, Fayetteville
Tacker, Phil, Associate Professor, Biological and Agricultural Engineering Department, Little Rock
Vories, Earl D., Agricultural Engineer, USDA-ARS Cropping Systems and Water Quality Research Unit, Portageville, Mo.
Wall, M., Extension Entomologist, Southeast Arkansas
Wilkins, Thea A., Professor, Department of Plant Sciences, University of California, Davis, Calif.
Zawislak, Jon, Research Assistant, Entomology Department, Fayetteville
## CONTENTS

<table>
<thead>
<tr>
<th>Chapter</th>
<th>Title</th>
<th>Authors</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Contributors</td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Preface</td>
<td></td>
<td></td>
<td>12</td>
</tr>
<tr>
<td>Arkansas Cotton Research Group</td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Acknowledgments</td>
<td></td>
<td></td>
<td>14</td>
</tr>
<tr>
<td>Cotton Incorporated and the Arkansas State Cotton Support Committee</td>
<td></td>
<td></td>
<td>15</td>
</tr>
</tbody>
</table>

## SUMMARIES OF ARKANSAS COTTON RESEARCH 2004

- **University of Arkansas Cotton Breeding Program - 2004 Progress Report**
  - Fred M. Bourland
  - 19

- **Germplasm Enhancement for Cotton Improvement**
  - Carlos A. Avila and James McD. Stewart
  - 23

- **Development of a Molecular Marker Linked to Reniform Nematode Resistance in Cotton**
  - Carlos A. Avila, James McD. Stewart, and Robert T. Robbins
  - 28

- **Evaluation of Techniques for Quantifying the Physiological Response of Cotton to High Temperature**
  - Androniki C. Bibi, Derrick M. Oosterhuis, Evangelos D. Gonias, and Fred M. Bourland
  - 34

- **Screening a Diverse Set of Cotton Cultivars for High Temperature Tolerance**
  - Androniki C. Bibi, Derrick M. Oosterhuis, Evangelos D. Gonias, and Fred M. Bourland
  - 39

- **The Physiological Response of Cotton to High Night Temperatures**
  - L. Milenka Arevalo, Derrick M. Oosterhuis, and Robert S. Brown
  - 44
Effect of Foliar Chaperone™ Applications on Endotoxin and Protein Concentration, Insect Mortality, and Yield Response of Cotton
Derrick M. Oosterhuis and Robert S. Brown............................ 51

Yield Comparison of Modern Versus Obsolete Cultivars as a Measure of Yield Variability
Robert S. Brown, Derrick M. Oosterhuis,
L. Milenka Arevalo, and Larry A. Fowler................................. 57

High Daytime Temperature Stress Effects on the Physiology of Modern Versus Obsolete Cotton Cultivars
Robert S. Brown and Derrick M. Oosterhuis............................. 63

Effects of Early-Season Adverse Conditions on Root Development and the Subsequent Stress
Nathan B. Mills, Derrick M. Oosterhuis,
and Bobbie L. McMichael......................................................... 68

Effect of the Plant Growth Regulator PGR-IV Plus as a Safener for Glyphosate Applications in Cotton
Evangelos D. Gonias, Derrick M. Oosterhuis,
Androniki C. Bibi, and Robert S. Brown................................. 72

Cotton Plant Response to Trimax™ Insecticide Foliar Application and Increasing Temperature
Evangelos D. Gonias, Derrick M. Oosterhuis,
and Androniki C. Bibi................................................................. 76

Seedcotton Yield and Petiole Phosphorus as Affected by Phosphorus Fertilizer Application
Morteza Mozaffari, Derrick M. Oosterhuis, J. Scott McConnell,
Nathan A. Slaton, Edwin E. Evans, Evangelos D. Gonias,
Androniki C. Bibi, and Claude Kennedy................................. 80

Effect of Potassium Fertilization on Yield, Petiole K, and Reflective Properties of Cotton
Morteza Mozaffari, Derrick M. Oosterhuis, J. Scott McConnell,
Nathan A. Slaton, Edwin E. Evans, Androniki C. Bibi, Evangelos D. Gonias, Fred M. Bourland and Claude Kennedy............. 85
Cotton Yield and Petiole Nitrogen Content as Affected by Nitrogen Fertilizer Application  

Evaluation of the Effect of Pelleted Poultry Litter and Inorganic Nitrogen on Cotton Yield in the Mississippi Delta Region of Arkansas  
Morteza Mozaffari, Nathan A. Slaton, Edwin E. Evans, J. Scott McConnell, Katy Hattenhauer, and Claude Kennedy ... 95

Comparisons of Foliar Nitrogen Fertilization Strategies and Methods for Cotton  
J. Scott McConnell, Ryan C. Doherty, Jason A. Rauls, and Morteza Mozaffari ................................................................. 99

Long-Term Irrigation Methods and Nitrogen Fertilization Rates in Cotton Production: The Last Three Years of the McConnell-Mitchell Plots  
J. Scott McConnell, Jason A. Rauls, Ryan C. Doherty, and Morteza Mozaffari ............................................................... 106

Varietal Responses of Cotton to Nitrogen Fertilization  
J. Scott McConnell, Ryan C. Doherty, Jason A. Rauls, and Morteza Mozaffari ................................................................. 115

Fertilizer Recommendation Practices for the Most Popular Crop Rotations in Arkansas Under Conventional and Reduced Tillage Systems  
Leo Espinoza, Claude Kennedy, and Paul Ballantyne .......... 119

Plant Response to Irrigation Treatments in Arkansas Cotton  
Sreekala G. Bajwa and Earl D. Vories ................................. 126

Gene Expression in Developing Cotton Fibers as a Model of Water-Deficit Stress in Cotton Roots  
Bill Hendrix, James McD. Stewart, and Thea A. Wilkins ...... 134
Evaluation of Mepiquat Chloride Treatments at Cutout or the Latest Possible Cutout Date
Matt L. Cordell, William C. Robertson, and Frank E. Groves .......................................................... 141

Heliointine Control with WideStrike™ in Arkansas, 2004
Gus M. Lorenz, III, Jarrod Hardke, C. Kyle Colwell, Jeremy K. Greene, Glenn E. Studebaker, Chuck D. Capps, and Donald Plunkett ................................................................. 144

Efficacy of Selected Insecticides for Plant Bug Control in Arkansas, 2004

Performance of Bollgard II in Arkansas, 2004
Gus Lorenz, III, C. Kyle Colwell, Jarrod Hardke, Jeremy K. Greene, Chuck D. Capps, Glenn E. Studebaker, and Donald Plunkett ............................................................... 153

Economic Effect of Late Irrigation on Mid-South Cotton
Robert Hogan, Jr., Earl D. Vories, Jeremy K. Greene, William C. Robertson, Jason Stewart, and Phil Tacker ....... 156

Summary of Experiments: Glyphosate-Resistant Horseweed in Arkansas Cotton
Marilyn R. McClelland, Ronald E. Talbert, Kenneth L. Smith, James L. Barrentine, Griff M. Griffith, and Monica B. Kelley ................................................................. 161

Effects of Glyphosate and Insecticide Interactions on Control of Tarnished Plant Bug, Lygus lineolaris, in Roundup Ready Cotton
Jeremy K. Greene and Chuck D. Capps .................................................... 165

Control Options for Thrips in Southeast Arkansas, 2004
Chuck D. Capps, Jeremy K. Greene, Glenn E. Studebaker, and Gus M. Lorenz, III ..................................................... 169

Effect of Boll Age on Stink Bug Feeding and Yield Loss, 2004
Jeremy K. Greene and Chuck D. Capps .................................................... 173
Efficacy of Selected Pesticides For Control of Stink Bugs, 2004
Jeremy K. Greene and Chuck D. Capps................................................. 177

Effect of Foliar-Applied Insecticides for Plant Bug in 2004
Glenn E. Studebaker ............................................................................. 186

Cotton Aphid Treatment Decisions Based on Density Estimates of Predaceous Coccinellids
Adam Chapell, Tim Kring, Gus M. Lorenz, III,
Jeremy K. Greene, and Glenn E. Studebaker........................................ 190

Measuring Baseline Susceptibility of Heliothine Populations for Bt Resistance Monitoring
M. Ibrahim Ali and R.G. Luttrell......................................................... 195

Effect of Planting Date on Response of Cotton to Envoke™
Griff M. Griffith, James L. Barrentine,
Marilyn R. McClelland, and Oscar C. Sparks................................. 200

Variation in Heliothine Pheromone Trap Captures Across Large Cotton-Producing Farms in Southeastern Arkansas
Kerry C. Allen, R.G. Luttrell, M. Ibrahim Ali, J. Patterson,
G. Head, and W. Mullins................................................................. 204

Effects of Increasing Meloidogyne incognita Densities on the Interaction with Thielaviopsis basicola Under Early-Season Environmental Conditions
W. Scott Monfort, Terry L. Kirkpatrick,
and Craig S. Rothrock................................................................. 210

Evaluation of Carfentrazone in a Layby Herbicide Program
Frank E. Groves, Kenneth L. Smith, Jason R. Meir,
and Monica B. Kelley................................................................. 217

Utilizing Natural Biological Control for Cotton Aphids: Cotton Aphid Fungus Sampling Service Twelfth Year
Donald C. Steinkraus and Jon Zawislak........................................... 220

Cotton Aphids Infected by Neozygites fresenii Produce Less Offspring and Honeydew
Sasha Kay and Donald C. Steinkraus................................................ 224
Effects of Simulated Drift of Glyphosate, Propanil, and 2,4-D on Cotton
William C. Robertson, Matt L. Cordell, and Frank E. Groves
228

The Influence of Micronaire Estimation and Heat Unit Accumulation on Defoliation Timing
Frank E. Groves, William C. Robertson, and Matt L. Cordell
232

Defoliation Timing Based on Heat Units Beyond Cutout
William C. Robertson, Matt L. Cordell, and Frank E. Groves
235

Evaluation of Yield Monitors for On-Farm Cotton Variety Testing
Matt L. Cordell, William C. Robertson, and Frank E. Groves
238

Costs and Returns for No-Till Cotton: Two Years of On-Farm Observations
Kelly J. Bryant
241

Cotton Research Verification Programs - 2004 Progress Report
Frank E. Groves, William C. Robertson, and Kelly J. Bryant
249

Appendix I
Student Theses and Dissertations Related to Cotton in Progress in 2004
254

Appendix II
Research and Extension 2004 Cotton Publications
256
PREFACE

The final state average lint yield of 1114 lb lint/acre from 900,000 harvested acres shattered the previous record of 916 lb/acre in 2003 by almost 200 lb. Dryland yields were very good and irrigated yields were even better. Total bales produced exceeded the 2 million bale mark, which surpassed the previous record set in 1948 of just under 2 million bales from 2.305 million harvested acres. However, the season average price of $0.488 resulted in lower earnings in 2004 compared to 2003 in which season average prices were $0.625.

The high soybean prices at the start of 2004 resulted in a reduction in cotton acreage from the ten-year average of one million acres. Cotton planting started early and was well underway by mid-April. However, wet weather in some areas extended planting into late May.

Excessive rain continued through much of the early season and hampered weed- and insect-control measures. In some areas of the state producers were not able to get a tractor in the field during the month of June.

Final splits or the single application of fertilizer was delayed in some areas until flowering. The excessive rainfall in most areas of the state negatively impacted the bottom crop, which was almost nonexistent in southwest and southeast Arkansas.

Plant bug pressures were heavy during the boll-filling period. Stink bug pressures, which were high the previous year, did not materialize in 2004. The Boll Weevil Eradication Program continued to make great progress toward eradicating the weevil statewide.

Both day and night temperatures were very favorable most of the season with the exception of a short period in mid-July. Great concerns were expressed during August about the low heat-unit accumulation. For a number of days the accumulation of heat units was limited to the single digits. Leaf reddening as a result of the cool temperatures was common. The fruit shed generally seen each year after the onset of flowering was not experienced in 2004. Cool weather in August was followed by a warm September, which helped fill the bolls all the way to the terminal. The number of seeds per boll was higher than usual, with some counts of over 40 seeds per boll. In addition, timely rainfall was received throughout the growing season in most areas, especially northeast Arkansas.

The first half of harvest flew by at almost record pace and many fields were harvested with no rainfall occurring from first cracked boll to harvest. Hard lock and boll rot were not seen. Late-season rains decreased harvest efficiency and increased the amount of cotton on the ground, although yields remained high. The late-season rains negatively impacted fiber color, however, grades were excellent in the early crop. Fiber length and micronaire were good. Slightly over 5% of the crop received discounts for high micronaire, while less than 1% received discounts for low micronaire.

The record yields were attributed mainly to favorable temperatures and timely rainfall throughout the season, but also to boll weevil eradication, improved varieties, and the technologies associated with these varieties.

Bill Robertson and Derrick Oosterhuis
Fig. 1. Weekly maximum and minimum temperatures and rainfall for 2004 compared with the long-term 35-year averages at West Memphis, Ark.
ARKANSAS COTTON RESEARCH GROUP
2004/2005

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 (Chm.), Bill Robertson, Craig Rothrock, James McD. Stewart, David Wildy, and Jerry Williams.

Pest Management: Jeremy K. Greene, Terry L. Kirkpatrick, Tim Kring, Gus Lorenz, Randy Luttrell, Bill Robertson, Craig Rothrock (Chm.), Kenneth L. Smith, Don Steinkraus, Glenn Studebaker, Tina Teague, and Seth Young.

Production: Kelly Bryant, Mark Cochran, Leo Espinoza, Dennis Gardisser, Frank Groves, Robert Hogan, Gus M. Lorenz, J. Scott McConnell, Morteza Mozaffari, Derrick M. Oosterhuis (Chm.), Lucas Parsch, Donald Plunkett, Bill Robertson, Phil Tacker, 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 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 2004 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 in Arkansas is supported, in part, 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>01-960AR</td>
<td>Robertson</td>
<td>Herbicide drift</td>
<td>$12,000</td>
</tr>
<tr>
<td>02-191AR</td>
<td>Greene</td>
<td>Stink bug thresholds</td>
<td>$15,500</td>
</tr>
<tr>
<td>02-192AR</td>
<td>Guy</td>
<td>Large-scale variety evaluations</td>
<td>$10,000</td>
</tr>
<tr>
<td>02-193AR</td>
<td>Kring</td>
<td>Aphid threshold with beneficials</td>
<td>$11,787</td>
</tr>
<tr>
<td>02-291AR</td>
<td>Oosterhuis</td>
<td>Cotton Research in Progress</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>04-470AR</td>
<td>Bourland</td>
<td>Cotton breeding</td>
<td>$26,130</td>
</tr>
<tr>
<td>04-439AR</td>
<td>Kirkpatrick</td>
<td>Reniform nematodes biology</td>
<td>$18,488</td>
</tr>
<tr>
<td>04-492AR</td>
<td>Teague</td>
<td>Impact of irrigation on pests</td>
<td>$19,823</td>
</tr>
<tr>
<td>04-491AR</td>
<td>Greene</td>
<td>Stink bugs in BGII</td>
<td>$13,000</td>
</tr>
<tr>
<td>04-447AR</td>
<td>Talbert</td>
<td>Resistant horseweed</td>
<td>$18,661</td>
</tr>
<tr>
<td>04-440AR</td>
<td>Oosterhuis</td>
<td>High temperature effects</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>Bt translocation</td>
<td>$2,950</td>
</tr>
<tr>
<td>04-443AR</td>
<td>Oosterhuis</td>
<td>Root development</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>04-477AR</td>
<td>Robertson</td>
<td>Sub-surface drip irrigation</td>
<td>$15,570</td>
</tr>
<tr>
<td>04-445AR</td>
<td>Robertson</td>
<td>Technology transfer</td>
<td>$25,130</td>
</tr>
<tr>
<td>04-476AR</td>
<td>Baker</td>
<td>Plant stress</td>
<td>$23,814</td>
</tr>
<tr>
<td>04-446AR</td>
<td>Robertson</td>
<td>Defoliation timing</td>
<td>$19,140</td>
</tr>
<tr>
<td>C/S pool</td>
<td>Robertson</td>
<td>Cottonseed pool - Ark.</td>
<td>$5,000</td>
</tr>
<tr>
<td><strong>TOTAL</strong></td>
<td></td>
<td></td>
<td><strong>$309,283</strong></td>
</tr>
</tbody>
</table>
SUMMARIES OF
ARKANSAS COTTON RESEARCH
— 2004 —