

2004 Arizona Cotton Report Summary

This publication is intended to increase awareness and readership of articles included in the **2004 Cotton Report** by providing a short summary and web link of each article in the report. With online access increasing and tight budgets, a decision has been made to print fewer hard copies of the entire cotton report and direct individuals to access complete articles online. This publication does not include details about the methods and results of each article, so it does not serve as a citable reference source. We hope that wide distribution of this publication that has a synopsis of the article in every section of the **2004 Cotton Report** will provide increased awareness of the topics and issues addressed in the report and serve as a tool for locating complete articles online more easily.

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Contents

Introduction	5
Review of the 2003 Arizona Cotton Season	7
CROP MANAGEMENT AND PHYSIOLOGY	
Late Season Crop Management Effect on Fiber Micronaire	10
Planting Date by Variety Evaluation in Graham County	10
Conservation Tillage Effects on Infiltration and Irrigation Advance Times in Arizona Cotton	11
Effects of Meqafol and Calcium Metalosate ® Applications at Early Bloom on Cotton	11
PHYSIOLOGY AND GROWTH REGULATORS	
Mepiquat Formulation Evaluation in southeastern Arizona	12
Late Planted DPL451BR Cotton Responses to Plant Growth Enhancement Products Applied at Three Crop Development Stages in Palo Verde Valley, 2003	12
VARIETY TESTING	
2003 Low Desert Upland Cotton Advanced Strains Testing Program	13
Arizona Upland Cotton Variety Testing Program, 2003	13
Upland Cotton Variety Evaluation in Graham County, 2003	13
Acala/Upland Cotton Variety Trial, Safford Agricultural Center, 2003	14
Short Staple Variety Trial in Virden, NM, 2003	14
Pima Cotton Regional Variety Trial, Safford Agricultural Center, 2003	14
NARROW ROW PRODUCTION SYSTEMS	
Comparision of Twin and Single Line Cotton Production Systems	15
Plant Population Effects on Twin Line Cotton Production	15
SOIL FERTILITY AND SOIL MANAGEMENT	
Comparision of Potassium Fertilizer Products and Amounts on DPL555BR Cotton, 2003	16
Residual Soil Nitrogen Evaluations in Irrigated Desert Soils, 2003	16
Phosphorous Fertility Evaluation in Graham County	17
INSECT INVESTIGATIONS	
Search for Effective Chemical Controls for Lygus Bugs and Whiteflies in Arizona Cotton	18
Comparative Efficacy and Selectivity of Acetamiprid for the Management of <i>Bemisia Tabaci</i> ...	18
RESISTANCE MANAGEMENT	
Preliminary Screening of Different Cottons for Resistance to Sweetpotato EHITEFLY Infestations	19
Update on Pink Bollworm Resistance to <i>Bt</i> Cotton in the Southwest	19
WEED CONTROL	
Round Ready Flex Cotton: Glyphosate Tolerance and Weed Management, 2002-2003.....	20
Reduced Tillage and Crop Residue Effects on Cotton Weed Control, Growth and Yield	20

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Introduction

Arizona cotton growers received renewed optimism last year with spot prices increasing above the current target price of 72.4 cents/lb. in late October for the first time since July of 1998. Changing global market conditions and production technologies continue to present opportunities and challenges for Arizona's cotton industry. Arizona cotton farmers have demonstrated their agility to respond to these challenges and have done better than many predicted.

Performance of new technologies and production methods, along with the continued efficacy of established technologies and practices, for production regimes that vary from the low desert of Yuma to the high desert elevations in Southeast Arizona are the focus of articles included in the 2004 University of Arizona Cotton Report. This report is intended to provide scientific and unbiased information that will empower the irrigated cotton industry, particularly producers, in Arizona and the desert Southwest to improve their economic vitality.

The College of Agriculture and Life Sciences at the University of Arizona is proud to be a part of the agricultural community of Arizona. The efforts of many scientists, students, technicians, and grower-cooperators are highlighted in this Cotton Report.

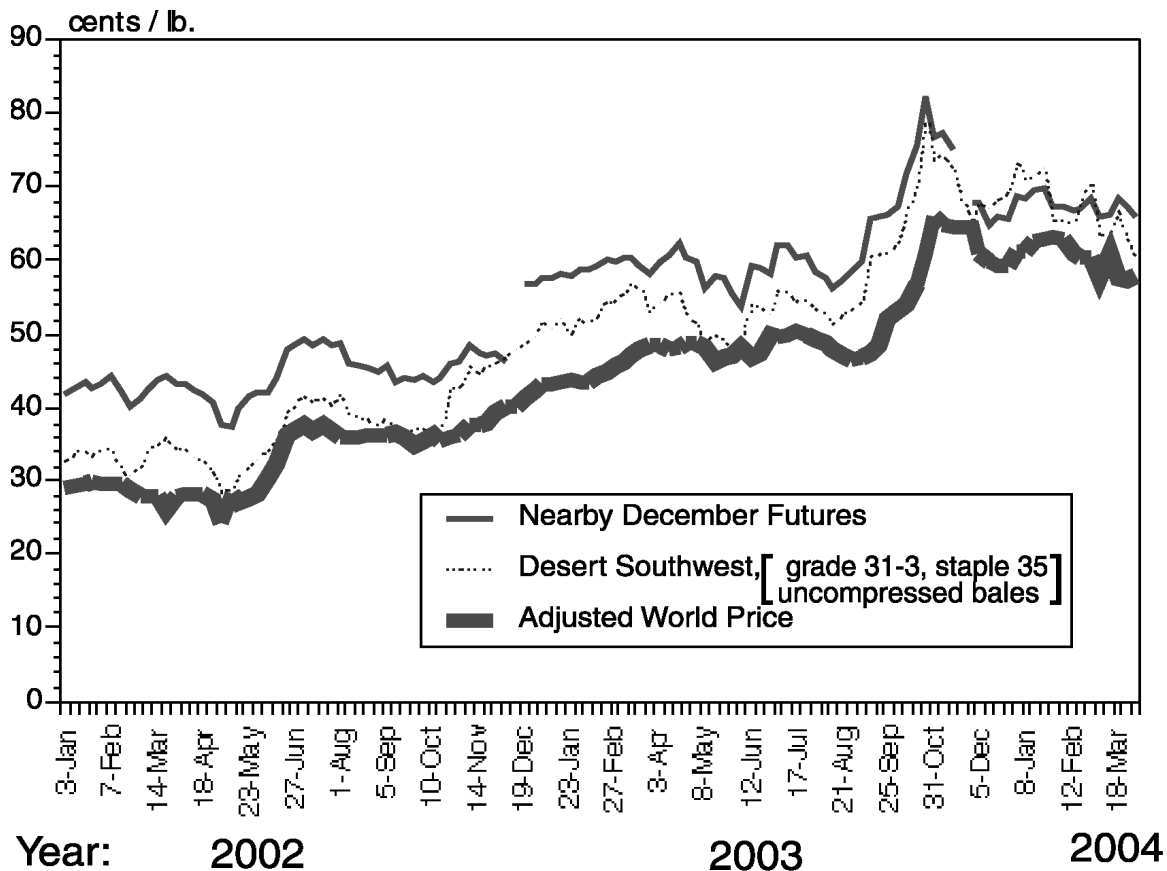
A handwritten signature in black ink that reads "Gene Sander". The signature is written in a cursive, flowing style.

Gene Sander
Vice Provost and Dean
College of Agriculture and Life Sciences

Review of the 2003 Arizona Cotton Season

Russell Tronstad, Steve Husman, Randy Norton, Eric Norton, Pat Clay and Mohammed Zerkoune

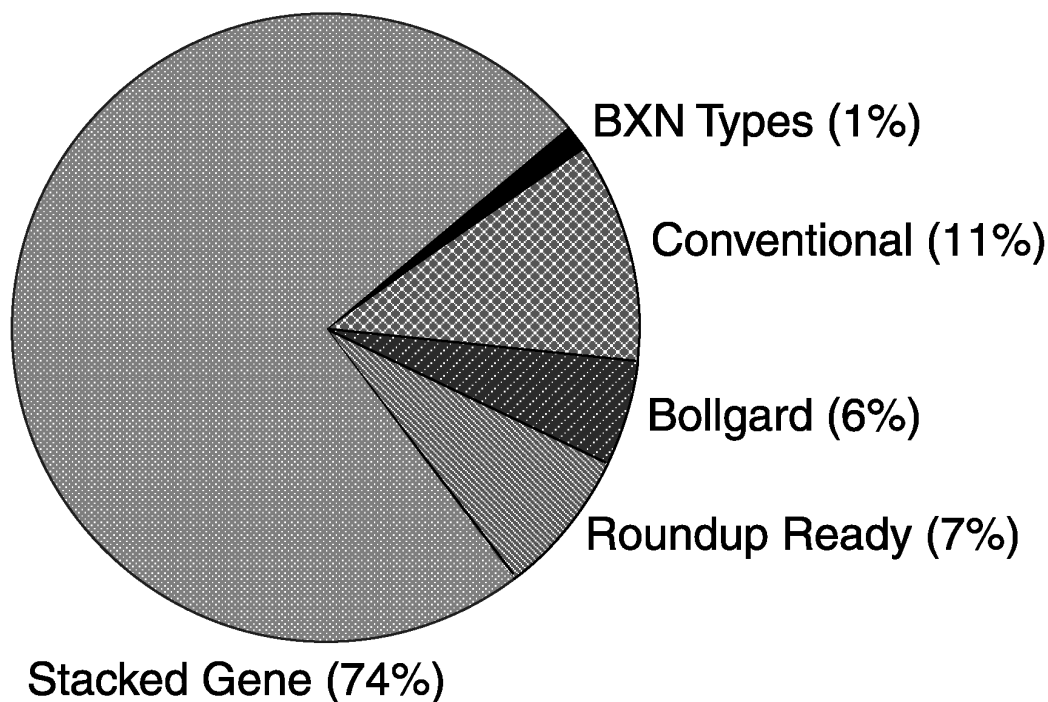
Arizona Agricultural Statistics Service (USDA/NASS) reports that Arizona planted 218,000 acres of cotton in 2003, down 2.4% from the 223,300 acres planted in 2002. All of the decline is attributed to American Pima (*G. barbadense* L.) cotton, since its acreage dropped from 8,300 to 3,000 acres while Upland (*Gossypium hirsutum* L.) remained constant at 215,000 acres. Yield estimates for 2003 are down from 2002 for both Upland and Pima. Upland yields dropped 8.6%, going from 1,381 to 1,262 lbs. lint/acre and Pima fell from 1,013 to 960 lbs. lint/acre, a 5.2% decline. The most recent five-year average yield for Upland is 1,286 lbs. lint/acre. Total Arizona lint production for 2003 was down 10.2% from the 630,300 bales produced in 2002. However, U.S. cotton production was about 5.9% higher for 2003, with total production estimated at 18.2 million bales. Despite higher production nationally, prices rose noticeably during the third quarter of 2003, as described in figure 1. A decline in global production spurred export demand and fueled higher prices. Global ending stocks for the last three marketing years have declined from 47.00 (2001/02) to 36.29 (2002/03) and 31.61 (2003/04, April estimate) million bales.



Source: USDA/AMS, Daily Cotton Price Quotes, Thursday Closing Prices.

Figure 1. Recent Upland price movements, weekly frequency for Jan. 2002 to Apr. 2004

The percentage of Upland acreage planted to different classes of seed varieties in 2003 for Arizona is described in figure 2. Arizona cotton producers have fully embraced the transgenic technology. Transgenic seed varieties increased from 81% of all Upland cotton in 2002 to 89% in 2003. However, “stacked gene” varieties or those that contain both Bollgard and herbicide resistant Roudup Ready genes, increased from about 44% to 74% of planted Upland acreage last year. Total acreage planted to varieties containing Bollgard and Roundup Ready genes for 2003 were 80% and 81%, respectively. Going from 2002 to 2003, total coverage for Bollgard and Roundup Ready genes increased by 16% and 24%, respectively. Herbicide Buctril resistant or BXN varieties remained at essentially 1% for both years.



Source: USDA/AMS, Cotton Varieties Planted, 2003 Crop. Note, 6.41% of miscellaneous varieties reported were distributed to the above categories using their respective proportions.

Figure 2. General seed varieties of Upland cotton planted in Arizona for the 2003 crop

While the weather conditions were somewhat challenging from several perspectives, Arizona producers have difficulty defining what a “normal” season looks like. The year began with unusually warm temperatures. Above average temperatures were experienced in January and February but this was followed with a cool and damp March and April. The wet and cool conditions delayed field preparation and planting for the majority of the state. In some cases, unexpected cooling or rainfall forced replanting of some acreage. The majority of Arizona’s cotton acreage was planted and successfully established from mid-April into early May, somewhat later than normal.

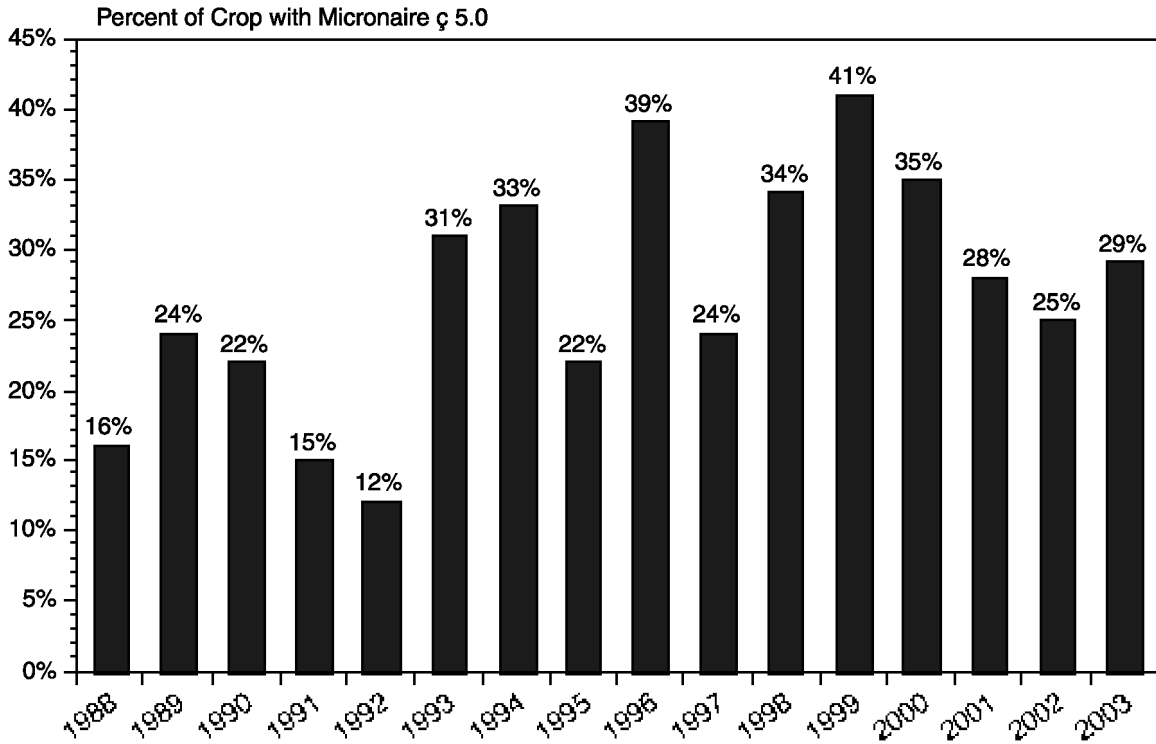
Once planted, weather conditions were quite favorable in May and June resulting in good early to mid season fruit set and retention. Monsoon flows arrived in the state in early July and continued for a prolonged period with relief arriving approximately mid-August. Typical monsoon conditions of elevated nighttime low temperatures and increased humidity result in some square and young boll loss. However, low desert production areas experienced unusually high daytime and nighttime low temperatures resulting in severe shed of squares and immature bolls.

High elevation production areas in eastern Arizona (Graham County) also experienced higher than normal temperatures. Conversely, the higher temperatures in these areas resulted in better than average cotton production conditions resulting in excellent yields. Higher elevation areas accumulated heat units more typical to low desert regions, resulting in excellent yields for them.

Warmer than average months for September and October provided the opportunity to produce a secondary fruiting cycle for low desert regions. The majority of the crop was carried longer into the fall in order to compensate for the severe fruit shed experienced in July and August. As a result, final yields were closer to normal as evidenced by the final yield average.

Micronaire values were better than expected given the 2003 growing conditions with 29% of the bales classed in the discount range, 4% more than in 2002. It appears that the more immature bolls associated with the second fruit set were able to reduce average micronaire for some producers. High micronaire has been a quality issue for Arizona’s Upland crop in recent years,

as described in figure 3. The potential for high micronaire continues to be a point of concern for the future reputation of Arizona’s cotton quality and economic viability. As illustrated by some of the articles in this Cotton Report, varieties that produce desirable High Volume Instrument fiber qualities are generally more profitable than higher yielding lint varieties without desirable fiber qualities. Insect pest pressure was generally light for 2003, however, some areas did require multiple (2-3) treatment applications to effectively control whitefly. This is primarily due to the high September and October temperatures coupled with a late crop.



Source: USDA/AMS, Quality of Cotton Classed

Figure 3. Percentage of Arizona Upland cotton that received a micronaire classification • 5.0, 1988–2003

CROP MANAGEMENT AND PHYSIOLOGY SECTION

Late Season Crop Management Effects on Fiber Micronaire

J.C. Silvertooth and A. Galadima

A field experiment was conducted during the 2002 and 2003 growing seasons to evaluate a central Arizona grower's method of addressing high cotton fiber micronaire based on the management and timing of agronomic inputs. In-season management and irrigation termination combined with defoliation methods has led to consistent production of premium fiber micronaire in recent years. Steps to accomplish crop defoliation and the subsequent mixing of seed cotton from the top (younger) and lower (older) bolls achieved at harvest are intended to keep the micronaire at premium levels and further prevent discounts on the crop. A companion study was conducted in 2002 at the University of Arizona Maricopa Agricultural Center (MAC-1,175 ft. elevation) in an effort to duplicate the grower's late season crop management operations. This study consisted of two treatments, a control (conventional) which received an application of 10 oz. Ginstar combined with 1/2 pt. surfactant in 20 gal./acre carrier and a treatment which received the conventional treatment in addition to a pre-defoliation of Accelerate and a post-defoliation of Gramoxone, consistent with the grower's methods. At the grower's location, data was collected during the 2002 and 2003 seasons. In 2002 and 2003, plant growth and development measurements taken in-season revealed that height to node ratio (HNR) and fruit retention (FR) levels tracked well and were similar for both sites and years (grower's fields and MAC study). Lint yield estimates indicated no difference between conventional defoliation and the treatment receiving additional compounds at MAC in 2002. Average yield estimates were high for the cooperator-grower fields in both the 2002 and 2003 seasons. Results of the analysis performed on final micronaire data indicated no significant difference in micronaire values between the two methods of defoliation and late season management at MAC. In addition, fiber micronaire values exceeded the premium level (>5.0) for both treatments at MAC. In contrast, the data of 2002 and 2003 obtained from the cooperator-grower gin records revealed consistent results for average fiber micronaire for all of the fields monitored in this project which were at premium levels (<5.0).

Planting Date by Variety Evaluation in Graham County

E.R. Norton and L.J. Clark

A single field study was established to evaluate the effects of planting date (PD) on the yield and fiber quality characteristics of several cotton varieties commonly grown in the Upper Gila River Valley of Safford. Eight varieties selected for evaluation in 2003 ranged from medium to medium-full varieties. These varieties included two Delta and Pine varieties (DP555BR and DP655BR), two Fiber Max varieties (FM989BR and FM991BR), two Stoneville varieties (ST5303R and ST5599BR), one CPCSD variety (Riata), and one variety from the Arizona Cotton Growers Association breeding program (AG3601). These eight varieties were planted on three separate planting dates (1 April, 23 April, and 12 May; 341, 525, and 779 heat units accumulated after January 1 respectively) in a split-plot within a randomized complete block design with four replications. Overall analysis of variance revealed significant differences due to main effects (PD; OSL=0.00043), sub effects (variety; OSL=0.0029), and interaction effects (PD*variety; OSL=0.0266). Extremely cool conditions surrounding the first PD resulted in significantly lower yields than the other two planting dates. Yields for PD 1 ranged from 506 lbs. lint/acre to about 850 lbs. lint/acre with DP555BR producing the highest and CPCSD Riata producing the lowest yield. Conditions surrounding the second PD were much improved over PD 1. However, soil temperatures still hovered near to and below the optimum temperature of 65°F. Yields were dramatically higher in PD 2 when compared to PD 1, ranging from a low of 847 lbs. lint/acre (AG3601) to 1139 lbs. lint/acre (FM991BR). PD 3 resulted in the best conditions for seedling emergence and stand establishment and produced the highest yield. Yields ranged from a low of 945 lbs. lint/acre (CPCSD Riata) to 1465 lbs. lint/acre (FM991BR). Fiber quality data demonstrated a couple of interesting trends. Micronaire tended to increase with later plantings for most varieties while fiber length had an inverse relationship with PD. Micronaire levels tended to be high enough to be discounted for every variety in at least one and usually two PDs, except for Riata. Riata had the lowest micronaire, and the longest and strongest fiber grades. These results are consistent with other evaluations of the high fiber quality associated with many of the California Acala varieties. However, relatively lower yields for this variety currently make it an unsuitable variety for this region despite the high fiber quality. Results from this evaluation demonstrate the importance of monitoring soil temperature and keeping a close eye on local weather forecasts when making planting date decisions regardless of the calendar date.

Conservation Tillage Effects on Infiltration and Irrigation Advance Times in Arizona Cotton

E.C. Martin, K.O. Adu-Tutu, W.B. McCloskey, S.H. Husman, P. Clay and M. Ottman

Field experiments were initiated in 2001 for a cotton-based conservation tillage project at sites in Marana, Coolidge, and Goodyear, Arizona. For the 2002 season, soil and water management assessments were made to evaluate surface irrigation performance under conservation tillage, following cover and grain crops. An additional site was added in the winter of 2002 at Maricopa, Arizona. Analyses included soil texture, infiltration rate, and water advancement. At Coolidge, conservation tillage plots had higher infiltration rates and longer advance times than the conventional plots in 2002 and 2003. At Marana, infiltration rates were initially higher for the Conservation plots but the rates converged at the end of four hours in 2002. In 2003, Conventional plots infiltrated about one inch more. Advance times for Marana showed water infiltration for Conventional wheel rows to be the fastest. At Goodyear, Conservation plots infiltrated more than Conventional plots during 2002. This also resulted in a slower advance time for the Conservation plots. In 2003, treatment effects were not comparable due to tillage by the grower. At Maricopa, Conservation plots infiltrated almost 2.2 inches more water than Conventional plots and water reached the end of the field three hours ahead of the fastest Conservation plot. Seasonal irrigation water applications to each treatment were relatively equal for all sites with the exception of Coolidge. Here, the long field combined with sandy soil made it difficult to adequately irrigate the Conservation plots. In 2002, an additional 21 inches of water was applied to the Conservation plots. In 2003, that amount was reduced to 12.5 inches. The yield data show a significant difference in 2002 only at Coolidge. There, Conservation plots yielded more than the Conventional ones. This may have been due to more water applied to the Conservation plots. In 2003, the opposite occurred with the Conventional plots yielding more than the Conservation plots. This could have been due to herbicide damage. At Maricopa, the Conventional plot also yielded more than the Conservation plot. Initial indications are that the conservation tillage does impact irrigation performance and may not be suitable for all locations depending on soil type and field layout.

Effects of Megafol and Calcium Metalosate® Applications at Early Bloom on Cotton

Michael D. Rethwisch, Mark Reay, Tim Cox, Jessica Grudovich, Jessica Wellman and Erica Hawpe

Foliar fertilizers are not widely used in low desert cotton production systems. Thus, data about their effects in this production regime are rather limited. This study documents the effects of Calcium Metalosate® and Megafol, each applied at the rate of 1 qt./acre to DPL555BR cotton. Treatments were applied on July 7, and plants had been growing vigorously just prior to application. Plots were approximately 0.75 acres in size with four replications. Plant mapping data from late July indicated that non-treated cotton had numerically higher retention rates at each of the first three fruiting positions, slightly more total nodes, and a larger number of reproductive nodes. In part, this is due to retention of the first fruiting structure on the check plants being lower (node 6.75) than the treated cotton (node 7.95 for Megafol, node 8.4 for Calcium Metalosate®). Tractor passage through treated plots may also have knocked off some developing squares however.

No statistical differences were noted for lbs. of lint/acre among either foliar treatments, reflecting nearly identical treatments (1,203 lbs./acre for Megafol; 1,198 lbs./acre for Calcium Metalosate®). However, treated cotton did have slightly higher yields than the untreated check (1,162 lbs/acre) and fiber length and strength was significantly different by treatment, with the shortest and weakest fibers from cotton treated with Megafol. Calcium Metalosate® treatments had significantly longer and stronger lint than Megafol treated cotton plots, but lint from untreated cotton plots was significantly longer and stronger than either foliar treatments (36.6 staple, 31.0 g/tex). Reasons behind these differences are unclear.

It is difficult to correlate slight yield increases noted with treatments in early July, especially in light of lower fruit retention rates observed from plant mapping data in late July and the large amount of lint production that occurred late in 2003 due to summer heat. Multiple differences were noted for treatments in regards to lint quality, indicating foliar fertilizers may affect cotton profitability. Size of bolls and cotton lint from early summer bolls was not obtained, but may have been an overlooked aspect of this study.

PHYSIOLOGY AND GROWTH REGULATORS

Mepiquat Formulation Evaluation in Southeastern Arizona

E.R. Norton and L.J. Clark

A series of experiments were conducted in 2003 in the Upper Gila River Valley in Safford, AZ to evaluate several different formulations of the plant growth regulator (PGR) Pix manufactured by BASF. Two experiments were conducted at the Safford Agricultural Center (SAC) while the third was conducted on a grower-cooperator field in the same valley. Experiments conducted at SAC involved evaluating the four formulations of Pix (Pix, Pix Plus, Pix Ultra, and Pentia) in a standard (STD) treatment regime and a low rate multiple (LRM) regime. The untreated control plots in both the LRM and STD experiments produced higher yields than any of the other PGR formulations. In comparing only PGR formulated treatments, the Pentia treatment produced the highest yield in both the STD and LRM experiments. No significant differences were observed in fiber quality for either the LRM or STD experiment. The third experiment conducted on a grower-cooperator field was a Pentia demonstration experiment. Three treatments including a control, a standard, single Pentia application, and an aggressive split application of Pentia were employed. The highest yield was produced in the most aggressive Pentia treatment. Results from this set of experiments demonstrate the importance of incorporating information from plant monitoring techniques when making decisions about PGR applications.

Late Planted Cotton Response to Plant Growth Enhancement Products, Palo Verde Valley

M. D. Rethwisch, M. Reay, G. Chaffin, R. Perez, J. Grudovich, J. Wellman and E. Hawpe

An experiment to investigate the effects of several plant growth enhancement products (AuxiGro® WP, FirstChoice® Bollster, CalMax, FoliGro® BollSet) on DPL 451BR was conducted in the Palo Verde Valley. The cotton field chosen for this project was planted in April 2003. Flowering, boll/lint production, and product effectiveness were tested under extreme high temperature conditions that existed during 2003. Products were applied July 11 (shortly after first bloom), August 1st and/or August 15. Three rates (1, 2, 4 oz./acre) of AuxiGro® WP were applied at each date, although just a single rate of the other products was evaluated. Data collected were plant-mapping values following the first two application dates as well as lint yield and quality at harvest on October 20-23. Results show significant differences for treatment rates containing AuxiGro® WP, as shown in the responses to applications on August 1 (retention rates) and August 15 (cotton quality factors). These responses were significantly different than the untreated check, and were often significantly different than the Bollster fertilizer treatment itself, even though Bollster was also included with AuxiGro® WP treatments.

Although yields for any treatment and the untreated check were not significantly different, previously noted differences in retention for the AuxiGro® WP treatments may not have been realized due to the high temperatures and extended periods of not only Level 1 but Level 2 stress during the course of the experiment. Per acre cotton revenues were highest (\$609.85/acre) for the 4 oz./acre of AuxiGro® applied on August 15, due to the highest lint value. More desirable micronaire combined with increased fiber strength and length resulted in a higher lint value. Application of CalMax showed a significant increase in fiber strength following two applications of 4 oz./acre of AuxiGro® + Bollster, but CalMax following two applications of Bollster did not affect fiber strength when compared with each of the two application treatments. A third application of FoliGro® BollSet was detrimental for cotton yields and strength compared to only two applications of this product, although both treatment regimens resulted in shorter fibers that were not quite as strong as the untreated check.

VARIETY TESTING SECTION

2003 Low Desert Upland Cotton Advanced Strains Testing Program

S. Husman and K. White

Upland cotton advanced strains and commercial check varieties were evaluated in replicated field studies at three locations in 2003. The test sites in Arizona included Safford, Maricopa, and Yuma. Seven seed companies submitted a maximum of ten advanced seed strain entries per location. Three commercial check varieties were used at the Safford and Yuma sites, and included ST4892BR, DP449BR, and DP565. Two commercial check varieties were used at Maricopa and included ST4892BR and DP449BR. Data collected include vigor and relative maturity ratings, yield, and fiber quality. The research was conducted in order to develop publicly available unbiased performance data of genetic materials that have moved to the advanced stages of testing and are being considered for commercial release. The data have historically been used to add to seed company databases and assist with commercial release decisions.

Arizona Upland Cotton Variety Testing Program, 2003

S. Husman, R. Norton, E. Norton, P. Clay, M. Zerkoune, K. White

Each year the University of Arizona conducts variety trials across the state to evaluate the performance of Upland cotton varieties. These tests provide unbiased data on the performance of varieties when tested side-by-side under typical production practices. In 2003, a total of 11 trials were planted. Two in the Yuma region (Yuma County), two in the western region (La Paz and Mohave counties), four in the central region (Maricopa and Pinal counties), one in the southern region (Pima county), and two in the eastern region (Graham, Greenlee, and Cochise counties). We tested eight to fourteen commercially available varieties at each test site. This article presents a comparison of the 2003 variety tests for all locations.

Upland Cotton Variety Evaluation in Graham County, 2003

E.R. Norton and L.J. Clark

A field trial was established for the 2003 growing season as part of the statewide Upland Cotton Variety Testing Program. This trial was located in Thatcher, AZ and Dennis Layton Farms was the grower-cooperator. The location was one of eleven around the state. A total of twelve varieties were entered from six cooperating seed companies. Varieties included DP655BR, DP555BR, DP449BR, and DP5690R from Delta and Pine Land Company; FM989BR, FM991R, and FM991BR from Fiber Max; ST5303R and ST5599BR from Stoneville; Riata from CPCSD; AG3601 from Arizona Cotton Growers Association; and SCX-7 from Salcot. The twelve varieties were planted in a randomized complete block design with three replications. Individual plots consisted of 4, 38" rows extending the full length of the irrigation run (1250 ft.). Plant measurements were collected throughout the season to evaluate growth and development characteristics of each variety. Yield and fiber quality data was collected at the end of the season by harvesting and weighing each individual experimental unit. Sub-samples were collected for fiber quality analysis. Percent emergence data indicate differences in seedling vigor and stand establishment. Percent emergence ranged from a high of nearly 90% (Fiber Max FM989BR) to less than 50% (Delta and Pine DP555BR). Even with the low percent emergence for DP555BR, an adequate stand was achieved for each variety and did not significantly impact final yield. Significant differences were observed in final lint yields with Fiber Max FM991BR producing the highest yield at 1690 lbs. lint per acre and Fiber Max FM989BR producing the lowest yield at 1292 lbs. lint per acre, a difference of approximately 400 lbs. Delta and Pine DP655BR has been the standard variety planted in the valley for several years. The only variety that produced more lint than DP655BR was FM991BR. Gross lint revenues, calculated using premium/discounts for fiber quality, were highest for FM991BR with a value of \$952/acre. All varieties had overall premiums except for AG3601 which was discounted due to high fiber micronaire. Results from this evaluation indicate that FM991BR appears to be another variety growers can choose from that has the potential to perform very well in the Upper Gila River valley.

Acala/Upland Cotton Variety Trial, Safford Agricultural Center, 2003

L.J. Clark, K.F. Ellsworth and E.R. Norton

Eight Acala varieties from New Mexico(4), California(3), and Arizona(1) along with thirteen upland varieties of interest to the area were tested in a replicated small plot trial on the Safford Agricultural Center in Graham county at an elevation of 2950 feet. The highest yielding variety in this study was DP 555BR with a lint yield of 2203 lbs./acre, but FM991BR produced the highest per acre gross revenue at \$1527. Sierra, a new Acala variety from California, was the highest yielding Acala with a lint yield of 1872 lbs./acre and a gross revenue of \$1324 per acre. Average lint yield was 500 pounds per acre higher than for the 2002 season, indicating that 2003 was an above average year for growing cotton and that daily heat units following planting were above the threshold. In addition to yield, several other agronomic variables were measured. These include plant height, total nodes, and boll weights. From plant height and total nodes, height-to-node ratios were calculated. Differences were observed between these variables by variety but the most notable point is that plants were very robust in their growth habit and fruiting forms, heavier than the previous year. HVI fiber quality data were reported and the estimated value in cents per lb. of lint is provided. HVI data show an average fiber length of 1.13 inches, with only one variety producing less than 1.10, and seven varieties having fiber of 1.15 inches or more. A New Mexico experimental variety had the longest fiber at 1.18 inches. The average fiber strength was 32.1 grams per tex and the same NM experimental variety produced the strongest fiber. In general, all of the varieties included in this study had very desirable HVI fiber values.

Short Staple Variety Trial in Virden, NM, 2003

L.J. Clark and E.R. Norton

This study is a continuation of variety trials conducted in the Duncan/Virden area over many years to supply yield and revenue data on premium cotton varieties for local growers. In recent years, the introduction of herbicide resistant cultivars has been particularly interesting to help clean up many weedy fields. The premium quality New Mexico Acala varieties do not, at this time, have herbicide resistance traits and have struggled to produce high enough yields to compete with the lower quality varieties that are available. Fifteen cotton varieties were tested including two 1517 varieties from New Mexico, Sierra, the newest Roundup-Ready from CPCSD, Salcot Sacala, a new Acala from Arizona, and the AZ Cotton Growers variety. The rest of the entries were Roundup-Ready short- to mid-season varieties from Delta Pine, Stoneville, FiberMax, and Paymaster. The highest yielding variety in the trial was Riata, a Roundup Ready Acala from CPCSD, with a yield of 1255 pounds of lint per acre. Sierra, ST 5599RR, ST 5303R, and 1517-99 produced around 100 pounds less lint per acre than Riata but the yields were not statistically different. Plant heights, first-fruiting branches (FFB), total nodes and boll weights were measured and height-to-node ratios were calculated. Many differences were seen between varieties with all of these variables. HVI data were obtained for each variety. This data was then used to determine the value of the lint and then estimate the gross revenue produced by each variety. The highest lint value (cents per pound) was produced by 1517-99 with 1517-95 and Riata following closely behind. The highest gross revenue was produced by Riata, due to a combination of both high yield and lint quality.

Pima Cotton Regional Variety Trial, Safford Agricultural Center, 2003

L.J. Clark, E.W. Carpenter and E.R. Norton

This study is part of a regional Pima cotton variety testing program that is conducted in 8 locations from the West Side Field Station in California to El Paso, Texas. Additional varieties were added to supply information needed by cotton growers in southeastern Arizona. Seventeen long staple varieties were tested in a replicated small plot trial on the Safford Agricultural Center in Graham County at an elevation of 2950 feet. Yields were exceptionally high for 2003 with average yields nearly 600 pounds per acre more than what was harvested in 2002. The highest yielding variety in this study was Hazera (HA) 195 with a yield of 2027 pounds of lint per acre. This inter-specific hybrid, from Israel, has been the highest yielding variety in the study since it was included in 2001. This fuzzy seeded hybrid has fiber qualities as follows: length - 1.41 inches, strength - 34.8 g/tex and uniformity of 87.5. The averages from this study were 1.43, 42.5 and 88.3 for these same variables, respectively. DP HTO was the highest yielding non-hybrid variety in the study with a yield over 1900 pounds of lint per acre. For comparison purposes, it's length, strength and uniformity were: 1.39, 41.9 and 88.5. Other varieties in the top half of the study were: HA 14-08, OA 360, OA 359, HA 7-66, DP 340 and DP 744, in descending order of their yields. Yield, other agronomic data, and fiber quality data along with corresponding gross lint revenues are also included in this paper.

NARROW ROW PRODUCTION SYSTEMS SECTION

Comparison of Twin and Single Line Cotton Production Systems

Stephen H. Husman, William B. McCloskey, Kyrene White, Jeffrey Hamilton, Patrick Clay, Randy Norton, Eric Norton, and Mohammed Zerkoune

Twin line (two seed lines 7.25 in. apart per bed) and conventional single line (one seed line per bed) production systems were compared at 18 sites across Arizona and the Palo Verde Valley near Blythe, CA in 2002 and 9 sites in 2003. Three experiments at the Chaffin site in 2002 compared twin line plant populations of 57,000 (57K), 75,000 (75K), and 90,000 (90K) plants per acre (PPA). In 2002, the twin line system produced more lint than the conventional single line system at 4 of the 18 locations; the yields of the twin line and single line systems were 1273 and 1186 lbs./acre, 1572 and 1461 lbs./acre, 1478 and 1290 lbs./acre, and 1309 and 1210 lbs./acre, respectively, at the Grasty, Ramona, Rovey, and Wells sites, respectively. In 2003, none of the experiments resulted in higher twin line system lint yields. In 2002, there were no significant differences in yield or fiber micronaire in 7 of the 18 experiments. In 2003, there were no significant differences in yield in 3 of the 9 experiments. In 2002, the twin line system produced less lint than the conventional system at 5 of 18 locations; yields of the twin line and single line systems were 2019 and 2189 lbs./acre, 1400 and 1489 lbs./acre, 1537 and 1845 lbs./acre, 1065 and 1200 lbs./acre, and 1271 and 1431 lbs./acre, respectively, at the Chaffin (75K), Cooley, Hull, Papago, and Wakimoto sites, respectively. In 2003, the twin line system resulted in less yield in 6 of the 9 experiments; yields of the twin line and single line systems were 1154 and 1285 lbs./acre, 1906 and 2109 lbs./acre, 1797 and 1938 lbs./acre, 878 and 1114 lbs./acre, 726 and 821 lbs./acre, and 1230 and 1404 lbs./acre, respectively, at the Hull, Marlatt 1, 2, and 3, Murphy Late Plant, and the University of Arizona (UA) Marana Agricultural Center sites respectively. In 2002, fiber micronaire was reduced in five experiments; the micronaire values were 4.25 and 4.73, 4.46 and 4.78, 4.60 and 4.85, 4.76 and 4.98, and 4.93 and 5.15, for the twin line and single line systems, respectively, at the Rogers, Papago, Grasty, Hull, and Perry sites, respectively. In 2003, there were no significant differences in fiber micronaire at all 9 test locations. In 2003, visual observations suggested that the spindle pickers were unable to effectively harvest bolls the lowest bolls primarily below the cross-over point of the two mainstems in the twin line system. Hand harvest comparisons of the twin and single line system resulted in yields of 1776 and 1661 lbs./acre respectively, a 6% difference at the Maricopa Agricultural Center. It was concluded that the inability to effectively harvest twin line cotton is the most significant system problem with this production system.

Plant Population Effects on Twin Line Cotton Production

Stephen H. Husman, William B. McCloskey and Kyrene White

Three experiments at the University of Arizona Maricopa and Marana Agricultural Centers in 2002 and 2003 measured the effect of plant populations on the yield of cotton planted in a twin line bed configuration. In 2002 at Maricopa Ag. Center, plant populations were 52800, 69200, 82800, and 96200 plants per acre (PPA) for Stoneville 4892BR, 54800, 70800, and 90500, respectively, and 104500 PPA for AG3601. The two lowest plant populations which were in the range of common commercial plant densities resulted in the greatest lint yields for both varieties (an average of 1708 and 1287 lbs. lint/acre for ST4892BR and AG3601, respectively) but there was a significant linear decrease in yield with increasing plant population. In 2003, the cotton variety Delta Pine 449BR was planted with population densities of 22000, 29000, 36000, 46000, 51000, 61000, and 64,000 PPA at the Marana Ag. Center and 24000, 34000, 41000, 56000, 63000, 71000, and 86,000 PPA at the Maricopa Ag. Center. Cotton yield did not vary significantly as a function of population density at Maricopa and averaged 1526 lbs. lint/acre. At Marana there was a slight trend of increasing yield with increasing plant density, with the three highest plant populations averaging 1385 lb lint/acre. In the experiments with ST4892BR and AG3601 at Maricopa in 2002 and with DP449BR in 2003 there was a linear decrease in fiber micronaire with higher plant density. But this effect was not observed in Marana, possibly because plant populations were lower there than in the other experiments.

SOIL FERTILITY AND SOIL MANAGEMENT SECTION

Comparison of Potassium Fertilizer Products and Amounts on DPL555BR Cotton, 2003

Michael D. Rethwisch, Mark Reay, Aron Quist, Tim Cox, Jessica Grudovich, and Jessica Wellman

Several fertilizers containing potassium and sulfur were evaluated for their effect on cotton grown on a sandy soil. Fertilizers were applied/injected both at planting and first flower. Plant mapping data were obtained in both July and August, and potassium levels in petioles were obtained in August and September. Applying more potassium did not result in significant lint yield increases for the summer of 2003. However, heat stress for this year caused high levels of fruiting structure losses on late planted cotton which may have greatly obscured results as boll carpels serve as potassium sinks. Treatments were documented to have no lasting effect on fruit loss amounts, although differences in petiole potassium were noted in mid-August. Cotton treated with the highest levels of potassium and sulfur affected cotton uniformity and staple/length in that both parameters were slightly less when compared with results from other treatments. Increasing potassium/sulfur did result in stronger fiber strength, however this decreased slightly at the higher levels of fertilization. The 2.5 gal + 2.5 gal Tracite 0-0-21 treatment had the lowest micronaire as well as lowest yield, but it also had the highest revenue/acre due to the 4.9 micronaire. There does not seem to be a clear pattern or reason for this occurrence at this time and further testing is necessary to confirm this result.

Residual Soil Nitrogen Evaluations In Irrigated Desert Soils, 2003

J. C. Silvertooth, A. Galadima, and E.R. Norton

Field experiments aimed at investigating N fertilizer management in irrigated cotton production have been conducted for the past 16 seasons at three University of Arizona Agricultural Centers (Maricopa, MAC; Marana, MAR; and Safford, SAC). In 2003, residual N studies were conducted at two of these locations (MAC and MAR). The MAC and SAC experiments have been conducted each season since 1989 and the Marana site was initiated in 1994. Original purposes of the experiments were to test nitrogen (N) fertilization strategies and to validate and refine N fertilization recommendations for Upland (*Gossypium hirsutum* L.) and American Pima (*G. barbadense* L.) cotton. Each experiment has utilized N management tools such as pre-season soil tests for NO_3^- -N, in-season plant tissue testing (petioles) for N fertility status, and crop monitoring to ascertain crop fruiting patterns and crop N needs. At each location, treatments varied from a conservative to a more aggressive approach of N management. Results at each location revealed a strong relationship between fruit retention levels and N needs of the crop. This pattern was further reflected in the final yield analysis as a response to the N fertilization regimes used. The higher, more aggressive N application regimes did not consistently benefit yields at any location. Generally, the more conservative, feedback approach to N management provided optimum yields at all locations. In 2001, a transition project evaluating residual N effects associated with each treatment regime was initiated with no N fertilizer applied. Therefore, all N taken-up by the crop was derived from residual soil N. In 2001, 2002, and even 2003 there were no significant differences among the original fertilizer N regimes in terms of residual soil NO_3^- -N concentrations, crop growth, development, lint yield, or fiber properties. Lint yields were very uniform at each location in 1991 and averaged 1500, 1100, and 850 lbs. lint/acre for MAC, MAR, and SAC, respectively. In 2002, results were very similar and yields averaged 1473 and 1060 lbs. lint/acre for MAC and MAR locations respectively. The results for 2003 were similar to the results of the prior two years with yields at 1322 and 1237 lbs. lint/acre for MAC and MAR, respectively. Trends associated with residual fertilizer N effects are not evident at either location following three consecutive seasons of N fertilizer treatments.

Phosphorus Fertility Evaluation in Graham County

E.R. Norton and L.J. Clark

This project is a continuation of an ongoing phosphorus (P) fertility evaluation that began in 1998, at Safford, AZ on a grower cooperator field. The field study conducted during the 2003 season consisted of five treatments of varying rates of P fertilizers from 0 through 165 lbs. of P_2O_5 per acre. Treatments were arranged in a randomized complete block design with three replications. Plot sizes were 12, 36 in. rows wide and extended the full length of the irrigation run of 1250 feet. Three of the five treatments (treatments 3, 4, and 5) consisted of varying rates of P fertilizer applied as a liquid blend (11-30-0-5S) proprietary to United Agri Products (UAP) injected in the soil at approximately the 4 leaf stage prior to the first post plant irrigation. An additional treatment (treatment 2) of calcium thiosulfate (CATS) proprietary to Tessengerlo-Kerley was also applied. In an effort to ensure uniform application of fertilizer nitrogen (N) across all treatments, a solution of urea-ammonium-nitrate (UAN) was applied to bring uniform the level of all treatments with respect to N fertilizer. Lint yield results indicate a strong positive response to applied P, consistent with the previous four years of P fertility work done in this area. The highest applied P treatments resulted in the highest lint yields with an increase of approximately 155 lbs. lint/acre above the control, an increase of about 12%. Fiber quality data did not indicate any significant differences among treatments for any of the fiber quality parameters measured. Compiling all yield data from the prior six years and plotting percent relative yield as a function of applied P fertilizer demonstrates a positive response to P fertilization. These results indicate the need for local growers to consider P fertilization as an important component of their fertility program. This is particularly true for cotton fields that have had very little or no rotation with small grain crops that are commonly fertilized with a P based fertilizer such as 16-20-0.

INSECT INVESTIGATIONS SECTION

Search for Effective Chemical Controls for Lygus Bugs and Whiteflies in Arizona Cotton

Virginia Barkley & Peter C. Ellsworth

Whiteflies and Lygus bugs continue to be key pests for Arizona's cotton industry. Some of our most popular and time-tested chemicals are still providing efficacy toward Lygus or whiteflies when used in a timely manner. However, promising new chemicals may also become available in the near future. Through research, growers can be kept updated on options for successful IPM. An experiment was conducted in order to expand our knowledge of currently available compounds and upcoming advances in insecticide development. In this experiment, 11 different compounds were tested for efficacy and duration of activity against whiteflies, Lygus, or both. Although none were active on Lygus adults, some chemicals were very effective on all stages of nymphs. Orthene® or Vydate® continue to show good results against Lygus but were not superior to a new compound. The best performing insecticide against Lygus was flonicamid, a novel chemistry under development by FMC. This insecticide had the best control over Lygus nymphs, was the highest yielding treatment, and required one less spray than other top performing compounds. Among newer chemistries for Lygus control is fipronil (Regent® by BASF), which performed slightly better than Vydate but not quite as effective as Orthene. Another higher-yielding regime included the use of novaluron, a novel insect growth regulator (IGR) scheduled for registration in 2005 (Diamond® by Crompton Corporation). This IGR was tested against whiteflies and Lygus bugs, but in light of yield data, Lygus efficacy should be examined more closely. None of the neonicotinoids were effective against Lygus, but several proved to be promising for whitefly control. Of the neonicotinoids tested and sprayed on threshold, dinotefuran (under development by Valent) showed good activity. The performance of spiromesifin (Oberon®, a new chemistry by Bayer) was similar to dinotefuran but needing one less spray. Intruder® out-performed all whitefly treatments, requiring only two sprays to control whiteflies season-long. Intruder and currently utilized IGRs of Knack® and Courier® proved to be very effective against whiteflies. All insecticides in this test underwent very rigorous testing under extreme Lygus and whitefly pressures.

Comparative Efficacy and Selectivity of Acetamiprid for the Management of *Bemisia tabaci*

Steven E. Naranjo and David H. Akey

The integrated control concept emphasizes the importance of both chemical and biological control for pest suppression in an agricultural system. A two-year field study was conducted to evaluate the selectivity of acetamiprid for controlling sweetpotato whitefly, *Bemisia tabaci*, in cotton compared with a proven selective regime based on insect growth regulators (IGRs) of pyriproxyfen and buprofezin. Acetamiprid was highly effective in controlling all stages of *B. tabaci* compared to our untreated control and generally produced lower pest densities than the IGR regime. However, six of 14 taxa of arthropod predator were significantly depressed with the use of acetamiprid compared to our untreated control, including common species such as *Geocoris punctipes*, *Orius tristicolor*, *Chrysoperla carnea*, *Collops vittatus*, *Hippodamia convergens*, and *Drapetis nr. divergens*. Compared to other independent and concurrent studies using mixtures of broad-spectrum insecticides at the same research site, acetamiprid depressed fewer populations of predator taxa in our study, but for those taxa affected, reductions from acetamiprid were larger in many cases. In contrast, only one species was significantly reduced in the IGR regime compared with the untreated control. Predator:prey ratios were generally depressed with the use of acetamiprid compared with both the IGR and untreated control regimes. Parasitism by aphelinid parasitoids was unaffected or depressed slightly in all insecticide regimes compared with the control. Although highly efficacious for whitefly control, our results suggest that acetamiprid is a poor substitute for IGRs currently used in an integrated control program for *B. tabaci* in cotton.

RESISTANCE MANAGEMENT SECTION

Preliminary Screening of Different Cottons for Resistance to Sweetpotato Whitefly Infestations

P.J. Alexander, L. Forlow Jech, and T.J. Henneberry

Sweetpotato whitefly (SPW), *Bemisia tabaci* (Gennadius) Biotype B, is a worldwide pest causing excessive food and fiber crop losses. Although SPWs attack more than 500 hosts, infestations and reproduction on different hosts are extremely variable, suggesting plant preference and the possible existence of SPW resistant germplasm. We are currently conducting studies with different cottons to identify potential sources of SPW resistant germplasm. Fifteen cotton entries were evaluated in a randomized complete block experiment with four replications at Phoenix, AZ. Plots were designed such that a single row of 10 plants comprised each entry. Plots were not treated with insecticide. Cantaloupe, *Cucumis melo* L. var. *cantalupensis*, was interplanted among cotton rows to encourage the development of SPW populations. Numbers of SPW adults, eggs, and immature forms were counted on leaf samples for five dates during the season using established procedures. Results of our regression analysis showed that SPW adults, eggs, and nymphs are significantly related to leaf hairiness. Seasonal mean numbers of SPW adults, eggs, and nymphs were highly variable within and between leaf color, shape, and hairiness of cotton types considered. Further studies are justified since some of the cottons may be potential sources of SPW resistant germplasm.

Update on Pink Bollworm Resistance to Bt Cotton in the Southwest

*Timothy J. Dennehy, Gopalan C. Unnithan, Sarah A. Brink, Brook D. Wood,
Yves Carrière, Bruce E. Tabashnik, Larry Antilla and Mike Whitlow*

Monitoring of Arizona pink bollworm (PBW), *Pectinophora gossypiella*, susceptibility to the Bt toxin Cry1Ac has been conducted annually since 1997. PBW were collected from cotton fields located throughout the Southwest in 2002, cultured in the laboratory, and tested for susceptibility to Cry1Ac using diet-incorporation bioassays. A total of 13 Arizona collections were successfully reared and bioassayed. Collections from California (6), New Mexico (1), and Texas (1) were also tested.

Laboratory selection of pink bollworms collected from Arizona in 1997 and exposed to Cry1Ac in diet produced a strain capable of surviving on Bollgard® cotton. Subsequent studies showed that 10 µg Cry1Ac/ml of insect diet was a reliable diagnostic concentration for detection of pink bollworm that were homozygous for resistance to Cry1Ac. On this basis, resistant PBW were detected in 2002 in only 2 out of 13 Arizona strains. The overall frequency of resistant PBW in 2002 for Arizona was 0.17% and ranged from 0.0 to 1.7%. One of six California collections evaluated had a single resistant survivor. No resistant pink bollworms were detected in the single New Mexico and Texas collections evaluated. Resistant PBW were significantly more abundant in Arizona in 2001 and 2002 than they were in 1998, 1999 or 2000. However, the frequency of resistant survivors in bioassays was low for 2001 and 2002, and markedly lower than in 1997.

The Arizona Cotton Research and Protection Council evaluated the efficacy of Bt cotton in 2002 using adjacent pairs of Bt and non-Bt fields at 43 locations across Arizona. Pink bollworms were found in an average of 23.3% of these non-Bt boll fields. Bolls from Bt cotton fields yielded an average of 0.144% (range 0 to 1.300%) infested bolls. Of these, all but three of the pink bollworm recovered from Bt cotton plantings came from bolls that tested negative for Cry1Ac. We conclude from these findings that there is no indication that pink bollworm resistance to Cry1Ac was a problem at the locations sampled in 2002. Bt cotton continued to exhibit exceptional field performance in Arizona.

WEED CONTROL SECTION

Roundup Ready Flex Cotton: Glyphosate Tolerance and Weed Management, 2002-2003

William B. McCloskey, Kwame O. Adu-Tutu, and T. Vint Hicks

The tolerance of Roundup Ready (RR) Flex cotton to topical Roundup Weathermax (glyphosate) applications and weed management programs was studied in 2002 and 2003 at the University of Arizona Maricopa Agricultural Center. RR Flex cotton demonstrated excellent tolerance to glyphosate as measured by flower pollen shed and lint yield when sprayed topically with glyphosate at 2.25 lbs. ae/acre four times (at the 3 leaf, 6 node, 10 node and 14 node growth stages). Line 1445 contains the current commercial RR genetic construct, and it had a flower sterility/pollen shed rating of 4.6 (1 equals full pollen shed and 5 equals no pollen shed, measured on 28 June 2003) than the ratings of 1.1 to 1.9 for lines containing the RR Flex genetic construct. Cotton yields followed a similar pattern with 1445 yielding 386 lbs. seed cotton/acre compared to 1477 to 1894 lbs. seed cotton/acre for the best lines containing the RR Flex genetic construct (yields were generally low because all the cotton considered contained the Cocker genetic line that does not perform well under hot desert production conditions). The presence of the RR gene did not affect the yield of genotype pairs that were identical except for the presence or absence of the RR Flex genetic construct. In the weed management study, delaying the first topical glyphosate application resulted in larger, more difficult to control weeds and reduced cotton yield by allowing greater early season competition between weeds and cotton. The best weed control programs included early (1 to 2 leaf growth stage) topical applications at rates greater than 0.75 lbs. ae/acre and a second Roundup application after the first post-planting irrigation (10 node growth stage). Data also suggest that there may be significant value in making a layby, directed-broadcast application that includes a residual herbicide such as prometryn at layby.

Reduced Tillage and Crop Residue Effects on Cotton Weed Control, Growth and Yield

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Tillage operations conducted in a barley and cotton double-crop rotation were reduced by eliminating tillage prior to planting cotton and cultivations for weed control in cotton, especially by eliminating tillage before planting barley after cotton. Data collected in 2002 and 2003 in Coolidge and Marana showed that a weed sensing, automatic spot-spray system reduced the amount of spray volume and herbicide used by 50 to 60%. Data from Maricopa in 2003 indicate that savings will be much greater for a treatment with thick Solum barley cover crop residues and much less if volunteer grain germinates after grain harvest. Similar weed control was obtained with the weed sensing, automated spot-spray system compared to conventional continuous spray systems for most weed species. At Coolidge in 2002, the minimum tillage treatment for a barley cover crop produced 24% more lint than the conventional tillage system (1089 versus 880 lbs./acre) because more water was applied. In 2003, the minimum tillage treatment yielded 24% less than the conventional tillage treatment (1178 versus 1539 lbs./acre) due to herbicide injury. There were no differences in cotton yields among the tillage systems at Goodyear in 2002 and 2003. In Marana (2002 and 2003) and Maricopa (2003), yield differences between treatments were related to planting date, with late-planted cotton yielding less than early-planted cotton. At Marana, cotton yields of the minimum-till and conventionally tilled treatments were not statistically different. At Maricopa, the early-planted minimum-till cotton yielded less than the early-planted conventionally tilled cotton (956 versus 1141 lbs./acre). Yield comparisons between conservation and conventional tillage cotton production systems are not yet definitive and more research needs to be conducted. Economic comparisons between production systems indicated an advantage for conservation/minimum tillage treatments when cotton yields are comparable.