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Cotton Field Day

Tuesday, September 19, 2006

University of California · Shafter Research and Extension Center

17053 North Shafter Avenue • Shafter, CA 93263

Sponsored By:

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And

USDA Agricultural Research Service Western Integrated Cropping Systems Research Unit

WELCOME

to the

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SHAFTER RESEARCH & EXTENSION CENTER

The information contained in this booklet was assembled for distribution at the 2006 Cotton Field Day at the Shafter Research & Extension Center. The following items are included for your information:

- Summaries of 2006 Research Projects.
- List of all approved Research Projects for 2006 at the Shafter Research & Extension Center, including contact information.
- A listing of the current members of the Shafter Research & Extension Center Research Advisory Committee (RAC). The RAC meets to discuss station operation, allocation of resources, facility needs, and research priorities. Comments regarding station research activities should be directed to this committee.

We would like to express our gratitude for the continued financial support of the many cooperators in the Cotton Industry who contribute to the facilities and research support at the Shafter REC, including:

- CA Crop Improvement Association
- University of California, Davis – Plant Sciences & Entomology Departments
- United States Department of Agriculture – Agricultural Research Service
- Grower/Cooperators
- PCA's, Advisors & Consultants
- Cotton Incorporated
- CA Department of Food & Agriculture
- Cotton Pest Control Board
- San Joaquin Valley Cotton Board
- CA Cotton Growers & Ginners Associations
- Chemical supplies and seed companies
- Supima Association

Acknowledgements

The dedication of the University of California and USDA-ARS staff at the Shafter Research and Extension Center is gratefully acknowledged for all their work on the projects you see both at this center and at off-site locations, and for putting on this Field Day. A special than you to California Planting Cotton Seed Distributors (CPCSD) for the use of the tour trailers. And finally, we would like to acknowledge our valued sponsors, as this Field Day would not be possible without their on-going support.

We welcome you to the Shafter Research and Extension Center and thank you for attending the Cotton Field Day. If we can provide you with additional information about on-going projects or activities her at the Research Center, please feel free to contact us.

Bob Hutmacher	Brian Marsh	Ed Civerolo
Extension Agronomist	UCCE Farm Advisor	Acting Research Leader
Shafter REC/ UC Davis	Shafter REC Director	USDA-ARS, Shafter

Shafter Research and Extension Center

AG futures

SUMMER INTERNSHIP PROGRAM 2006

Theme Statement

The annual Ag Futures Conference introduces outstanding high school students, who have an agricultural background and interest, to current research and educational activities being conducted by the University of California.

The conference goal is to expand the awareness and improve the student's understanding of the exciting world of the agricultural and environmental sciences. Our hope is to encourage these students to seriously consider the wide variety of career opportunities developing in today's agriculture and to permit the college or university of their choice to assist them in achieving their goals.

The **Ag Futures Conference** is held annually at the Shafter and Desert Research and Extension Centers.

The University of California Agricultural Futures Summer Intern program provides high school students the opportunity to study with researchers from the U.C. Division of Agriculture and Natural Resources and USDA - ARS. The eight-week program is designed as an intensive educational experience for high school juniors and seniors interested in the agricultural and biological sciences. Interns will actively participate in on-going research, and gain valuable knowledge through the scientific investigation process. A faculty member will mentor the intern and provide the guidance and instruction necessary for the student to perform his/her research.

Emmalee Barlett from Bakersfield High School was the 2006 Ag futures intern. Dr. Brian Marsh served as her mentor.

Funding for the Shafter Research and Extension Center 2006 Ag Futures Internship Program was provided by The Exchange Club of Stockdale

Studies associated with *Lygus* and cotton aphid management

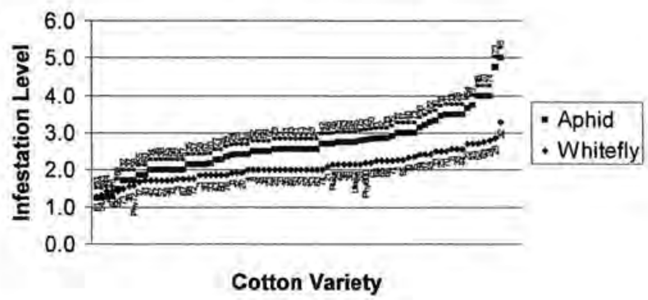
Jay Bancroft, Maria Garcia, and Jason Welch
USDA-ARS

Background and update on results of previous studies.

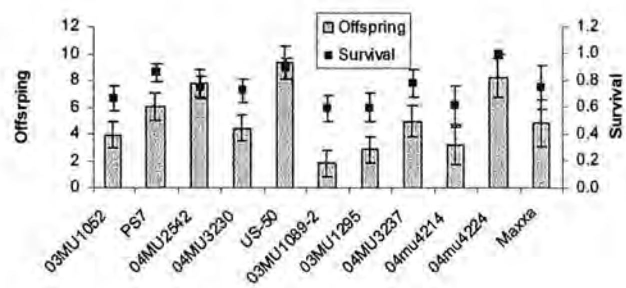
Lygus bugs play a pivotal role in cotton pest management. They cause direct damage to bolls, and their control with broad spectrum pesticides disrupts natural enemies and induces outbreaks of secondary pests. Cotton pests and their natural enemies move within cotton fields and migrate between the field and adjacent areas. Quantitative knowledge of the movement of *Lygus* bugs is lacking in the field. Understanding of the dispersal and host finding behavior of these pests and their natural enemies is needed for IPM. This will also be important for the selection and conservation of *Lygus* parasitoids. Previous mark-recapture studies measured the movement of *Lygus* bugs within cotton, alfalfa and bean fields and between alfalfa and cotton (Bancroft 2005). Most *Lygus* were predicted to have lifetime dispersal less than 1000 feet within fields, but they may fly much farther when host-plants are not available. Simulation models of dispersal have also been constructed that can quantify the effect of plant condition and weather on observed dispersal patterns. The experiments provide a valuable link between pest management practices and the migratory behavior of *Lygus*.

Last year several experiments examined sampling issues and cotton insect's response to water and fertilizer treatments. A sampling experiment showed the sweep net to be most effective for capturing *Lygus* adults, while DVac and sticky cards were not very efficient. Several species of the predator community were better monitored with simple pitfall traps.

The results show larger abundances of *Lygus* in the high water treatment. Further analysis showed a weaker but significant effect of nutrients available in the plant, and effects on abundance in the rest of the arthropod community.



Another experiment studied behavior of *Lygus* in response to bare ground nearby cotton and alfalfa. The flight behavior study showed an activity threshold in response to temperatures above 90F. There was an especially strong increase in activity in the morning as the field warmed up. We discovered a strong attraction to upwind alfalfa fields. W also showed *Lygus*' propensity to fly toward larger lush canopies and avoidance of flying over even small gaps of bare ground.



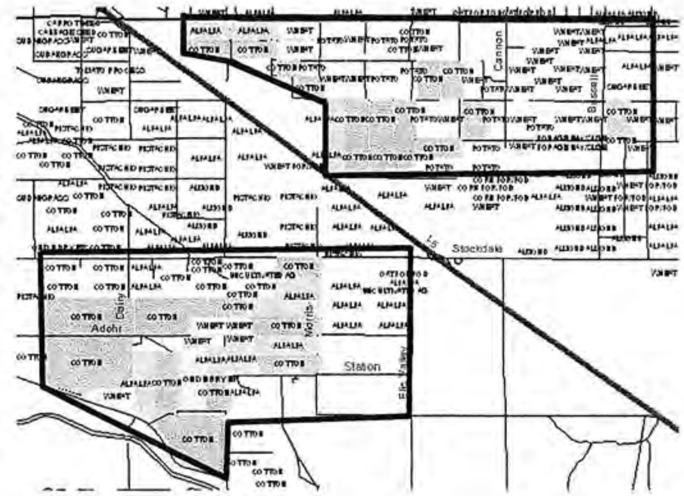
Resistance studies screened varieties for prevalence of aphid and whitefly (graphs at right). Controlled cage-experiments further characterized the suitability of varieties for aphids.

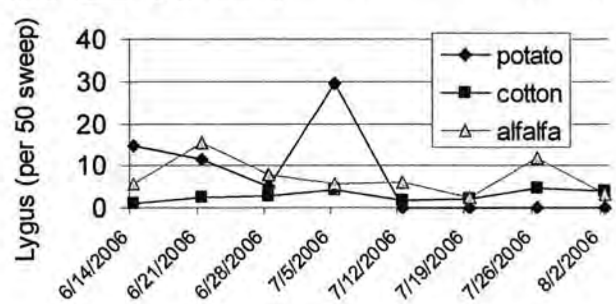
Current projects

Brief descriptions of current projects and preliminary results are provided.

Lygus landscape dynamics

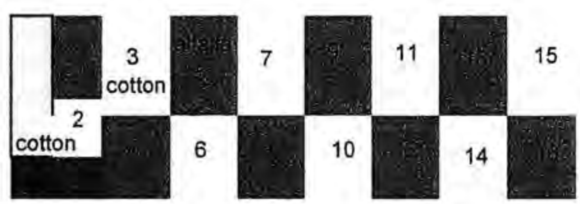
This is a cooperative effort with several growers, Dale Deshane (PCA) and Peter Goodell (UC Kearney) that is supported by a grant from Cotton Incorporated. *Lygus* populations were monitored at 2 large field sites in Kern county (see map). Each of 77 fields was sampled two times per week, unless agronomic activities prevented sampling. Samples were 25 sweeps in Alfalfa and 50 sweeps in cotton. Samples were frozen and *Lygus* and natural enemies are currently being counted. A database of all data is being used to record all the data. A time series of Lygus is shown at right. Variability among fields (for a given week and crop) was generally less than variability through time suggesting samples were at an appropriate scale to assess landscape population dynamics as a result of environmental conditions. Host-plant condition and pesticide application data are also being entered. Detailed cotton growth and development were collected on 36 fields at the same locations where Lygus population data are being collected. Two plants per inspection are mapped for fruit retention, phenological stage of plant and fruit, as well as height and number of nodes. These data will be used in an analysis to understand causes of local *Lygus* population densities, and they are going to be used to test a simulation model to forecast *Lygus* populations.

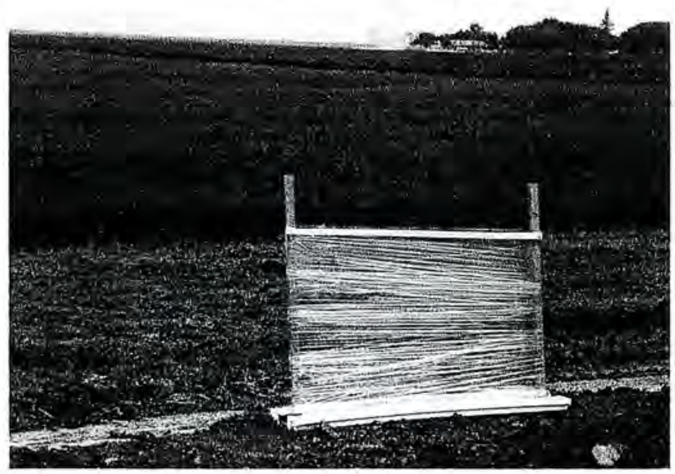




Flux

The figure shows the southwest corner of SREC field 44. Eight plots (60x150') of cotton and alfalfa are shown. The timing of irrigation and alfalfa cutting has been coordinated to maximize the measurement of *Lygus* emigration from alfalfa. The dispersal of *Lygus* between cotton and alfalfa is being measured around two alfalfa fields that are cut each week Interception traps (see picture) and sweep samples are used in the source alfalfa fields, precutting, and in surrounding cotton. This will provide a measure of the proportion of *Lygus* and their natural enemies that successfully emigrate from cut fields.





Temperature tolerance

Acquisition of reliable environmental chambers has enabled sophisticated studies of the effects of temperature, humidity, light, and host plant on insects.

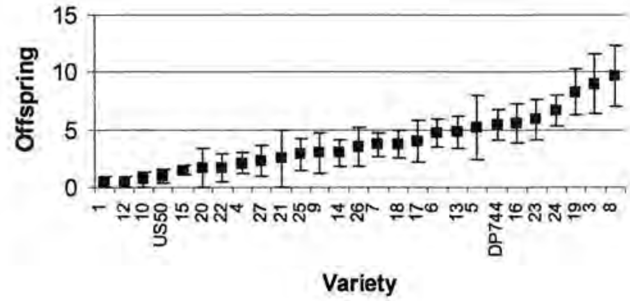
Interception trap. 2 x 1 m

Cotton aphids frequently exceed treatment thresholds and are especially problematic in late season when sticky cotton lint is a concern. We have shown that they utilize many of our common weeds (Bancroft 2006). Biocontrol efforts with two parasitoid wasps showed overwintering success for both species, but these parasitoid's populations have not yet taken off. We are performing high temperature studies to determine their climate suitability in the southern SJV. These exotic (foreign) wasps compare favorably to native natural enemies in rapid aphid suppression.

A study of *Lygus* temperature tolerance aims to measure the effect of high temperature on survival and reproduction. This ongoing study aims to resolve enigmatic reproductive observations of *Lygus* in the field during hot summer temperatures in the SJV.

Resistance

These studies expand upon screening studies preformed previously. Characteristics of the 27 selected varieties are being evaluated as indicators of resistance. The graph at right shows results from cage studies of aphids on SREC field 44 this year (yellow block above). Common varieties for controlled comparison are labeled on the x-axis.



Reference materials are available from -and questions about the research can be directed to Jay at 746-8003 or jsbancroft@pw.ars.usda.gov

Bancroft, J.S. (2005). Dispersal and abundance of *Lygus hesperus* in field crops. Environmental Entomology 34(6): 1517-1523.

Bancroft, J.S., R. Hutmacher, L Godfrey, P Goodell, M McGuire, P. Funk. (2006). Comparison of sticky cotton indices and sugar composition. Journal of Cotton Science 10: 97-104.

Bancroft, J.S. (2006) Comparison of two species of aphids (Homoptera: Aphididae) on nine host-plants using age specific fecundity and survival. Southwestern Entomologist 31 (3).

Godfrey, K., and M. McGuire. 2004. Overwintering of *Aphelinus* near *paramali* (Hymenoptera: aphelinidae), an introduced parasite of the cotton aphid in the San Joaquin Valley, California. Fl. Entomol. 87: 88-91.

Acknowledgement Critical help was provided by the SREC farm crew and student interns Rikki Ackerman, Lane Gray, James Harwood, Chelsea Peterman, and Camilo Reyes.

Management of Key Cotton Arthropod Pests with Insecticides and Acaricides

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Field Assistants: Sandra Bravo, Erika Brimage, Mitzi Medina, Richard Perez

INTRODUCTION

Integrated pest management of California cotton insect and mite pests is based on a long record of successful research and implementation. Maintaining cost-effective and efficacious insecticides and miticides is a constant, evolving process. As the pest biology, cropping patterns, cotton varieties, production techniques, and other factors change in the cotton agroecosystem, pest management needs change. The development of resistance in pests and regulatory actions are two of the key actions that influence the availability of crop protection tools. Fortunately, new materials are developed to facilitate control and to compensate for these losses. Regulatory actions with pesticides are ongoing and appear inevitable in California. Most recently, volatile organic compound (VOCs) issues have surfaced and regulations to restrict many emulsifiable concentrate pesticide formulations are being formulated. The fuming action of these products is important for managing pests in cotton, which creates a challenge. Through this project I strive to monitor and study insecticide/miticide issues relative to cotton and to address research needs and to further IPM programs on cotton.

The specific studies summarized in this report on the management of whiteflies and cotton aphids were conducted at the Shafter REC in 2005 and 2006. Results are primarily from 2005 as the 2006 studies are ongoing.

SUMMARY

Cotton aphids were a persistent problem in the SJV in 2005. Mid-season populations above threshold levels were rare, but in most situations low to moderate populations were continual and of concern to PCAs. Late-season populations were present and required treatments. Whitefly populations, another culprit for sticky cotton, were generally low. Three efficacy studies were done at the Shafter Research and Extension Center to examine insecticide efficacy on cotton aphids occurring during 1.) the mid-season period and 2.) the late-season period. One of the priorities was to examine alternative formulations of chlorpyrifos (to Lorsban 4E) as well as the efficacy of experimental materials. The treatments were applied with ground equipment at 20 GPA on 25 July and 14 Sept.

2005 Mid-Season Aphids (Fig. 1): Cotton aphid populations started to expand in mid-July and pretreatment numbers were 35.9 aphids per leaf. At 3 days after treatment (DAT), all the chemical treatments provided significant control. The Assail treatments, 70WP at 0.6 oz. and 30SG, provided over 90% aphid control. Several other treatments including Provado, Assail 70WP (1.1 oz.), Furadan, Thiodan, and Lock-on showed 85%+ control on this date. Aphid populations declined substantially over the next 4 days with the untreated plots averaging 9.7

aphids per leaf. All the treatments except Vydate significantly reduced the aphid levels at 7 DAT. Lorsban 4E, Assail (0.6 oz.), and Furadan provided 90% or more control. At 14 DAT, Lorsban 4E, Assail 30 SG and Assail (1.1 oz.) still provided over 85% aphid control. Similar trends were seen at 21 DAT, albeit with low aphid pressure.

2005 Late-Season Aphids – Acala (Fig. 2): Pre-treatment cotton aphid populations averaged 27 per leaf which is much higher than threshold levels. Aphid levels at 1 DAT were assessed to examine knock-down of aphid populations. At 1 DAT, populations in the untreated plots were 8.1 aphids per leaf. Aphid numbers in the Assail 30SG plots were the lowest (~75% control) with eight of the twelve treatments providing no control. At 5 DAT, aphid numbers in the Lock-on treatment were highest and the lowest levels were seen in the Provado and Assail (both formulations) plots. The best control seen was 77% at 5 DAT; the highest level of control in the study was seen at 7 DAT with Provado, Assail 30SG, and Furadan at 85%+ control. At 14 DAT, the aphid populations expanded greatly in most treatments. Numerically, the best control was provided by Provadao, Assail 70WP, and Furadan. Seven of the treatments provided some level of control compared with the untreated.

2005 Late-Season Aphids - Pima: Similar studies were conducted in pima cotton against late-season aphids. Aphid populations in the untreated ranged from 4 to 6 per leaf during the study. At 8 DAT, Assail (both formulations) provided over 90% control and Provado, Carbine and endosulfan over 75% control.

2006 Mid-Season Aphids: Studies are ongoing for the 2006 year. Treatments (25 different ones in total) against mid-season aphids were made on 18 July. Populations in the untreated averaged 106.5 aphids per leaf. At 7 days after treatment,

- 90%+ control – Assail 70WP, Assail 30WG,
- 80-90% – Lorsban 4E, Trimax Pro, Vydate C-LV,
- 70-80% – Carbine 50DF,
- 60-70% – Lock-on, Fulfill 50DF, Ecosmart,
- 50-60% -- Provado, Lorsban 75WDG, endosulfan,
- 40-50% -- Curacron, Centric

In summary, Assail (both formulations), Provado, Lorsban 4E, and Furadan were efficacious for managing infestations of cotton aphids. Carbine was also effective to a slightly lesser extent. The 30SG formulation of Assail appeared to have quicker knockdown of aphids than the 70WP. Mid-season aphids were clearly easier to control than aphids occurring late-season on senescing cotton. The WDG and Lock-on formulations of chlorpyrifos were only slightly less effective than the 4E formulation for mid-season aphid control but were inferior on late-season aphids. The cotton species (acala vs. pima) did not have a significant effect on late-season aphid control efficacy.

Acknowledgements

The acala cotton portion of this research was funded by the Cotton Incorporated State Support Program and the pima cotton research was funded by the Univ. of California Integrated Pest Management Program. We thank the staff of the Shafter REC for their technical assistance.

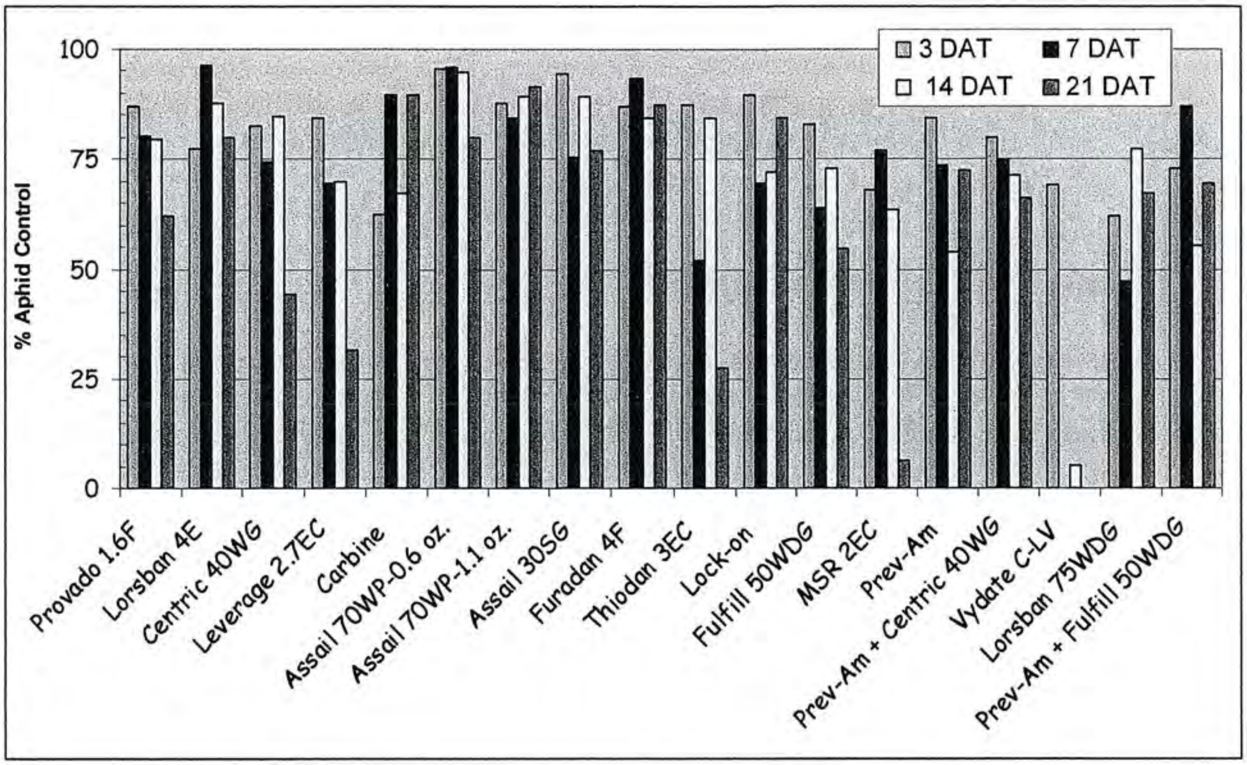

Figure 1. Mid-season cotton aphid control - 2005.

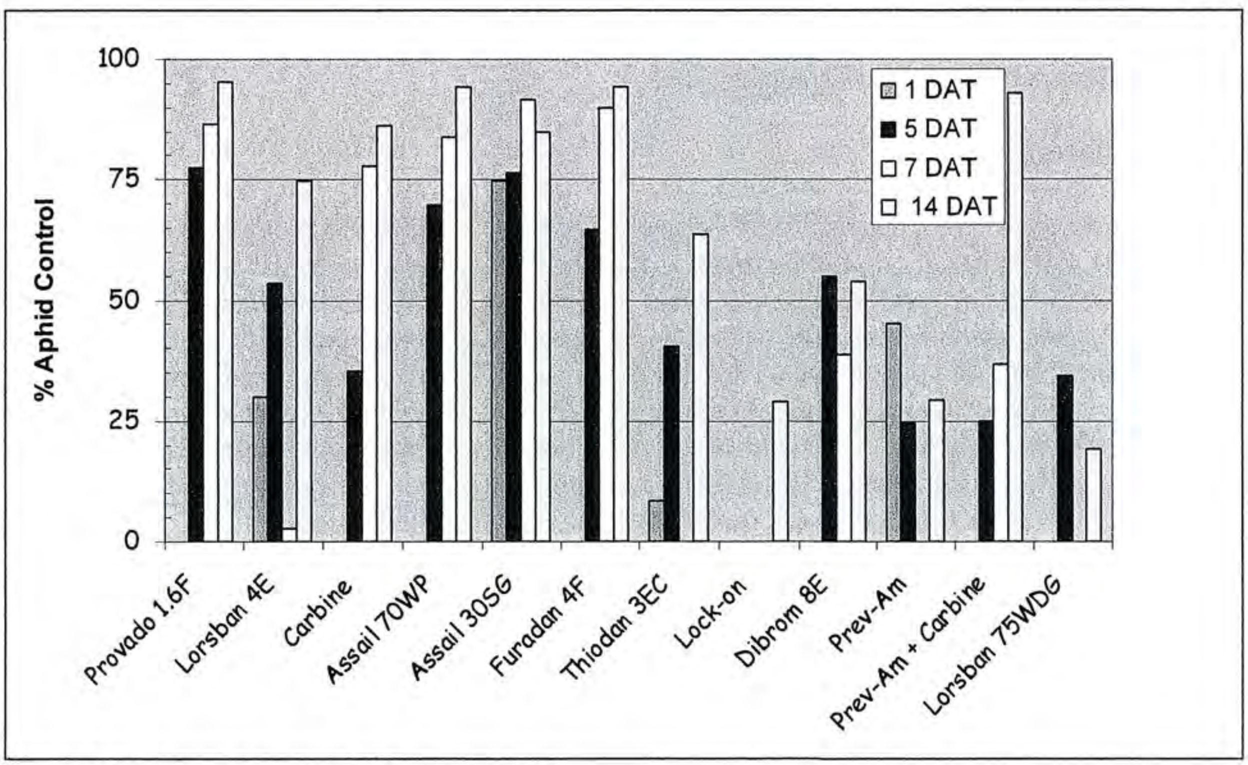

Figure 2. Late-season cotton aphid control - 2005.

Control of *Lygus hesperus* on alfalfa with *Beauveria bassiana*

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Justification and Problem Statement

The Western tarnished plant bug, *Lygus hesperus* is a major pest of cotton in the San Joaquin Valley and a closely related species, *L. lineolaris*, is quickly becoming the primary pest of cotton in the Southeast US. Research in the past few years aimed at developing a control strategy that targets the pest species and sustains natural enemy populations, which would otherwise be killed by chemical pesticides that are currently used. *Beauveria bassiana* is a fungal pathogen that infects a wide range of insect hosts including *Lygus* bugs. Commercial formulations of this fungus are available for pest control around the world.

Alfalfa is a favorite host of *Lygus* bugs and serves as a source of infestation on cotton. Previous research evaluated California and Mississippi isolates of this fungus in comparison with the commercial isolate on small scale field studies on alfalfa. We found that application of *B. bassiana* causes significant levels of infection in *Lygus* bug populations and the infection is carried over to cotton with populations migrating from alfalfa. We wanted to test the efficacy of *B. bassiana* in a large scale operation to evaluate its true potential for practical use.

Procedures:

Experiments were conducted at J.G. Boswell Company's alfalfa fields in Kings Co. Commercial formulation of *B. bassiana* (Mycotrol O® at 1 pt/ac = $1X10^{13}$ spores/ac) was compared with chemical treatment that had a mixture of Warrior (3.84 oz/ac), Thionex 3EC (2 pts/ac) and Capture 2EC (6.4 oz/ac). Each treatment was applied to three plots that were 2640' long x 360' wide (Fig. 1). Plots within each treatment were placed together. Fungus treatment was applied to a total of five plots, using the middle three for observations and one on either side as a buffer. Treatments were administered by fixed-wing aircraft around 2200 h. To facilitate thorough suspension of the fungal spores, Silwet L-77, a wetting agent, was mixed at a pint per acre with Mycotrol.

Observations were made in two locations within each plot before administering the treatments and again on 3, 7 and 9 days after to monitor populations of *Lygus* bugs and beneficial insects. On each observation day, insects from 50 sweep net samples were collected to estimate population trends. Additionally 20 *Lygus* bugs were also collected and maintained on cut beans in plastic vials for 10 days to monitor fungal infection.

Results and Discussion:

Lygus bug populations were high (1-2 per sweep) and consisted mostly of adults when the test was started. Plots were also infested with thrips. There was a general reduction in adult *Lygus* bug populations in both treatments by the third day following application (Fig. 2). However, plots receiving fungus had significantly higher numbers of Lygus than plots receiving chemicals. Numbers of thrips as well as beneficial insects like minute pirate bug and assassin bug also showed a significant decline in plots treated with chemicals compared with plots treated with fungus. Plots treated with fungus had significantly more nymphs than plots treated with chemicals but natural enemy populations were higher in fungus treated plots. Although daily high temperatures ranged from 37 to 41°C (99 to 106° F) in the first three days after the treatment, 91% of the field-collected *Lygus* bug adults were killed by *B. bassiana* when incubated in the laboratory (Fig. 3).

This study demonstrated that *B. bassiana* is effective in causing high levels of infections under practical field conditions even when the temperatures are high.

Although *B. bassiana* was ineffective against nymphal stages that contributed to the population build up, it did not adversely affect natural enemy populations. Identifying an appropriate time to target the adults with *B. bassiana* before they reproduce or combining fungus with chemical treatments that impact nymphs might provide a practical solution for controlling the pest species while maintaining natural enemy populations.

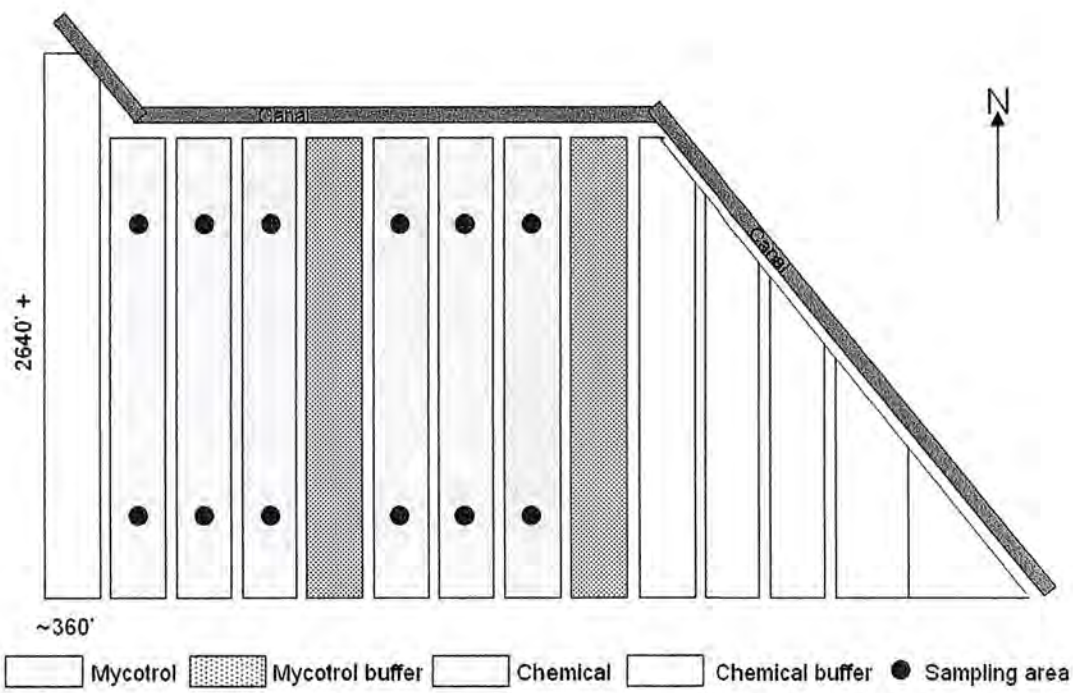

Fig. 1. Field plan of alfalfa at J. G. Boswell Ranch, Corcoran, Kings Co

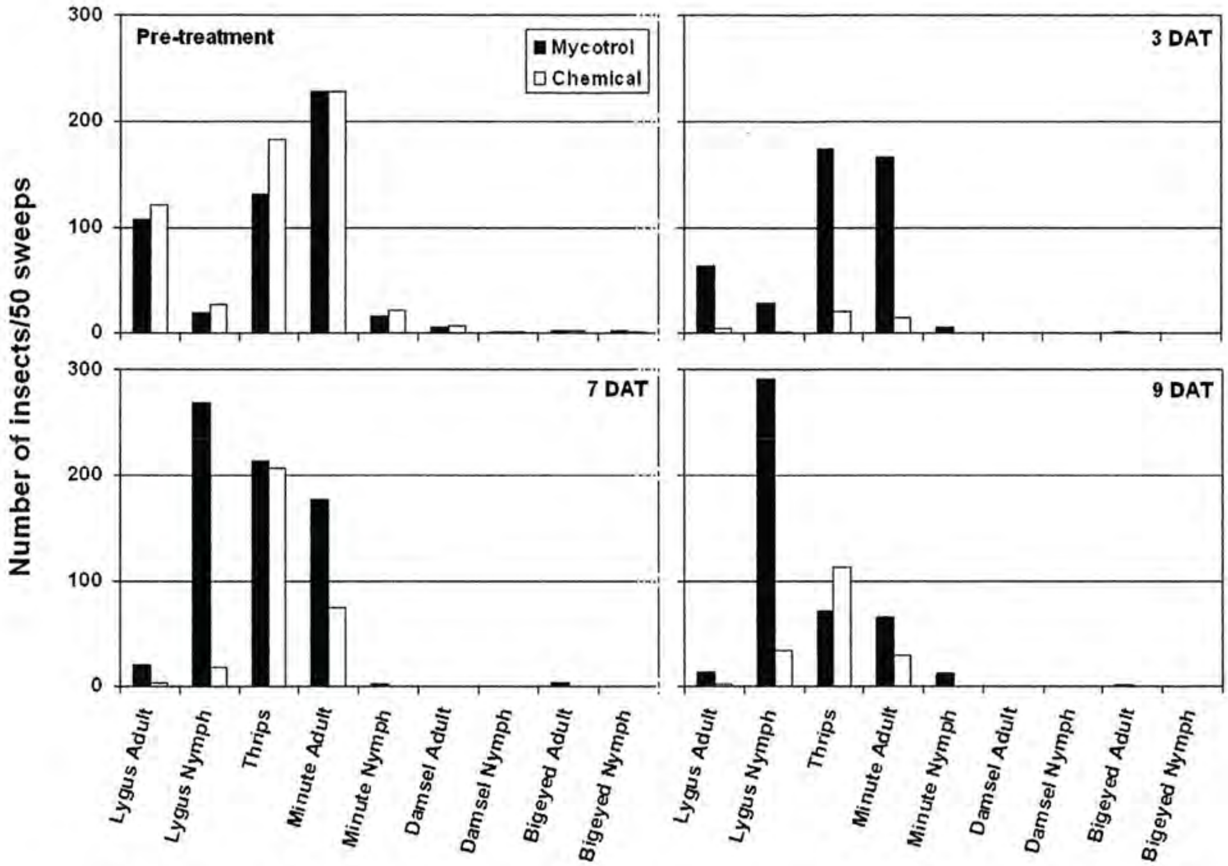

Fig. 2. Effect of chemical and *B. bassiana* (Mycotrol) applications on insect populations in alfalfa 3, 7 and 9 days after treatment (DAT).

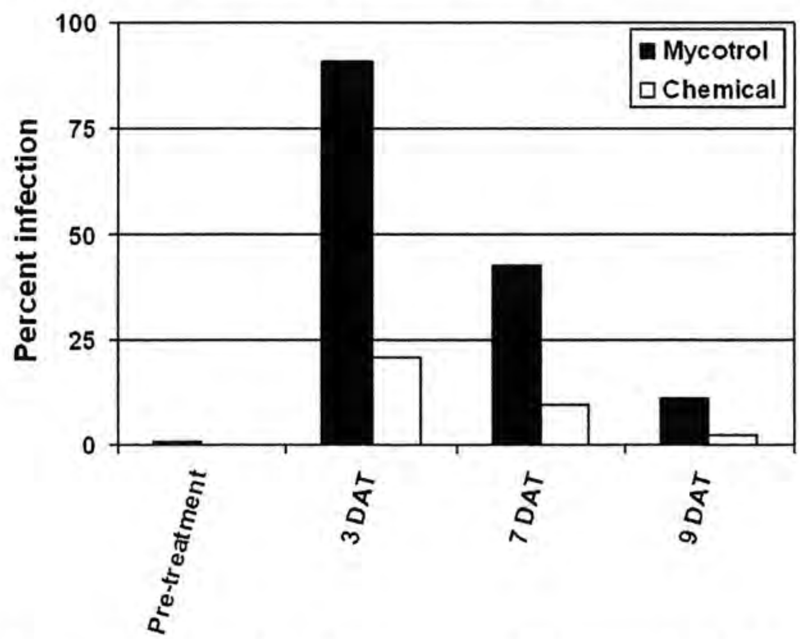

Fig. 3. Infection caused by *B. bassiana* in field-collected adult *Lygus* bugs that were incubated in the laboratory.

Development of Sampling and Decision Plans for Silverleaf Whitefly on Pima Cotton

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Field Assistants: Sandra Bravo, Erika Brimage, Mitzi Medina, Richard Perez

INTRODUCTION

Bemisia whitefly populations are a significant annual threat to cotton production, particularly pima cotton, in the San Joaquin Valley. This pest has the potential to reduce cotton yields; however, the prospect of cotton lint contamination, creating a condition called sticky cotton, is the primary concern associated with whitefly infestations. Important research on sampling, damage potential, and management of *Bemisia* whiteflies has been conducted in Arizona. This research has formed the backbone of our present management scheme in California. In summary, this research supported three stages of whitefly management during the season with different insecticide chemistries during each stage. The need to management resistance and the characteristics of the insecticides have led to this plan and to the particular management tools. A presence-absence sampling plan based on adult infestation (a leaf must have 3 or more adults to be considered infested) and on nymphal infestation (large nymphs in a quarter-sized leaf disk) and the fifth leaf as the recommended sampling universe was developed. However, significant differences in whitefly infestation patterns, biology, crop landscapes, environmental conditions, and particularly cotton species (upland [*Gossypium hirsutum*] versus pima cotton [G. *barbardense*]) have created the need to adapt and modify this management program for the SJV. Most importantly, our infestations generally occur late enough in the season that yield reductions are not the norm but rather the threat of sticky cotton is more important. The presence of cotton aphids in the SJV production system is another reality that must be considered.

Results from the 2005 studies will be briefly summarized herein. Studies are just beginning for the 2006 season.

SUMMARY

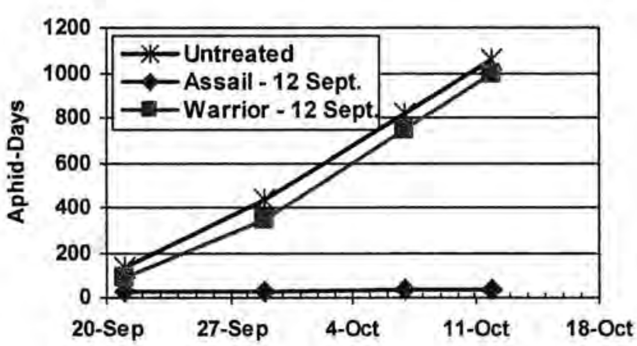
In 2005, whitefly populations were very low at the Shafter REC (at least in this particular plot). Cotton aphids were, however, present in significant numbers. Therefore, this project was altered to accommodate the insect infestations and late-season cotton aphid populations and sticky cotton was the focus. A similar study was ongoing in a neighboring acala cotton plot so the comparison between the two cotton species could be made.

Studies were conducted at the Univ. of California Shafter Research and Extension Center in irrigated Acala ('Phytogen 72') and irrigated Pima ('Phytogen 800') cotton in 2005. Insecticides were used to manipulate naturally-occurring populations of cotton aphids and silverleaf whiteflies in neighboring field plots of Acala and Pima cotton. Treatments were applied with ground equipment to plots measuring 13 x 90 feet with 4 replicates. Treatments were started at the initiation of boll opening (12 Sept.) and continued at approximately weekly intervals until (and including) the time of defoliation (7 Oct. in Acala plot and 25 Oct. in Pima plot). The treatments applied were Assail 70WP (1.7 oz./A) to control aphids and to reduce whitefly levels, Warrior (3.8 fl. oz./A) to flare aphid populations, and Lorsban 4E at 24 oz./A to control aphids only. Untreated plots were also included. Insect populations were quantified every 5 to 7 days; leaf samples (10 fifth main stem node leaves per plot) were collected and aphids and whitefly nymphs counted in the laboratory. Aphid control treatments were re-applied if there was evidence of aphid build-up once a treatment regime was initiated.

Cotton lint was hand-harvested from the Acala plots on 20 Sept., 6 Oct., 18 Oct., 2 Nov., and 7 Nov. and from Pima plots on 4 Oct., 20 Oct., 1 Nov., 14 Nov., and 18 Nov. Cotton was machine-harvested on 7 Nov. (Acala) and 18 Nov. (Pima). Additional samples of lint were hand-harvested from selected treatments on 5 Dec. following ~0.5 inch precipitation. All lint samples were ginned and stickiness determined at CIRAD (French Agricultural Research Centre for International Development) by high speed stickiness detector.

In 2005, populations of whiteflies were very low in the Acala and Pima cotton plots; levels of cotton aphids were moderate and persistent during the open boll period. The insecticide treatments generally altered the populations as desired. Treatment regimes with the highest and lowest accumulation of aphid-days are indicated in Fig. 1 and 2. Aphid populations in the Pima cotton plot were twice that of the Acala cotton plot. Stickiness in the acala cotton ranged 2.7 sticky spots (Assail applied on 12 Sept.) to 47.8 sticky spots (Warrior applied on 12 Sept.). Sticky spot values greater than ~15 are problematic in acala cotton. Overall, the values correlated with the insect numbers quite well. In the pima cotton, the sticky spot data ranged from 8.5 to 43.8 sticky spots. There was less agreement with the treatment regime in the sticky spot data in the pima than the acala cotton. In addition, the "threshold" for stickiness is lower in pima cotton than acala cotton.

Acknowledgements
The acala cotton portion of this research was funded by the Cotton Incorporated State Support Program and the pima cotton research was funded by the Univ. of California Integrated Pest Management Program. We thank the staff of the Shafter REC for their technical assistance.



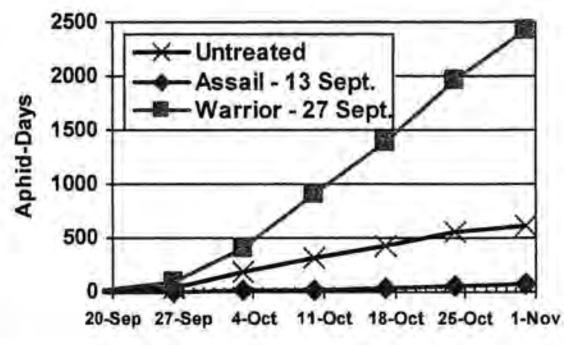


Figure 1 (left) and 2 (right). Aphid populations (accumulated aphid-days) as influenced by insecticide application made to late-season Acala (left) and Pima (right) cotton, 2005. Populations in the treatments and application dates with the highest and lowest aphid-day numbers are shown as well as the level in untreated plots.

Sticky Cotton Prevention – Late Season Insect and Defoliation Management

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Preventing sticky cotton is crucial in producing quality cotton. Late-season populations of cotton aphid and Silverleaf whitefly can produce significant amounts of honeydew when populations build. These pests are of most concern from mid-boll filling through harvest, when insect populations build and threaten exposed lint. Pest management guidelines for cotton aphid and silverleaf whitefly focus on strategies to use once threshold pest populations are reached, with the approach varying with the composition of the developing population (nymphs, adults), crop growth stage, and with the presence of exposed lint. Current pest management guidelines for whitefly and aphid can be interpreted as meaning defoliation is the final event of the season. This is based on the assumption that defoliation will remove the leaves and therefore problem insects with defoliant / harvest aid applications. Typically, the period of time between the first defoliation application and actual harvest can be two weeks or even longer, with lint exposed to honeydew if green leaves persist for any duration or significant terminal regrowth occurs.

The project conducted over four growing seasons has evaluated interactions of specific harvest aids and late-season insecticides for their impact on: (1) silverleaf whitefly and aphid population densities during the period from first defoliant application through harvest; (2) cotton stickiness (including measures of stickiness made based on the High Speed Stickiness Detector (H2SD machine) at two to three times (depending on year of study, first harvest aid application, intermediate date, at final harvest) and sugar analysis to evaluate if relative sugar composition matched insect pest distributions. Multiple treatment combinations of defoliants/desiccants differing in mode of action and speed of impact on leaves were each tested with and without combination insecticide applications to evaluate impacts on fiber stickiness.

The project has evaluated interaction of harvest aids and late-season insecticides for their impact on:

1. silverleaf whitefly and aphid population densities during the period from first defoliant application through harvest
2. cotton stickiness (including measures of stickiness made based on the High Speed Stickiness Detector (H2SD machine) at the time of first harvest aid application and at final harvest) and sugar analysis to differentiate whether sugars attributed most to SLWF or cotton aphid were present at each site, and whether relative sugar composition matched insect pest distribution

The work to date on this project has identified that:

(1) in addition to periods prior to first harvest aid applications, late-season periods between first harvest aid application and harvest can allow risk of exposure to additional stickiness if aphid and SLWF populations are not controlled into final weeks prior to harvest;

(2) stickiness issues can occur with threshold populations made up of mostly SLWF or cotton aphid;

(3) the time course of the development of the stickiness was evaluated only in the current year of this three year trial, with the data indicating that with insect pressure, stickiness increases could occur between the first and third weeks after first harvest aid application;

(4) relationships between stickiness counts at harvest and aphid or SLWF nymph counts on specific leaf positions used for treatment threshold decisions (and at times of about ½ week, one week and two weeks after harvest aid / insecticide treatments) were only roughly correlated;

(5) Fiber samples were hand collected from all bolls on sampled plants, machine ginned and analyzed for stickiness using a high speed thermal detector. At multiple test locations in prior years, pre-treatment lint collected after 60% boll opening but before defoliant applications averaged <10 sticky spots per sample (borderline "sticky" by high speed detector method).

Previous reports can be reviewed to summarize other project data during prior years. At the time of preparation of this report, we have not finished evaluation of crop agronomic data (defoliation, desiccation, regrowth ratings) or the insect count summary for the project. That information will be worked up and provided in part at the March meeting to report to the Cotton Incorporated State Support Committee. A preliminary analysis of the sticky spot count data has been completed, consisting only of a broad summary of the total number of sticky spots according to treatment. Fiber stickiness levels were highly variable and increased by a factor of 2 to over 3 times pretreatment levels during the 3 weeks after first defoliant, indicating high potential for lint contamination during this period. Stickiness levels were significantly lower in all defoliant and defoliant/insecticide treatments than in untreated controls, and showed a numerical but not statistically significant trend toward lower stickiness levels with defoliant treatments that included tribufos (Def/Folex). Insecticide applications within any defoliant treatment tended to reduce stickiness levels. Studies will continue in 2006 and funding is requested to continue through the 2006, with the project terminating at the conclusion of 2006 efforts.

Plans for Studies in 2006: Further efforts in this project will be directed toward simplified defoliant/insecticide combination treatments, more locations to provide assessment of plant and insect factors best correlated with stickiness, evaluation of relative impacts on stickiness when combination of aphids and SLWF are present (provided situation found in grower cooperator field), and repeated lint sampling dates to evaluate time course of honeydew depositions and measured stickiness levels.

Locations: Plans are to select a minimum of two trial sites, and if possible, increase the locations to three to better characterize the range of conditions and mixes of SLWF and aphids in the SJV. Due to locations of staff involved in the trials, Tulare County, Kings and Kern Counties are the most likely sites, with the county trial locations selected based upon field observations and insect counts made during the month leading up to timing of first harvest aid applications. Research station locations will be used if available and appropriate in terms of pest populations. Grower cooperators will be identified and fields scouted to identify possible sites representing different cropping areas and pest pressures.

Treatments / Measurements: Defoliation / insecticide treatment combinations will be simplified (fewer total treatments) to allow a focus on the plant and insect factors most likely to impact stickiness accumulations and the time course of stickiness accumulations. This is in contrast to the focus of the initial two years of the study, which was on evaluation of differences in stickiness between different defoliants, with and without insecticide applications. Crop management treatments to be considered for comparative impacts include late-season supplemental irrigation and/or nitrogen to impact leaf water and N status. It is already known from a variety of prior studies that more vigorous plants (typically higher water and N availability) can support insect populations later into the growing season, but less is known of leaf level N or water status and its potential impacts on stickiness during this pre-harvest (first harvest aid to harvest) period. Insect scouting efforts will be started earlier to identify prevailing conditions in plots within a week prior to harvest aid applications. At one or two locations on only two treatment combinations, stickiness samples will be collected by pulling cotton out of all open bolls at intervals that match the timing of insect monitoring in select treatments, with three total sample dates at approximately one week intervals. Honeydew accumulations will be evaluated using stickiness measurements on seedcotton of all bolls open at each sampling time. Better understanding of the time course of accumulations should improve our ability to make useful decisions regarding the duration and intensity of control needed for SLWF and aphids during this period.

Western cotton (Acala, Upland, and Pima) germplasm enhancement for agronomic, fiber traits, and pest resistance.

Part of project P36 (Project 36 is located field 22).

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Project Cooperators:
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Summary:

Since the re-establishment of the USDA-ARS, WICS, genetic/breeding program, we have been focusing on bringing germplasm from any possible source available to us in order to increase genetic diversity. Most of the time, the genetic diversity in the cotton crop is used as an indicator to recognize potential threats to sustaining high yields. In the last couple of years, several troubling developments have recognized *Fusarium oxysporum* f.sp. *vasinfectum* (FOV) Atk. Sny & Hans as a recurring and potentially expanding threat to cotton production. The vulnerability of cotton production to this pathogen highlights the need for comprehensive research to protect the cotton industry from FOV, both from virulent populations which may be introduced and new virulent strains arising from within cotton production areas. Until recently, only race 1 and race 2 were known to occur in the United States (DeVay, 1986; Smith et al., 1981). UC scientists have recently identified race 4 of FOV in cotton plants grown in California fields.

This race 4, first identified in India on Asiatic cottons, had not previously been identified in the U.S. Historically, most cotton crop loss in the San Joaquin Valley to Fusarium wilt was thought to all be associated with races 1 or 2, and in these fields the worst damage was observed when there was also significant nematode damage from root knot nematode (Veech, 1984; Bell, 1984). However, within the past few years, race 4 FOV caused extensive symptoms in cotton plants grown in clay loam and loam soils in which root knot nematode populations and root damage from nematodes were nonexistent or extremely low. In field evaluations in California, disease expression of race 4 has been most severe in Pima cotton fields, but the fungus also has the capability to infect and cause disease in Acala and Upland cottons (Hutmacher et al., 2005; Kim et al., 2005; Ulloa et al., 2006). From these evaluations it was concluded that most commercial Pima (*Gossypium barbadense* L.) cultivars grown in California were susceptible to FOV race 4 (stand loss, stunting, etc). This research identified potentially new improved resistant germplasm. Because of the need of tolerance/resistant pima germplasm in California and because we know that host-plant resistance is the most economic and effective strategy for Fusarium wilt control in cotton, this year we are testing SJ-P01F germplasm line for possible release in the near future for public incorporation into California cotton cultivars. In addition, we are continuing to develop highly resistant germplasm.

In preliminary trials, SJ-P01F did not show superior Fusarium wilt (FOV) tolerance for race 4 or yield as compared to Phytogen 800 (which is the most tolerant commercial variety). However, SJ-P01F showed reasonably good tolerance to FOV race 4, yield, and fiber quality for a pima cotton germplasm. SJ-P01F was also designated or named as USDA-39 and UCA-FOV-

03. Final yield and fiber quality-characteristic data will be obtained this year for possible release. The primary reason for SJ-P01F release is to provide the private and public breeders with an additional source for FOV race 4 resistance with acceptable yield and fiber quality which will be easier to select for or incorporate into new advanced commercial experimental varieties.

Reference

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Population development, selection, and evaluation for heat stress.

P67 (Project 67 is located field d22).
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The primary objective of this research is to identify/develop broadly adapted Acala and Upland improved cotton germplasm with potential heat stress tolerance, better fiber quality, and lint yield, broadening the genetic base of cotton.

Summary:

Cotton is routinely grown in the hot, irrigated areas of the far Western U.S., and these extended periods of high temperature can reduce cotton (*Gossypium hirsutum* L. and *G. barbadense*) lint yield, even with adequate irrigation conditions. Extended periods of extremely high temperatures are common in these areas during the critical stage of peak flowering. When temperatures in the San Joaquin Valley reach temperatures above normal during the critical stage of peak flowering, California growers suffer the consequences of reduced yield by these cotton varieties weaknesses to heat. The number of cotton commercial varieties for California with heat tolerance is not really known. However, it is known that Acala varieties Maxxa and Phytogen 72 yield poorly in the heat stress environment of Maricopa, AZ.

A cooperative project was initiated in 2003 with the goals of developing adapted elite cotton germplasm for the improvement of fiber quality with heat tolerance, and providing parental materials for the improvement of heat tolerance of Acala/Upland cottons. In 2003, 2004, and 2005 potential lines were evaluated for heat tolerance in replicated nurseries across locations (Maricopa, AZ, Tifton, GA, and Shafter CA). From this research, four cotton germplasm lines SJ-U86 (Reg. no. GP-868; PI 642414 and NSSL 441398.01) (Ulloa et al., 2006), AGC85 (Reg. no. GP-860; PI 641928), AGC208 (Reg. no. GP-861; PI 641929), and AGC375 (Reg. no. GP-862; PI 641930) (Percy et al., 2005) were developed by USDA-ARS and Cotton Incorporated and released in 2005, and SJ-U86 jointly released with the University of California in 2006. Germplasm lines originated from the cross of commercial cultivars 'FiberMax 958' and 'SG 248'. The pedigree of FiberMax 958 is CS6S/Siokra S-324 Sicala V-1, and the pedigree of SG 248 is Mo 89-117/'DP 5415'. The new upland cotton germplasm lines possess superior lint, fiber length, and competitive fiber strength under heat stress environments found in the Western U.S. The lines were selected on the bases of agronomic and fiber quality performance under heat stress tolerance across three different environments (CA, AZ, and GA). All four lines performed better than elite cotton cultivars grown commercially in side by side comparisons.

The primary reason for the release of the SJ-U86 line as an alternative germplasm choice was its significantly higher lint yield and higher lint percent when compared with those of well-known Acala high-quality cottons, with no overall sacrifice of fiber quality. In addition to its

superior performance in the San Joaquin Valley of California (2219 and 2416 kg ha^{-1}), SJ-U86 performs much better in the heat stress environment of Maricopa, AZ, where Acala cultivars Maxxa (1363 kg ha^{-1}) and Phytogen 72 (1583 kg ha^{-1}) yield poorly. In the hot environment of Maricopa, SJ-U86 yields slightly less than its heat-tolerant parent, SG 248 (2071 kg ha^{-1}), but with significant improvement in almost all fiber quality traits. This combination of heat resistance similar to SG 248 with fiber quality that matches Maxxa and Phytogen 72 suggests that SJ-U86 could be a source of improved heat resistance for California cottons. It might also serve as a source of improved fiber quality for heat stressed environments such as the low deserts of Arizona.

This year, 2006, again, we are participating in a cooperative project with the goals to continue the developing of adapted elite cotton germplasm for the improvement of fiber quality with heat tolerance, and providing parental materials for the improvement of heat tolerance of Acala/Upland cottons. Four genetically diverse populations (fiber quality and heat tolerance) were created using double crosses; advanced generation progeny are being evaluated for yield and fiber performance at different locations (AK, AZ, CA, LSU, MSU, SC, UC, and UGA). Early generation individual plant selection was performed at Maricopa, AZ under extreme heat conditions, and this year 74 progeny are being evaluated here at Shafter. The lines selected for advancement had fiber lengths that were generally superior or comparable to two Acala check cultivars.

Reference

Percy, R., May L., Ulloa, M., and Cantrell, R. 2006. Registration of AGC85, AGC208, and AGC375 Upland Cotton Germplasm Lines. Crop Sci. 46: 1828-1829.

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Assessment of Fusarium in the San Joaquin Valley: Field Evaluations and Variety Screening

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Fusarium wilt of cotton in California has been considered a potentially serious fungal disease caused by the organism *Fusarium oxysporum vas infectum* (also called "FOV") for many decades in several areas of the San Joaquin Valley (SJV). In the past, however, damage associated with FOV in SJV cotton has been notable only in areas with the combination of: (a) moderate to high populations of one or more specific races of FOV (usually race 1); (b) soils with a sandy or sandy loam texture; and (c) where root knot nematodes were present in high-enough populations to cause some significant root damage. Past research generally indicated that FOV damage was worst when both FOV inoculum and nematodes were present in relatively high concentrations.

Most cotton crop loss in the San Joaquin Valley associated with the fungal disease Fusarium wilt likely remains associated with nematode damage and race 1 FOV. However, field investigations in the SJV have found Fusarium symptoms in cotton in a wide range of soil textures in which root knot nematode populations are extremely low. In this project, numerous fields were surveyed in 2005 and 2006 (similar work underway since 2002) to look for plant symptoms of Fusarium wilt. This project has been directed toward two primary purposes: (1) support field efforts to collect plant tissue samples for identification and characterization of a race of FOV (race 4) newly-identified in SJV cotton fields; and (2) to conduct germplasm screening trials directed toward identifying useful genetic differences in susceptibility / resistance to race 4 FOV that can be utilized in further genetic evaluations and in use of improved host plant resistance as a way to overcome potential disease impacts. This work complements efforts of a University of CA Plant Pathologist (Dr. R.M. Davis, UC Davis) and staff in another CI supported project currently involved in identification of characteristics and origin of this FOV race, development of genetic tools to evaluate differences across Fusarium races in California and in comparison with damaging Australian strains.

This project has been directed toward two primary purposes: (1) support field efforts to collect plant tissue samples for identification and characterization of FOV race (focusing on race 4, a recently-identified disease in SJV cotton fields); and (2) to conduct germplasm screening trials to identify useful genetic differences in susceptibility / resistance to race 4 FOV that can be utilized in further genetic evaluations and to identify sources of host plant resistance useful to growers and breeders. The field survey efforts in answering requests for field FOV analyses have been considered complementary to the screening efforts in that they have helped identify suitable test locations for field FOV screens. The activities of field surveys and disease identification are closely tied in to a Cotton Incorporated project headed up by Dr. Michael Davis of the UC Davis Plant Pathology Department. (CI Project No. 02-238 CA "Characterization of CA isolates of Fusarium oxysporum vas infectum". Most of the plants and Fusarium samples detailed in the genetic analyses of Fusarium strains in that project were collected through the field collection and survey efforts of this project (CI # 02-303 CA, so the two projects are complementary in evaluating project results.

Screening trial efforts have included *Gossypium hirsutum* (Upland) and *Gossypium barbadense* (Pima) plantings as well as other, more exotic *Gossypium* species to gain a broader perspective of susceptibility and potential host plant resistance to race 4 FOV. Experimental varieties included in the field and greenhouse screening included commercial Upland, commercially-available Acala varieties, commercial Pima varieties, plus exotic and experimental entries including *Gossypium hirsutum, Gossypium barbadense, Gossypium herbaceum* and *arboretum*. Dr, Mauricio Ulloa and Dr, Richard Percy of the USDA-ARS in Shafter, CA and Maricopa AZ respectively were primarily responsible for help in selecting field and greenhouse screening selections.

Germplasm evaluations to date can be summarized as follows: (1) most Pima varieties show more severe symptoms and suffer higher levels of stunting and plant mortality than Acala/Uplands; (2) one highly-resistant commercial Pima variety and several USDA experimentals have been identified at screenings done at multiple sites; (3) most Acala / Upland germplasm tested, while less severely impacted than most Pima varieties, were infected by the race 4 FOV when present in the soil at field sites or when inoculated in greenhouse trials. Field evaluations and greenhouse plus field screening work are expected to continue during the 2006 season.

Two field screening studies at sites known to have race 4 damage present, and one greenhouse study with race 4-inoculated plants compared foliar and vascular symptom development, plant stunting and losses A wide range of genetic materials were tested for race 4 FOV susceptibility, including commercial Acala and Pima varieties and USDA experimentalsSignificant findings arising from these combined research projects to date include:

(1) none of the sampled fields (to date) were found to be infected with the highly virulent Australian strains;

(2) a wide range of strains have been identified across different soil types and production regions within the San Joaquin Valley;

(3) the race 4 FOV has been more virulent on tested Pima varieties than on tested Acala varieties, and

(4) the race 4 FOV causes significant foliar and vascular disease symptoms, stand loss or stunting even without nematode populations and root damage (particularly in Pima varieties tested, lesser symptoms and stunting in tested Upland varieties

(5) most Pima varieties show more severe symptoms and suffer higher levels of stunting and plant mortality than Acala/Uplands;

(6) one highly-resistant commercial Pima variety and several USDA experimentals have been identified at screenings done at multiple sites;

(7) most Acala / Upland germplasm tested, while less severely impacted than most Pima varieties, were infected by the race 4 FOV when present in the soil at field sites or when inoculated in greenhouse trials.

These field screening efforts are planned to continue in the 2007 season at multiple sites, including the UC Kearney Agricultural Center greenhouse facilities.

CALIFORNIA UPLAND COTTON
ADVANCED STRAINS VARIETY TRIALS

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2006 Activities – at Shafter and West Side REC sites. This testing program is maintained for non-Acala Upland cotton varieties at both the UC Shafter and UC West Side Research and Extension Centers in small plot trials which have been conducted since 1998 in response to requests for continuing information on varieties outside of the Approved Acala testing program. The project investigators are appreciative for the participation by seed companies and the UC Research Centers in providing support for ongoing testing of non-Acala Uplands. The actual varieties included in 2006 trials are shown in Table 1, but yield and lint quality data will not be available on 2006 studies until December 2006. Summary results will be posted on our UC cotton web site: http://cottoninfo.ucdavis.edu and in a January 2007 issue of the *California Cotton Review* newsletter.

Table 1. Entries in 2006 CA Upland Advanced Strains trials at UC Shafter and West Side Research and Extension Center sites (Phytogen 72 is an Approved Acala variety included for comparison purposes).

Seed Company or Breeder	Variety or Entry #
Phytogen	Phy-72
	Phy-745 WRF
Bayer / Fibermax	FM-9058 F
	FM-9068 F
	FM-9063 B2F
	FM-955 LLB2
	FM-966 LL
Stoneville / Monsanto	STX-4554 B2RF
	STX-6611 B2RF
	STX-6622 RF
	STX-6565 B2RF
	STX-4357 B2RF
Delta & Pine Land Co.	DP-445 BG/RR
	DP-454 BG/RR
	DP-117 B2RF
	DP-164 B2RF
	DP-167 RF

* NOTE: Acala variety included for comparison purposes (Phy-72 is not a CA Upland variety)

2005 Activities. Two variety trials (small-scale plot studies) were done on CA Upland cotton varieties in the San Joaquin Valley, and results (yield, HVI quality) are covered in reports available at the previously mentioned website. Data shown here will only cover the yield and gin turnout data from the "Advanced Strains" CA Upland trials from 2004, with these trials conducted only at the West Side and Shafter REC locations. The tests do not overlap those underway in other SJVCB or UCCE variety trials. HVI quality data summaries are available on the UC cotton web site: http://cottoninfo.ucdavis.edu for recent years.

Table 1. UNIVERSITY OF CALIFORNIA - **CALIFORNIA UPLANDS ADVANCED STRAINS (Farm Advisors & Specialist Trials) – 2005.** Lint yields (in lbs/acre and as % of Approved Acala variety "Phytogen-72") by test location and average gin turnout by variety in _2005 California Upland Advanced Strains Variety Trial_ (2 locations with 1 Acala variety (Phytogen-72) and 16 California Upland varieties). *(UCCE Cooperators: R. Hutmacher, B. Marsh, M. Keeley, R. Delgado, S. Bergen, E. Scott in fields at the UC Shafter and UC West Side Research & Extension Centers).*

Seed Company Or Breeder	Variety **Name or Number**	***40" rows*** **Shafter REC (Kern County) Lint Yields & Gin Turnouts**			***40" rows*** **West Side REC (Fresno Co.) Lint Yields & Gin Turnouts**			**Average Lint Yields Across 2 Locations**		**Average Gin Turnout Across Two locations**
		Lint yield (lbs lint per acre)	**Lint yield** (as % of Phy-72 Yield)	**Gin Turnout** (%)	**Lint yield** (lbs lint per acre)	**Lint yield** (as % of Phy-72 Yield)	Gin Turnout (%)	(lbs lint per acre)	(as % of Phy-72 Yield)	(%)
Phytogen	**Phytogen-72** (Acala for comparison)	1196	100	32.7	1326	100	33.1	1261	100	32.9
Bayer / Fibermax	**FM-960 RR**	1170	98	35.8	1645	124	36.0	1408	112	35.9
Bayer / Fibermax	**FM-960 B2R**	1298	109	33.9	1562	118	34.9	1430	113	34.4
Bayer / Fibermax	**FM-958 LL**	1062	89	34.3	1618	122	35.1	1340	106	34.7
Bayer / Fibermax	**FM-989 RR**	1165	97	35.3	1300	98	34.4	1233	98	34.9
Bayer / Fibermax	**FM-966 LL**	1128	94	34.6	1623	122	34.8	1376	109	34.7
Stoneville	**STX-0404 B2 RF** *(ST 4554B2RF) **	1389	116	33.7	1794	135	35.0	1592	126	34.4
Stoneville	**STX-0414 B2 RF**	1330	111	31.2	1207	91	32.1	1269	101	31.7
Stoneville	**STX-0406 B2 RF** *(ST 6611B2RF) **	1211	101	31.3	1228	93	31.9	1220	97	31.6
Stoneville	**STX-0403 RF** *(ST 6622RF) **	1207	101	32.8	1250	94	32.8	1229	97	32.8
Stoneville	**STX-0401 RF** *(ST 4664RF) **	1296	108	34.9	1918	145	35.5	1607	127	35.2
Delta & Pine Land	**DP-445 BG/RR**	1260	105	35.6	1805	136	36.8	1533	122	36.2
Delta & Pine Land	**DP-454 BG/RR**	1277	107	36.9	1735	131	36.3	1506	119	36.6
Delta & Pine Land	**DPLX-03X 179R**	1343	112	37.3	1472	111	36.9	1408	112	37.1
Delta & Pine Land	**DPLX-03X 232R**	1299	109	35.2	1591	120	35.7	1445	115	35.5
Delta & Pine Land	**DPLX-04Y 170 BR**	1368	114	35.1	1371	103	35.0	1370	109	35.1
Delta & Pine Land	**DPLX-05X 648 DR**	1453	122	36.1	1460	110	36.4	1457	116	36.3
Mean		**1262**	**106** *(not include Phy-72*	**34.5**	**1524**	**116** *(not include Phy-72)*	**34.9**	**1393**		**34.7**
LSD (0.05)		NS		0.6	96		0.5	139		0.4
C.V. (%)		16.6		1.2	4.4		1.0	9.9		1.2
P (Probability)		0.536		0.000	0.000		0.000	0.000		0.000

** name upon commercial release by company*

VARIETY by LOCATION interaction (for yields): LSD (0.05) = 271; C.V. = 13.7 %; P = 0.001

VARIETY by LOCATION interaction (for gin turnout): LSD (0.05) = 0.5; C.V. = 1.0 %; P = 0.000

UCCE Approved Acala and Pima Variety Trials

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Cooperators: Ron Vargas, Tome Martin-Duvall (UCCE-Madera and Merced Counties); Steve Wright, Gerardo Banuelos (UCCE-Tulare and Kings Counties); Dan Munk, Jon Wroble (UCCE-Fresno County); Brian Marsh (UCCE-Shafter REC and Kern County); Mark Keeley, Raul Delgado (Shafter REC)

The objectives of these studies with Acala and Pima varieties are to evaluate approved Acala varieties and Pima varieties submitted for testing under different environmental conditions and management across the San Joaquin Valley region of California. In order to provide a reasonable limit on the number of varieties in the tests, the entries include newly-approved varieties (approved by the San Joaquin Valley Cotton Board) for the current year, varieties released last year that are in their second year of testing, plus the top 4 or 5 previously-approved varieties (in terms of planted acreage). The new varieties are the focus of tests, but only remain in tests for a minimum of two years following release unless that variety moves into the top 4 or 5 varieties in planted acreage. Released varieties also may not show up in tests if companies request that the variety is for a special market and don't want it in multiple location testing, or when seed supplies are inadequate. The Pima tests focus on approved varieties, but in the past two years have also included a non-approved hybrid that has been of interest due to yield performance.

Acala Trials Summary – 2005. The goal of this project is to provide independent University data on yield and fiber quality performance of newly-available and widely planted Acala cotton varieties in the San Joaquin Valley of California. A "rule base" has been set up to determine entries in this Approved Acala Variety testing program. The list of varieties tested in any one year does not include all Acala varieties currently approved for the SJV, but rather the newest approved varieties in a comparison with some widely planted approved varieties. The emphasis is on providing information on "new" varieties after approval by the SJV Cotton Board, for comparison with a "standard" variety and other varieties that have achieved some success in the market (based upon acreage planted). Additional details are available (but not presented here) for plant map summaries, evaluations of *Verticillium* wilt incidence, and other field observations on plant performance and characteristics. Eleven Approved Acala varieties were planted in UCCE variety trials at 8 locations in 2005, 6 of them in large grower fields in Kern, Tulare, Kings, Fresno, Madera and Merced Counties. At 2 locations at West Side and Shafter Research and Extension Centers, these same eleven varieties were planted, plus one additional Approved Acala for which there was limited seed, and three non-Acala CA Upland varieties for yield comparisons. Average lint yields in Approved Acala trials were 1304 lbs per acre in 2005, considerably lower than the very high yields of 2002 and 2004 in these trials. A difficult, cool planting season followed by unfavorably high mid-summer day and night temperatures combined with moderate to high insect pressure in some areas to produce highly variable yields and fruit set problems in many areas of the San Joaquin Valley production area. These 2005 yields can be compared with across-site Acala trial averages of 1820 lbs per acre (2004), 1414 lbs/acre (2003), 1625 lbs/acre (2002), and 1326 lbs/acre (2001. Of the Approved Acalas in the seven-location analysis, 8 out of the 11 varieties had significantly higher yields than the Approved Acala SJV Cotton Board standard "Maxxa" averaged across seven sites. These 8 varieties were Phytogen-78 at 122% of Maxxa yields, Phytogen-72 at 114%, CPCSD-C702 at 111%, CPCSD-Riata RR at 109%, DynaGro-UAP-DGOA-265BR at 106%, CPCSD-Summit at 105%, CPCSD-Sierra RR at 105%, and Delta Pine DP-6207 at 104% of Maxxa average yields across all sites. Summaries of 2005 and prior year trial results are available at http://cottoninfo.ucdavis.edu). In addition, results are presented at the Cotton Workgroup meetings, in printed form in CA Cotton Review newsletter, and presented at winter and spring grower/PCA meetings of the University of California.

Acala - Approach for 2006. Five of the test sites for 2006 are large-scale evaluations at grower sites in Tulare, Kings, Fresno, Madera and Merced counties. At these locations, most trials are about 1300 foot run lengths, although some may be as short as 1000 feet and others as long as 2600 feet. Four replications were used at all locations. In addition, there are two smaller tests at both the University of CA Shafter Research and Extension Center and the West Side Research and Extension Center. Even in these smaller tests, plot sizes remain 300 feet in length by four rows in width.

At the large-scale county grower locations, a total of eight approved Acala varieties were planted at each of the test sites. The Acala varieties included in the test:

Company providing seed	**Variety Name**		**Company providing seed**	**Variety Name**
CPCSD	Summit **		Phytogen Seed	Phy-710R
Phytogen Seed	Phy-72		CPCSD	Fiesta RR
Phytogen Seed	Phy-78		Delta and Pine Land	DP-6222R
Delta & Pine Land	DP-6207			
United Ag Products	DGOA-265 BR			
** CPCSD*	*Daytona RF*			
** Delta & Pine Land*	*DP-444 BR*		** USDA-ARS Ulloa*	*AGC-375*
** Bayer / Fibermax*	*FM 966 LL*		** USDA-ARS Ulloa*	*SJ-U86*

- ** varieties identified with (*) and in italics are non-Acala CA Upland varieties included in the test as a comparison – these varieties were only planted as comparisons at the Shafter REC and West Side REC sites, and were not included in the grower field sites in the counties.*
- ***included as the new Acala "standard" variety of the San Joaquin Valley Cotton Board for 2006 (decided at March, 2006 Board meetings)*

At the West Side REC and Shafter REC locations, there are a total of 13 varieties in the tests (the eight Acala approved entries shown above plus five non-Acala CA Upland or USDA-ARS experimental Upland varieties for comparison purposes. The three CA Upland comparison varieties used in 2006 trials at the West Side and Shafter Research and Extension Center locations were CPCSD Daytona RF, Delta and Pine Land Co. DP-444 BR, and BayerFibermax FM 9666 LL, while USDA-ARS experimentals from Dr. Mauricio Ulloa's program included AGC-375 (recently released) and SJ-U86.

Pima Trials – 2006. The overall objective of this project is to develop a data base on growth, development and yield and quality parameters of approved Pima varieties. Varietal performance is analyzed at each individual location, across all locations and by years. A vital part of improving seedcotton yields in Pima and in maintaining high quality standards is to determine yield and quality component sensitivity under current management (irrigation, planting date, fertility, pest management) practices. This variety trial subjects all varieties to essentially identical cultural and management conditions at individual locations, and the overall trial represents multiple locations to allow evaluation of location effects. Verticillium wilt incidence is evaluated only in the S-7 and Phy-800 varieties, but these analyses are done at each test location. Pima varieties have in the past exhibited less sensitivity to Verticillium wilt than most non-Acala Uplands and some Acala varieties, a relative plus for planting Pima in some areas. The over-location and yearly data base continues to provide information with unbiased data regarding varietal performance. Data from this experiment and that produced in a four location study by Dr. Shane Ball as part of the San Joaquin Valley Cotton Board approved variety tests are the only public Pima varietal performance data generated in CA that are available to growers for review in making varietal selections.

Entries in the Pima trials are decided based on available newer entries approved by the San Joaquin Valley Cotton Board plus existing approved varieties still planted on significant grower acreage plus the San Joaquin Valley Cotton Board "standard" variety.

At the large-scale county grower locations, a total of eight Pima varieties were planted at each of the test sites. The Pima varieties included in the test:

Company providing seed	**Variety Name**		**Company providing seed**	**Variety Name**
Public Variety	S-7		Phytogen Seed	Phy-800
Delta & Pine Land	DP-340		Delta & Pine Land	DP-744
Delta & Pine Land	DP-353		CPCSD	Cobalt
CPCSD	E-503		*Hazera Seed LLC*	*HA-195 **
CPCSD	*Platinum **		*Phytogen Seed*	*Phy-810 R **
			** USDA-ARS Ulloa*	*05MU-1061*

** varieties identified with (*) and in italics are CA- Pima varieties (HA-195 is a hybrid) included in the test at Grower and Farm Advisor request as a comparison – this HA-195 variety is not included at all locations (included or not as each grower/cooperator decides) . At some test locations, other CA - Pima varieties were only planted as comparisons at the Shafter REC and West Side REC sites, and were not included in the grower field sites in the counties.*

Summaries of 2005 and prior year trial results are available at http://cottoninfo.ucdavis.edu), and 2006 results will be available at that same site upon completion of the data collection and analysis. For the past five years or more, the available data posted on the UC cotton web site has included HVI fiber quality data collected as part of the trials. In addition, results are presented at the Cotton Workgroup meetings, in printed form in CA Cotton Review newsletter in January or February of each year.

Evaluation of Low Pressure Irrigation Systems (LPS) for Cotton in Reduced Tillage Systems

Brian Marsh and Robert B. Hutmacher, UC Shafter Research and Extension Center; Michael Dowgert, Dennis Hannaford, Jim Phene and Jim Anshutz, Netafim USA; and Claude Phene, SDI+

Recently, water, energy, fertilizer, pesticides, labor cost and the capital investment in modern irrigation systems have risen dramatically and at a rate greater than farmer returns. Studies have demonstrated that drip irrigation can improve water use efficiency, reduce fertilizer losses and reduce application of pesticides and fungicides, particularly when compared with flood, furrow and sprinkler irrigation. As drip irrigation knowledge has evolved, Netafim Irrigation has developed Low Pressure Systems (LPS) that operate at 3 psi pressure while achieving a distribution uniformity of 90% or better. The conversion of leveled furrow irrigated fields to LPS using pressurized district water eliminates additional energy expenditures. It also conserves significant water and energy and allows the use of low pressure components, thus reducing the capital inputs of LPS. Three years of research results will be used to validate LPS irrigation design and management, and to demonstrate on-farm water, energy, chemigation, and labor savings in a reduced till system.

Materials and Methods:
This project consists of two irrigation treatments on undisturbed seedbeds replicated four times in a randomized block design:

1. Low pressure system with 60 in. lateral spacing (LPS-60) on 60 inch beds
2. Low pressure system with 40 in. lateral spacing (LPS-40) on 80 inch beds

In-season irrigation was determined by calculating crop evapotranspiration (ETc), using on-site CIMIS weather station measurements (ETo) and a generic crop coefficient for this area (Kc), where ETc = ETo x Kc; feedback from the rate of change of soil moisture measurements will be used to adjust irrigation schedules, as needed. Fertility--Acid (N-pHURIC, 10/55) was injected in all LPS irrigation water to maintain the solution pH at 6.5+/-0.04. Preplant liquid fertilizer (11-52-0) was injected at planting. Subsequent N-P-K fertilizers concentrations were adjusted to meet the crop requirement and were injected in the irrigation water as needed to maintain optimal petiole tissue levels (measured weekly).

Results:
Soil moisture feedback (Figure 1) was used to manage irrigation. Emitter output (shown in Figure 2) was within the expected range. Measurements made in the subsequent year showed more variation but still within acceptable limits. Lint yield was not significantly different between treatments (Table 1). Other measured parameters were also not significantly different. Lint yields were lower than expected due to disease and nematode pressure. The plot area was rotated to blackeye beans. Some design changes were made in LPS components that increase reliability and reduced maintenance. Cotton will be grown next year.

Figure 1. Soil moisture, 60 inch bed.

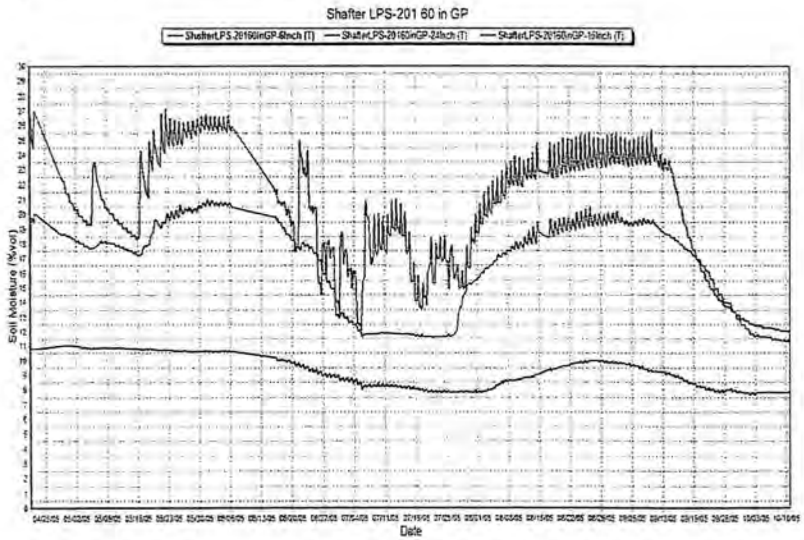

Figure 2. Emitter Output

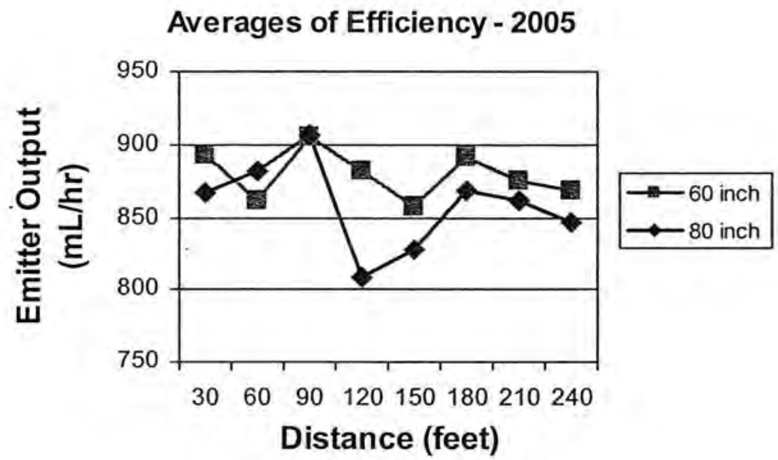

Table 1. Agronomic factors.

	Lint Yield	Plant Population	Applied Water
	-lbs/acre-	#/acre	-inches-
60" bed	965	44504	23.9
80" bed	838	46602	23.2
	ns	ns	

Figure 2. Cotton in 30" rows on 60" beds with a single drip line.

Influence of Irrigation Regime on yield of Maxxa and PhytoGen-72

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If insufficient water is applied to cotton, the resulting plant water stress can reduce yield. On the other hand, over-watering can cause rank growth and reduced yield. Somewhere in between there is a level of water application that produces maximum yield; our goal is to find that optimum level.

The subsurface drip irrigation system in field 41A (project 34) was used this season to apply water at six different and carefully controlled application rates. Water was applied daily. Treatment 4 received a nearly normal depth of water throughout the season using rates determined from previous experiments on crop coefficients (DeTar, 2004). The five other treatments received application depths which were proportional to that of treatment 4. The depth of water applied for all treatments is calculated by the equation

$$A = Ft * Cn * Ep$$

where A = depth of water to apply, inches;

Ep = normal pan evaporation;

Cn = degree of ground cover by the canopy, a decimal fraction; and

Ft = a treatment factor, which is equal to 0.3, 0.5, 0.7, 0.9, 1.1, and 1.3 for treatments 1, 2, 3, 4, 5, and 6 respectively.

The applications ranged from 33% of normal for the driest treatment to 144% of normal for the wettest treatment. Figure 1 shows the total depth of water applied this season (2006) to each treatment after planting. In addition to these numbers, there were about 5 inches of water available in the root zone at planting time.

We don't have the yields yet, but we there are some important results to report concerning plant growth characteristics. Figure 2 shows how the plant height for the PhytoGen-72 was affected by the treatments. The plant heights at the end of the season varied from 25 inches for the driest treatment to over 70 inches for the wettest treatment. The date of cutout, based on 5 nodes above white flower (NAWF), was also strongly related to the amount of water applied, as seen in figure 3. The driest treatment cut out 12 days earlier than the normal treatment. Treatment 6 is not shown in figure 3 because the plants stopped blooming before 5 NAWF was reached. The day of year (DOY) at which the plants were ready to defoliate is shown in figure 4. This is based on 4 nodes above cracked boll. At this writing (September 8, 2006), treatments 1, 2, 3, and 4 were ready to defoliate. The normal treatment was a little earlier this year than normal, possibly due to all the hot weather we've had this season. The driest treatment was ready to defoliate 15 days earlier than the normal treatment. Cutting back on the water can shorten the season considerably. Conversely, if the extrapolation holds true, over-watering by 44% could lengthen the season by about 10 days. Figure 5 shows how the soil moisture varied over the season. The soil moisture for treatment 4, the normal, held fairly constant, as it should. In fact, the slight deficit indicated increases irrigation efficiency. The soil moisture in the driest treatments is fast approaching the field wilting point of the soil, which normally averages about 3 inches of water in 5 feet of soil; field capacity is about 8 inches. Figure 6 shows how the final node count is closely related to the irrigation treatment.

We have documented the degree to which moisture regime controls plant height, final node count, and length of season.

LITERATURE CITED:

1. DeTar, W.R. 2004. Using a subsurface drip irrigation system to measure crop water use. Irrig. Sci. 23:111-122.

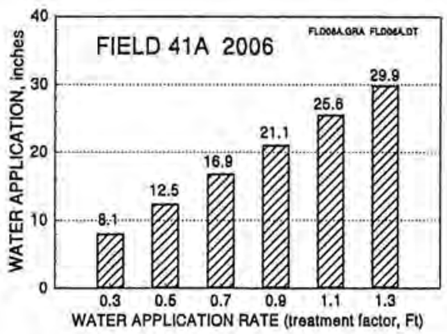

Figure 1. Depth of water applied after planting, in inches, for treatments 1 through 6 (l. to r.) in 2006.

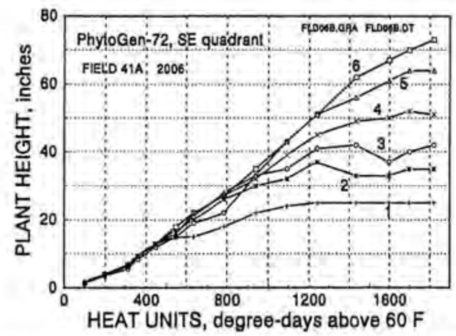

Figure 2. Plant heights vs. heat units for various treatments with PhytoGen-72 in 2006

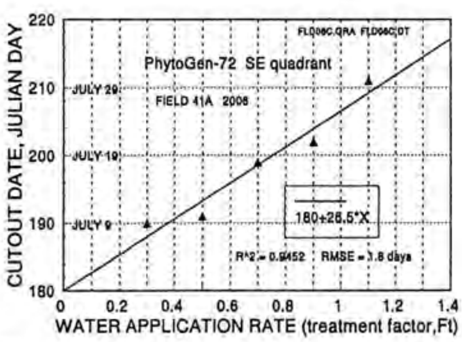

Figure 3. Cutout date as a function of irrigation treatment, PhytoGen-72, 2006

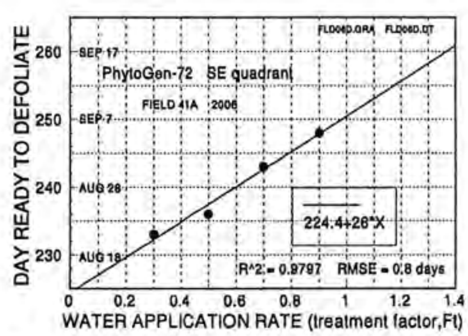

Figure 4. Julian day ready to defoliate as a function of irrigation treatment, 2006.

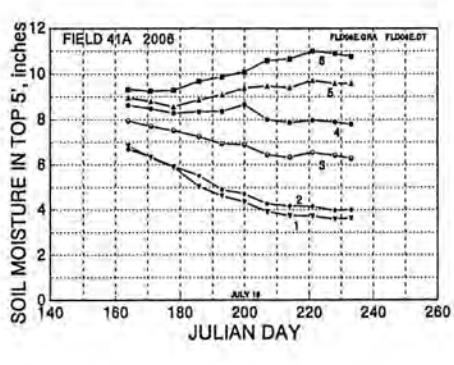

Figure 5. Moisture content of top 5 ft of soil.

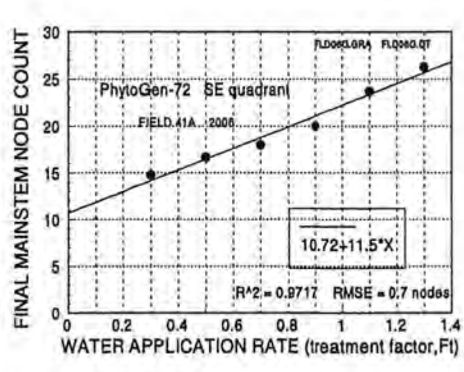

Figure 6. Final main stem node count.

Annual Morningglory Control in Blackeye Beans

Kurt Hembree and Neil Va, UCCE, Fresno County and Blake Sanden, UCCE, Kern County

Preliminary Findings Report

A trial is being run at the UC Shafter Research and Extension Center to screen preplant, preemergence, and post-directed herbicides for annual morningglory control, crop tolerance, and yield in blackeye beans. Planting and treatment information and data collected to date are shown in the following tables.

Table 1. Treatment information

Location: Shafter Field Station, Field 22	Irrigation: Furrow
Planted: 5/16/06 (cotton planter with soil cap)	Plot Size: 4, 40" beds wide and 45' long with 4 reps
Variety: CB-46	PPI = preplant incorporated with bed mulcher
Treated: 5/16 (PPI and PRE) and 6/29 (PD)	PRE = post-plant, preemergence
Sprayer: Ground boom sprayer	PD = postemergence, directed after 2nd water (row closure)
Volume: 14 GPA (PPI and PRE), 30 GPA (PD)	Nozzles: XR8002VS (6) PPI and PRE; 8002EVS (8) PD

Treatment	Lb ai/Acre	Rate/Acre	Timing	Date
1. Untreated	---	---	---	---
2. Dual Magnum 7.62	2.0	33.5 fl oz	PPI	5/16
Sonalan HFP 3.0	0.47	20 fl oz	PPI	5/16
Chateau 51 WD	0.06375	2 oz	PD	6/29
3. Dual Magnum 7.62	2.0	33.5 fl oz	PPI	5/16
Sonalan HFP 3.0	0.47	20 fl oz	PPI	5/16
Chateau 51 WD	0.1275	4 oz	PD	6/29
4. Dual Magnum 7.62	2.0	33.5 fl oz	PPI	5/16
Sonalan HFP 3.0	0.47	20 fl oz	PPI	5/16
Shark EW 1.9**	0.0155	1 fl oz	PD	6/29
5. Prowl H_2O 3.8	1.2	40 fl oz	PRE	5/16
GoalTender 4F	0.125	4 fl oz	PRE	5/16
Shark EW 1.9**	0.031	2 fl oz	PD	6/29
6. Chateau 51 WD	0.06375	2 oz	PRE	5/16
Chateau 51 WD	0.06375	2 oz	PD	6/29
7. Chateau 51 WD	0.06375	2 oz	PRE	5/16
Chateau 51 WD	0.09563	3 oz	PD	6/29
8. Chateau 51 WD	0.06375	2 oz	PRE	5/16
Chateau 51 WD	0.1275	4 oz	PD	6/29
9. Raptor 1.0 SL	0.031	4 fl oz	PRE	5/16
Chateau 51 WD	0.06375	2 oz	PRE	5/16
Chateau 51 WD	0.06375	2 oz	PD	6/29
10.Raptor 1.0 SL	0.031	4 fl oz	PRE	5/16
Chateau 51 WD	0.06375	2 oz	PRE	5/16
Shark EW 1.9**	0.031	2 fl oz	PD	6/29
11.Chateau 51 WD	0.03125	2 oz	PRE	5/16
Prowl H_2O 3.8	1.2	40 fl oz	PRE	5/16
Matrix 25%*	0.0315	2 oz	PD	6/29
12.Chateau 51 WD	0.06375	2 oz	PRE	5/16
Prowl H_2O 3.8	1.2	40 fl oz	PRE	5/16
Matrix 25%*	0.0625	4 oz	PD	6/29
13.Sandea 75%	0.0234	0.5 oz	PRE	5/16
Chateau 51 WD	0.06375	2 oz	PRE	5/16
14.Sandea 75%	0.0468	1 oz	PRE	5/16
Chateau 51 WD	0.06375	2 oz	PRE	5/16
15.Chateau 51 WD	0.03125	2 oz	PRE	5/16
Prowl H_2O 3.8	1.2	40 fl oz	PRE	5/16
Sandea 75%*	0.0234	0.5 oz	PD	6/29

*Non-ionic surfactant added at 0.25% v/v **crop oil concentrate added at 0.1% v/v

Table 2. Annual morningglory control

			Monrningglory Control on 7/19				Growth[2]	
Treatment	Rate/Acre	Timing	Total MG Per plot[1]	% MG Killed	% MG Injured	% MG Unaffected	7/19	8/7
1. Untreated	---	---	24.0 abc	0.0 d	0.0 c	100.0 a	3.3 a	4.0 a
2. Dual Magnum 7.62 Sonalan HFP 3.0 Chateau 51 WD	33.5 fl oz 20 fl oz 2 oz	PPI PPI PD	25.5 ab	25.5 abc	58.3 ab	16.2 cd	0.8 cde	2.0 bc
3. Dual Magnum 7.62 Sonalan HFP 3.0 Chateau 51 WD	33.5 fl oz 20 fl oz 4 oz	PPI PPI PD	24.0 abc	19.4 abc	60.1 ab	20.5 cc	1.5 b	1.6 cde
4. Dual Magnum 7.62 Sonalan HFP 3.0 Shark EW 1.9**	33.5 fl oz 20 fl oz 1 fl oz	PPI PPI PD	27.3 a	21.7 abc	66.3 ab	12.0 d	0.9 bcd	0.8 ef
5. Prowl H_2O 3.8 GoalTender 4F Shark EW 1.9**	40 fl oz 4 fl oz 2 fl oz	PRE PRE PD	22.3 abcd	25.5 abc	59.2 ab	15.3 cd	1.3 bc	1.8 bcd
6. Chateau 51 WD Chateau 51 WD	2 oz 2 oz	PRE PD	17.0 bcd	24.7 abc	58.9 ab	16.4 cd	0.5 def	1.0 def
7. Chateau 51 WD Chateau 51 WD	2 oz 3 oz	PRE PD	12.8 de	16.9 bc	59.2 ab	21.9 cd	0.3 ef	0.6 f
8. Chateau 51 WD Chateau 51 WD	2 oz 4 oz	PRE PD	18.5 abcd	31.0 a	52.4 ab	16.6 cd	1.0 bcd	2.5 b
9. Raptor 1.0 SL Chateau 51 WD Chateau 51 WD	4 fl oz 2 oz 2 oz	PRE PRE PD	14.0 de	15.9 bc	71.2 a	12.9 cd	0.3 ef	1.1 def
10. Raptor 1.0 SL Chateau 51 WD Shark EW 1.9**	4 fl oz 2 oz 2 fl oz	PRE PRE PD	14.3 de	27.1 ab	54.1 ab	18.8 cd	0.0 f	0.4 f
11. Chateau 51 WD Prowl H_2O 3.8 Matrix 25%*	2 oz 40 fl oz 2 oz	PRE PRE PD	14.3 de	2.2 d	51.3 b	46.5 b	0.3 ef	1.5 cde
12. Chateau 51 WD Prowl H_2O 3.8 Matrix 25%*	2 oz 40 fl oz 4 oz	PRE PRE PD	15.8 cde	13.6 c	55.6 ab	30.8 bcd	0.3 ef	2.0 bc
13. Sandea 75% Chateau 51 WD	0.5 oz 2 oz	PRE PRE	17.5 bcde	16.1 bc	65.2 ab	18.7 cd	1.5 b	1.8 bcd
14. Sandea 75% Chateau 51 WD	1 oz 2 oz	PRE PRE	19.3 abcd	15.5 bc	69.1 ab	13.4 cd	1.0 bcd	2.0 bc
15. Chateau 51 WD Prowl H_2O 3.8 Sandea 75%*	2 oz 40 fl oz 0.5 oz	PRE PRE PD	8.8 e	14.3 c	53.4 ab	32.3 bc	0.3 ef	1.6 cde
Statistical notation at p=0.05		CV: LSD:	30.92% 8.09	40.77% 10.44	20.14% 15.98	43.92% 16.38	45.63% 0.56	32.39% 0.76

MG = annual morningglory
[1]Morningglory plants counted per plot in center 2 rows (5') from furrow to furrow
[2]Mronigglory growth – visual rating of bean canopy covered by annual morningglory plants; 0 = no cover, 5= 100% cover

Table 3. Blackeye bean growth, injury, and pod set

Treatment	Rate/Acre	Timing	Crop Growth[1] 7/19	Crop Growth[1] 8/7	Crop Injury[2] 7/19	Crop Injury[2] 8/7	Pod Set[3] 7/19	Pod Set[3] 8/7
1. Untreated	---	---	5.0 a	4.0	0.0 d	0	4.8 a	3.1 c
2. Dual Magnum 7.62 Sonalan HFP 3.0 Chateau 51 WD	33.5 fl oz 20 fl oz 2 oz	PPI PPI PD	4.8 a	4.3	1.8 abc	0	4.3 ab	4.3 ab
3. Dual Magnum 7.62 Sonalan HFP 3.0 Chateau 51 WD	33.5 fl oz 20 fl oz 4 oz	PPI PPI PD	5.0 a	4.5	1.5 abc	0	3.8 ab	4.5 ab
4. Dual Magnum 7.62 Sonalan HFP 3.0 Shark EW 1.9**	33.5 fl oz 20 fl oz 1 fl oz	PPI PPI PD	4.8 a	4.8	1.3 bc	0	4.0 ab	4.4 ab
5. Prowl H_2O 3.8 GoalTender 4F Shark EW 1.9**	40 fl oz 4 fl oz 2 fl oz	PRE PRE PD	4.3 a	4.0	1.0 bcd	0	4.5 ab	3.9 b
6. Chateau 51 WD Chateau 51 WD	2 oz 2 oz	PRE PD	4.8 a	4.6	1.0 bcd	0	3.5 b	4.8 a
7. Chateau 51 WD Chateau 51 WD	2 oz 3 oz	PRE PD	4.5 a	4.6	1.8 abc	0	4.3 ab	4.5 ab
8. Chateau 51 WD Chateau 51 WD	2 oz 4 oz	PRE PD	4.5 a	4.3	2.0 ab	0	3.5 b	4.3 ab
9. Raptor 1.0 SL Chateau 51 WD Chateau 51 WD	4 fl oz 2 oz 2 oz	PRE PRE PD	5.0 a	4.6	1.8 abc	0	4.5 ab	4.6 ab
10. Raptor 1.0 SL Chateau 51 WD Shark EW 1.9**	4 fl oz 2 oz 2 fl oz	PRE PRE PD	4.8 a	4.5	0.8 cd	0	4.8 a	4.8 a
11. Chateau 51 WD Prowl H_2O 3.8 Matrix 25%*	2 oz 40 fl oz 2 oz	PRE PRE PD	3.5 b	4.6	2.0 ab	0	1.5 c	2.3 de
12. Chateau 51 WD Prowl H_2O 3.8 Matrix 25%*	2 oz 40 fl oz 4 oz	PRE PRE PD	2.5 c	4.5	2.5 a	0	0.5 d	2.1 e
13. Sandea 75% Chateau 51 WD	0.5 oz 2 oz	PRE PRE	5.0 a	4.5	1.0 bcd	0	4.5 ab	4.4 ab
14. Sandea 75% Chateau 51 WD	1 oz 2 oz	PRE PRE	5.0 a	4.5	1.0 bcd	0	4.3 ab	4.4 ab
15. Chateau 51 WD Prowl H_2O 3.8 Sandea 75%*	2 oz 40 fl oz 0.5 oz	PRE PRE PD	5.0 a	4.6	1.5 abc	0	2.0 c	3.0 cd
Statistical notation at p=0.05		CV: LSD:	10.27% 0.67	11.67% n.s.	50.42% 0.10	0.00% n.s.	16.68% 0.86	12.93% 0.73

[1]Crop growth based on a visual rating of 0 to 5; 0 = no growth and 5 = vigorously growing plants
[2]Crop injury based on a visual scale of 0 to 5; 0 = no injury and 5 = all plants are killed
[3]Pod set based on a visual rating of 0 to 5; 0 = no pods formed and 5 = all plants having a large number of pods

Management of Root-knot Nematode

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This project has the following two objectives:

1. Evaluate new products for management of root-knot nematode on carrots.

2. Evaluate the effectiveness of trap crops for management of root-knot nematode on carrots.

Root-knot nematodes (*Meloidogyne* sp.) are widely distributed throughout California and are the most important nematode pest of carrot. Current control methodology relies on the use of Metam sodium and Telone II.

The potential for loss of the standard chemical nematicides due to various environmental concerns is great enough to warrant a continued search for alternatives. Each year, a number of "promising" candidates are promoted by various sources. These include chemical nematicides, and what are termed natural or novel products or soil amendments. Even though many of these may not prove to be efficacious, demonstrating this by comparison to a standard nematicide treatment provides valuable justification for maintaining current registrations. Such a process succeeds in sorting out those that do truly have potential for nematode management. A trial is currently in progress to evaluate several new products including Quillaja 35% (an extract of the Soap Bark tree), Ditera DF, and two new products from Stoller.

Trap cropping is a nematode management technique that has been tested periodically since the late 1800's. A susceptible host is planted and larvae of a sedentary parasitic nematode such as root-knot are induced to enter and establish a feeding site. Once this has occurred, and the female begins to mature, she is unable to leave the root. The plants are then destroyed before the life cycle of the nematode can be completed, trapping nematodes within the root. By itself, trap cropping is not likely to provide the same level of control as a chemical nematicide such as Telone II, because not all nematodes are induced to enter the roots. However, the potential for loss of registration of this and other chemical nematicides for various environmental reasons is great enough that the use of two or more other techniques in combination, that will each provide partial control of the nematode population is warranted. A trap crop trial is currently in progress.

The majority of the carrots grown in California are grown in Kern County and the Shafter station provides climatic and cultural conditions similar to those in local grower fields.

2006 Shafter REC Research Projects

PRJ	LEADER	AGENCY	PHONE	EMAIL	TITLE
31	Jay Bancroft	USDA-ARS-WICS	661-746-8003	jsbancroft@pw.ars.usda.gov	Pest & Natural Enemy Mark Recapture Studies for Experimental Test of Movement Behavior in Alfalfa & Cotton
34	Michael McGuire	USDA-ARS-WICS	661-746-8001	mmcguire@pw.ars.usda.gov	Influence of irrigation regime on yield of Maxxa and PhytoGen-72
36	Mauricio Ulloa	USDA-ARS-WICS	661-746-8009	mulloa@pw.ars.usda.gov	Western Cotton (Acala, Upland, Pima) Germplasm Enhancement for Agronomic, Fiber Traits, & Pest Resistance
37	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	SJV Approved Acala Variety Trials
38	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	SJV Approved Pima Variety Trials
42	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	National & Company Entry Cotton Seed Treatment Trials
43	Steve Wright	UCCE Tulare	559-685-3309	sdwright@ucdavis.edu	Preventing Sticky Cotton: Defoliation & Late Season Insect Mngmt
45	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	California Upland and CA Pima Cotton Varieties (Advanced Strains Trial)
47	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	Deficit Irrigation Impacts on Acala & Pima Cotton
48	Larry Godfrey	UC Davis - Entomology	530-752-0473	ldgodfrey@ucdavis.edu	Mngmt of Key Cotton Arthropod Pests with Insecticides & Acaricides
56	Brian Marsh	UCCE Kern County	661-868-6210	bhmarsh@ucdavis.edu	Cotton Weed Control
58	Larry Teuber	UC Davis - Agronomy	530-752-2461	lrteuber@ucdavis.edu	Development of germplasm resources and breeding methods for alfalfa (Medicago sativa L.): development of host plant resistance to Lygus feeding damage in alfalfa, beans and cotton
62	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	Agronomic Testing of Enhanced Transgenic Upland Cotton
64	Michael McGuire	USDA-ARS-WICS	661-746-8001	mmcguire@pw.ars.usda.gov	Control of *Lygus hesperus* with *Beauveria bassiana*
66	Bob Hutmacher	UC Shafter REC	661-746-8020	rbhutmacher@ucdavis.edu	Screening Program Development to Evaluate Management Impacts on Seed Coat Fragments
67	Mauricio Ulloa	USDA-ARS-WICS	661-746-8009	mulloa@pw.ars.usda.gov	Population development, Selection, and Evaluation for Heat Stress and Study of Seed Coat Fragments
68	Brian Marsh	UC Shafter REC	661-746-8020	bhmarsh@ucdavis.edu	Evaluation of Low Pressure Irrigation Systems (LPS) for Cotton in Reduced Tillage Systems
70	Larry Godfrey	UC Davis - Entomology	530-752-0473	ldgodfrey@ucdavis.edu	Development of Sampling and Decision Plans for Silverleaf Whitefly on Pima Cotton
82	Brian Marsh	UCCE Kern County	661-868-6210	bhmarsh@ucdavis.edu	Corn Silage Hybrid Trial
83	Phil Roberts	UC Riverside	909-787-4222	philip.roberts@ucr.edu	Breeding Improved Pest Resistant Blackeyes and other Cowpeas
85	Becky Westerdahl	UC Davis - Nematology	530-752-1405	bbwesterdahl@ucdavis.edu	Mngmt of Root-knot Nematode
87	Kurt Hembree	UCCE - Fresno County	559-456-7556	kjhembree@ucdavis.edu	Herbicide screening for annual morningglory control

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