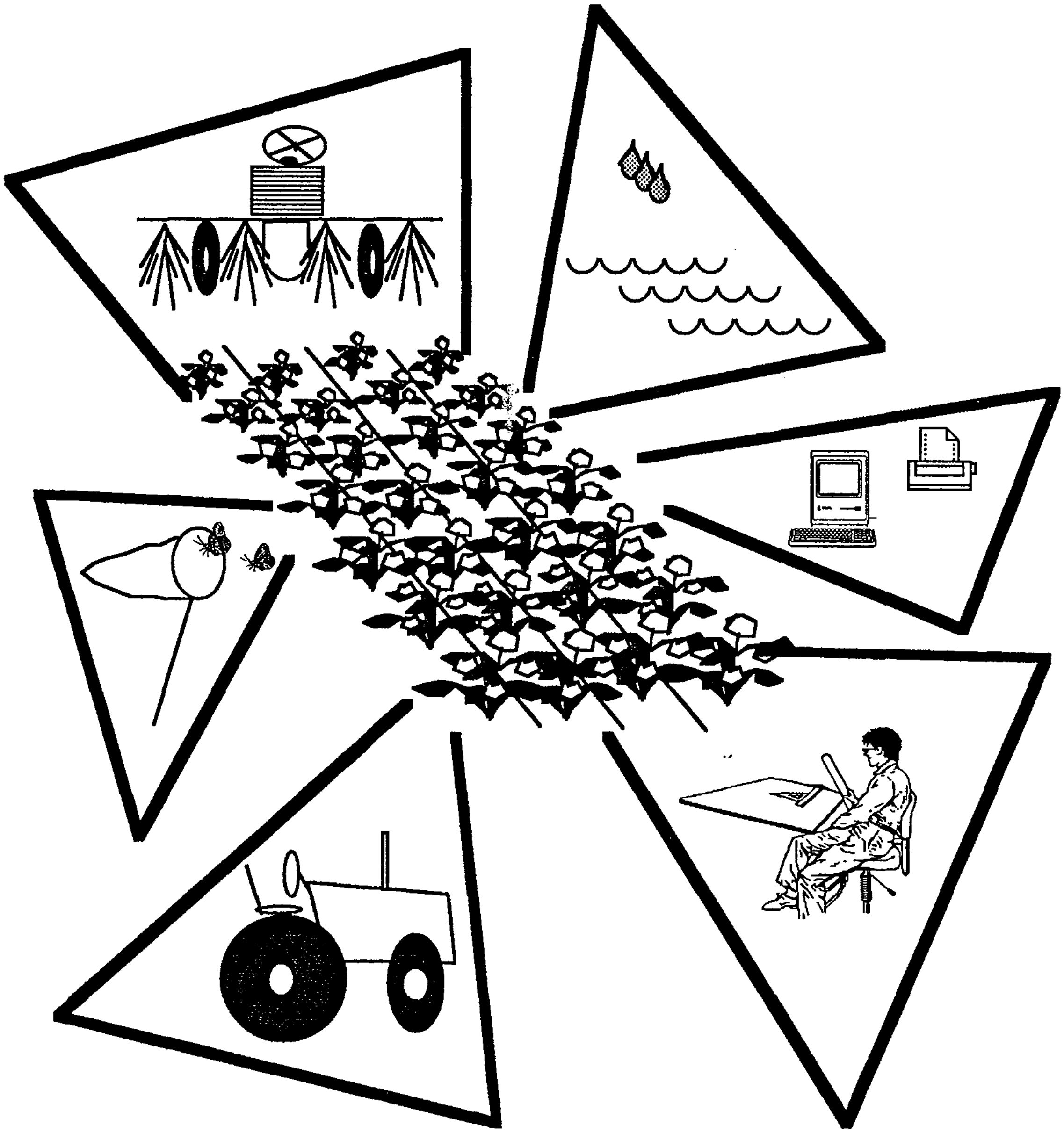

1990 Annual Report
USDA Cotton Research Station

17053 Shafter Avenue
Shafter, CA 93263

USDA-ARS
in cooperation with
University of California

ANNUAL RESEARCH REPORT

1990

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INTRODUCTION

The U. S. Cotton Research Station Annual Research Report is intended to inform upper level management within the Agricultural Research Service, other ARS research locations involved in natural resources research, and our many collaborators and cooperators about progress made on our research projects in 1990 and plans for 1991. It is our intent to keep the individual reports short but informative, focusing on objectives, approaches, summarized results and future plans for the project. We want to emphasize that the product of our research is to develop improved cotton management practices to contribute to water and energy conservation and sustainability of irrigated cotton agriculture.

The overall mission of the U. S. Cotton Research Station is: (1) to define, analyze and test cropping systems for irrigated cotton, (2) develop information on components of cropping systems including reduced inputs and biological control of pests, (3) devise strategies for optimizing cropping cotton systems and (4) devise cotton cropping systems that protect the environment, maximize water and nutrient use efficiency, improve soil productivity, and reduce energy inputs.

The Unit, in cooperation with personnel at the U. S. Salinity Lab in Riverside, CA, the Water Management Laboratory, Fresno, CA, and the University of California, Davis, CA has initiated 4 new CRIS research outlines and is addressing cotton cropping systems, reduced energy inputs, biological control of pests, improved water and nutrient use efficiency, cotton physiology and genetics, protecting the environment, and economics of irrigated cropping systems.

We invite you to use this annual report and to forward your questions and comments to us at your convenience; there will be appreciated. We thank you for your support and interest.

CLAUDE J. PHENE

Acting Research Leader

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UNIVERSITY OF CALIFORNIA - ANNUAL REPORTS

PUBLICATIONS

U. S. COTTON RESEARCH STATION STAFF

Federal Employees	Position
Scientists	
Phene, Claude J.	Acting Research Leader, Soil and Irrigation Scientist
Keeley, Paul E.	Location Leader, Plant Physiologist
Carter, Lyle M.	Agricultural Engineer
Hofmann, Wallace C.	Research Agronomist
Technical Support	
Ballard, Danny	Agricultural Research Technician
Chesson, Joseph	Agricultural Engineer
DeTar, William	Agricultural Engineer
Funk, Howard	Tractor Operator
Goodell, Nancy	Agricultural Research Technician
Hudson, Neal	Agricultural Research Technician
Penner, John V.	Automotive Worker
Thullen, Robert	Plant Physiologist
Administrative Support	
Stiles, Anna	Administrative Officer
Luna, Norma	Secretary

University of California - Cooperative Extension Employees

Scientists

Kerby, Thomas	Extension Cotton Specialist
Leigh, Thomas	Entomologist
Bassett, Dick	Agronomy Specialist

Technical Support

Perkins, Johnnie	Senior Superintendent/Agriculture
Bergen, Stanley	Senior Agricultural Technician
Bergman, James	Staff Research Associate
Keeley, Mark	Staff Research Associate
Wynholds, Paul	Staff Research Associate
Delgado, Raul	Gin Manager

Administrative Support

Jones, Patricia	Administrative Assistant

U. S. COTTON RESEARCH STATION COLLABORATORS

Collaborator

Garber, Richard	USDA-ARS, Shafter, CA
Rechel, Eric	USDA-ARS, Shafter, CA

NEMATOCIDE APPLICATION WITH PRECISION TILLAGE

L. M. Carter, W. C. Hofmann, and J. H. Chesson

OBJECTIVES: 1. To determine the efficacy of deep application of a fumigating nematocide. 2. To develop safe and environmental acceptable methods of applying nematocides.

PROCEDURE: The 1990 study consisted of 6 treatments: a control plot with normal tillage and no nematicide (treatment A); a normal 8 gallon per acre (gpa) Telone application with 2 shanks 10 inches to each side of the intended drill operated 10 inches deep (treatment B); a 22 inch deep precision tillage control plot with no nematicide (treatment C); and 22 inch deep precision tillage application at rates of 4, 6, and 8 gpa of Telone (treatments D, E, and F). The precision tillage tool consisted of two 32-inch long sub-soil shanks mounted to a tool bar with disk type bedders mounted behind the bar on pivoting arms which allowed constant depth of furrowing. The subsoil shanks had a forward angle of 15 degrees and were operated 22 inches deep from original soil level (depth from the top of the resulting bed was approximately 32 to 34 inches). For nematocide application, a .25 inch ID tube was welded to the trailing edge of the subsoil shanks to release the nematocide at the bottom of the slot. All nematocide treatments were applied with an experimental metering device which was controlled by ground speed and depth. A peristaltic metering pump was used for each applicator. The speed of the meter was controlled by a electro/hydraulic servo commanded by a rotary pulse sensor attached to the ground metering wheel. The metering wheel was mounted such that the meter would only operate when the shanks were deeper than 50% of the intended depth. The field chosen was known to have a high and fairly uniform population of nematodes. The treatments were applied in a latin square design (6 replications) to allow greater control over nematode population variability. Two weeks after treatment application but before planting cotton, soil samples from the 1st, 2nd, and 3rd foot were obtained from each plot and placed in small pots with a seedling tomato plant. An estimate of the initial nematode population for each plot was obtained by rating the degree of nematode galling in the tomato roots on a scale of 0 to 4 with 0 indicating no galling and 4 indicating severe galling.

RESULTS: Predictably, the application of 8 gpa of Telone with a normal application reduced the galling on tomatoes to a low level. However, that same reduction was obtained with 6 gpa applied with precision tillage. Even at the 4 gpa rate applied with precision tillage the nematode galling was drastically reduced suggesting that the efficiency of Telone can be substantially improved with deep application. Both applications methods were most effective in reducing the population in the second foot. We believe it is important to note that the effectiveness was greater for precision tillage application in the third foot compared to normal application.

There was an improvement in cotton yield related to precision tillage and to rate of Telone. With no nematicide, precision tillage increased the yield by 10%. However at 8 gpa of Telone the increase for precision tillage (tillage effect only) was 34%. The increase in yield with 8 gpa using normal application equipment was 16%. One way of interpreting these data is that precision tillage reduced the soil compaction limitation to root extension and the Telone reduced the nematode population, each contributing the increased yields. However, when the tillage effect and the nematocide are combined, the yield increase is greater than the sum of the individual effects. Perhaps a more important interpretation is that the low rate of 4 gpa of Telone applied with precision tillage produced a 19% yield increase compared to 8 gpa applied with normal equipment. These data suggest the possibility of dramatically reducing the applied rate of Telone with equal or better yields. An application of these findings could result in a two-fold advantage for the farmer, 1) lower input cost with greater yield and 2) reduced chemical applied to the soil and therefore less release to the air.

The metering system was judged to be practical for use by farmers. For farmer use, 1) higher quality (ie longer life) peristaltic meters should be purchased, 2) commercial sized, approved tanks, tubing and valves would be needed, and 3) the supply tubes to each shank should be equipped with a positive pressure-operated check valve. The experimental system prevented leakage during turns and reduced variation in application rate resulting from wheel slippage and acceleration or deceleration at ends of fields. With the deep application, there was absolutely no noticeable odor of the Telone suggesting that the method may meet the most stringent environmental rules.

<u>FUTURE PLANS</u>: A second year of data would be desirable before publication. However, the availability of Telone or similar products is uncertain for 1991. Therefore when the product is again available, the field study will be completed. In the meantime, the application methodology and experimental equipment should be cleaned up and published.

Treat	Application Method	Rate gpa	Nematode Galling Index on Tomatoes from Soil at 0-1'	1-2'	2-3'	Yield b/a
A	Normal	0	2.06	1.83	1.12	1.64
B	Normal	8	0.29	0.08	0.46	1.90
C	P.T.	0	1.83	2.21	1.98	1.82
D	P.T.	4	0.96	0.10	0.17	2.27
E	P.T.	6	0.40	0.40	0.15	2.38
F	P.T.	8	0.40	0.00	0.02	2.56

INSTRUMENTATION FOR SALINITY SURVEY

L. M. Carter and J. H. Chesson

OBJECTIVES: To develop apparatus and instrumentation for field scale survey-measuring salinity based upon theories developed by the USDA Salinity Laboratory, Riverside, CA.

PROCEDURE: The probe design was based upon earlier reported research by Carter. In concept the probe compacts a ribbon of soil .75 inch wide at the depth of operation using a curved wedge. The soil strain of .5 inch has been determined in the past for maximum mechanical compaction. To remove the surface organic material from the contact area, a forward sweeping tine was attached to the front of the probe. A five probe design, rather than the classical 4-probe design, was chosen to allow symmetrical operation behind a tractor in bedded soils. This configuration allows a probe in each of 5 furrows with the inter-probe distance fixed at the row spacing. For non-bedded soils the inter-probe distance can be varied between 20 and 42 inches. A folding 3-point mounting tool bar was designed with a detachable highway compatible truck for transportation behind a pickup. The system was designed so that one or two people could attach the tool to a tractor and prepare the system for operation within 5 minutes.

RESULTS: The system was tested in dry and wet soils without instrumentation for integrity as a tillage tool. Operation was found feasible beyond 6 mph. The instrumentation package was attached including the 5 probe monitor and geographic position sensor. The instrumentation was calibrated by Dr. Rhoades in a very saline soil.

FUTURE PLANS: The system will be field calibrated for variability with respect to speed, moisture, and soil types and field tested for suitability to task as the Shafter contribution to the cooperative program. At completion the system will be used to map salinity of several large agricultural areas. The future plans include development of a method and apparatus to utilize a electromagnetic sensor as a measure for salinity.

COTTON PLANTERS FOR DIRECT SEEDING INTO COVER CROPS

L. M. Carter and J. H. Chesson

OBJECTIVES: To adapt, modify or design planters and planter controls for direct seeding into cover crops.

PROCEDURE: Determine desirable and achievable planting conditions associated with direct seeding into cover crops, including type of cover crop, method of vegetation suppression and preparation prior to planting. Test operation and performance of unmodified cross slot planter designs. Design mechanisms and procedures for improving performance to acceptable levels. Investigate application of other planter designs and procedures for direct seeding into cover crops.

PROGRESS: Combining two years experience with the unmodified cross slot planter design, six conclusions can be stated: 1) the design is acceptable only within a narrow range of application which includes the original design criteria, ie dry soil planting of grains; 2) the depth of planting varies greatly with soil tilth and moisture with all seeds; 3) the design without modification is unsuited for cotton either for planting into cover crops or into prepared soil; 4) cotton planted into cover crops with this design requires rain or simulated rain for emergence; 5) cotton planted into prepared moist soil did not emerge or the emergence was well below any acceptable standard; 6) cotton planted into dry prepared soil with postplant irrigation emerged acceptably.

The heavy footprint of the gage-wheel-furrow-closure component was determined to be the cause of poor performance as described in conclusions 2, 3, 4, and 5. A mechanical-hydraulic servo control was designed as a combination seed depth control and footprint pressure control. The design was tested and found to perform as anticipated allowing control of seed depth within .25 inch and accurate control of footprint pressure. With the control operating seed emergence in prepared moist soil was comparable to 'normal' planters. With cover crops, the closure pressing could be increased and controlled for improved, if not completely adequate, emergence. The mechanism for the control was described for possible patent and therefore has not been disclosed to the public. Application to other existing designs was claimed in the patent description.

FUTURE PLANS: The operating parameters of the control will be documented and application to other planters and related devices will be determined. Depending upon interest, the control may be developed for technology transfer beyond publication of any potential patent.

BEST PRACTICE COTTON SYSTEMS

W.C. Hofmann, L.M. Carter, P.E. Keeley, and L.F. Elliott
J.H. Chesson, R.J. Thullen, D. Ballard, and N. Goodell

OBJECTIVES: To develop the criteria for 'best practice' cotton production systems. To test experimental component subsystems and the interrelationship of cotton production subsystems including rotational crops. To demonstrate for technology transfer 'best practice' systems.

PROCEDURE: Four systems were identified for inclusion in a field study resulting from a factorial of two systems categories: row spacing and tillage. The 'best practice' row spacing was selected as 30 inch as compared to the common practice of 38/40 inch spacing. As the 'best practice' tillage, the zone system with precision tillage and controlled traffic was selected to be compared to the common broadcast tillage system. The factorial arrangement allowed: 1) a 'farmer practice' 38/40 inch system; 2) a 'farmer practice' adaption using 30 inch row spacing; 3) a zone system treatment using 38/40 row spacing; and 4) the best practice system using both zone concepts and 30 inch row spacings. Treatment 1 and 3 were managed with 6 38-inch row equipment and were 12 rows wide. Treatment 2 was managed with 8 row 30 inch equipment and was 16 rows wide. Special equipment was developed for the best practice treatment #4 using 9-row 30-inch row equipment with wide furrows every three rows for traffic. In 1989 the south portion of the study was planted using a factorial layout with 6 replications of plots arranged in such a way that cross tillage could be applied to the two farmer practice treatments. The plot size varied by treatment in width with all treatments approximately 300 feet long. In 1990 the north portion was planted using the same arrangement with a different randomization to allow a rotation variable with alternate years. Sampling consisted of soil and petiole fertility, soil and plant water stress and yield.

RESULTS: Measurement of petiole samples shows that the best practice treatments were nitrogen deficit at the end of the growing season compared with the farmer treatments. We surmise that the best practice treatments with the increased water infiltration allowed greater percolation of water and thus greater loss of nitrogen by leaching. Attempts at differential irrigation based upon soil or plant water stress were frustrated by the approximate 7 to 10 day irrigation demand confounded with the need for dry periods for cultivation and water scheduling. Due to obvious and extreme variability in plant growth within plots a covariant was sought. There appeared to be a correlation between sandy areas in the plots and plant height therefore each plot was mapped and the percentage sand soil calculated. With a covariance analysis the estimate of the sand effect was -3.45 (lbs/a)/(% sand) for the 1989 yield data and -3.25 for 1990 in the south test. No correlation was evident for the north test.

Using contrasts among the least square means for the south test and contrasts among the GLM means for the north test, the yield data show important differences among treatments. The first year data for both the south and north tests show that the 38 inch systems yields were 4 to 7 percent greater than the 30 inch systems. Also for the first year both tests indicated no difference in yield between zone and broadcast systems. During the second year (which can be determined only for the south test) the trends reversed: 1) there was no detectable difference between row spacings and 2) the zone system yielded 8.6% more than the broadcast. The change from no difference to a difference between zone and broadcast can be explained by noting that the treatment effect did not exist at the initiation of the plots but was developed during the first year. The 30 inch vs 38 inch differences is difficult to explain since most studies on the station have shown substantial increases with 30 inch spacing.

FUTURE PLANS: The study became a nightmare in management. The size of the field test, the time to convert equipment, constraints on irrigation timing and lack of personnel and funds for collecting and processing samples compromised the study and no reasonable solution within the resources available could be found. Therefore the study was abandoned with plans to develop a small scale study to evaluate in depth certain of the questions identified by the large study.

SUMMARY OF CORE STUDY YIELDS

SOUTH CORE 1989

SOURCE	F VALUE	Pr > F
REPS	10.85	.0002
TREAT	17.39	.0001
SAND	28.93	.0001

Estimate of SAND regressor
-0.0069 (b/a)/(% sand)

LSMEANS (means corrected for sand)

	30"	38"	ave
ZONE	2.10 a	2.42 c	2.26 a
STAND	2.23 b	2.24 b	2.24 a
ave	2.17 a	2.33 b	

CONTRASTS

	F VALUE	Pr > F
38" vs/ 30"	25.86	.0002
ZONE vs/ STAND	0.39	.5407

NOTES:
Skips due to poor planting corrected using a factor of .9.

SOUTH CORE 1990

SOURCE	F VALUE	Pr > F
REPS	1.41	.2772
TREAT	5.68	.0156
SAND	4.52	.0595

Estimate of SAND regressor
-0.0065 (b/a)/(% sand)

LSMEANS (means corrected for sand)

	30"	38"	ave
ZONE	2.51 a	2.54 a	2.52 a +8.6%
STAND	2.24 b	2.42 a	2.32 b
ave	2.38 a	2.48 a	

CONTRASTS

	F VALUE	Pr > F
38" vs/ 30"	2.88	.120
ZONE vs/ STAND	10.05	.010

NOTES:
There were 4 missing plots due to scale malfunction.

NORTH CORE 1990

SOURCE	F VALUE	Pr > F
REPS	0.61	.696
TREAT	7.04	.0040
SAND	0.03	.862

No regression with SAND

MEANS (GLM w/o covariant)

	30"	38"	ave
ZONE	2.76 b	2.78 ab	2.77 a
STAND	2.65 c	2.86 a	2.76 a
ave	2.70 a	2.82 b	

CONTRASTS

	F VALUE	Pr > F
38" vs/ 30"	14.22	.0019
ZONE vs/ STAND	.16	.692

NOTES:
Since SAND was not significant, a second GLM model was fitted without the covariant.

GENERAL NOTES:
The percentage of poor growth for each plot was measured in 1990 and used as a covariant. It was assumed that the poor growth was caused by a variations in sand content since an abrupt change in growth occured at the boundaries consistent with sand streaks. All interpretations are based on the type III SS (ie, F values and probability)

WHEEL PATH RECOVERY

L. M. Carter and J. H. Chesson

OBJECTIVES: To determine the degradation of wheel paths (roads) over time with normal tillage. To determine number of years of normal tillage and cropping to return soil to original or comparable state.

PROCEDURE: The paths to be studies were created in 1984 and used for conduct of system studies with the wide tractive research vehicle (WTRV) until 1989. In 1990 the guidance wire was removed and the paths only were subsoiled on 15 inch centers to a depth of about 18 inches. The entire field was then disk harrowed twice with all traffic east to west to prevent movement of path soil into plot areas. The field was then bedded, preirrigated, and planted to black-eye beans which were allowed to grow until late July. The field was then irrigated to wet the soil to beyond 3 feet and penetrometer measurements made in plot and path areas.

RESULTS: The penetrometer data was analyzed for difference in means and differences in data distribution by treatments. When an accumulative distribution of data by treatments was plotted it was apparent that more variability existed among path data than in plot data. Using an univariate analysis it can be shown that the standard deviation for the path areas was between 1.38 and 1.43 MPa compared to the treatment areas with 0.64 MPa or 2.14 times greater. Using F-tests the probability that these are not the same exceeds 99.9%. The data could be from normal distributions but the data is skewed with less than expected low values. The path data could be fitted as a uniform distribution. The standard farmer approach to removing compaction (subsoiling) is not sufficient to remove the compaction within the fractured consolidates. There was no difference in the mean penetration resistance among paths and plots in the zone between the surface and 20 cm. This may be explained by the disk tillage which probably extended to 20 cm. At depths below 20 cm the mean penetration resistance for the paths was 15 to 18 MPa compared to 7 MPa for the plot areas which represents a very large difference and could easily explain the poor growth of beans.

Deep tillage with subsoilers will not remove compaction of road-ways within 1 year. Perhaps the bad news is that variability among zones within the tilled path zones is much greater than old plot area and no tillage machinery is available to directly influence this variability.

FUTURE PLANS: The field has been mapped to locate the old path areas. After normal tillage operations in 1991 and a crop, another series of penetrometer reading will be made. These data will be compared to the 1990 data to access any improvement in soil variability or penetrability.

SUMMARY OF UNIVARIATE STATISTICS FOR PATH AND PLOT AREAS
PENETROMETER DATA IN MPa

STATISTIC	PATH AREA POOR GROWTH	PATH AREA W/ NO GROWTH	PLOT AREAS
mean	2.29	2.44	1.26
S.D.	1.38	1.43	0.64
variance	1.922	2.054	0.407
CV	60.7	58.7	50.6
W:NORMAL	0.93	0.93	0.93
Skewness	0.57	0.51	0.99
Kurtosis	-0.41	-0.43	2.61
Mean: top zone	5.6	6.2	5.0
Mean: till zone	15.5	17.5	6.9
Mean: deep zone	15.5	15.4	8.3

BIOLOGY AND CONTROL OF BLACK NIGHTSHADE (SOLANUM NIGRUM) IN COTTON (GOSSYPIUM HIRSUTUM)

P. E. Keeley and R. J. Thullen

OBJECTIVES: To determine why control of nightshade with prometryn declined with time in a field study conducted in 1985, 1987, 1988, and 1989.

PROCEDURES: Both seed and soil samples were collected from field plots previously untreated and treated with prometryn. Treated plots were those where rates of prometryn from 1.5 to 2.0 lbs ai/A originally controlled black nightshade in 1985 and 1987 but failed to control nightshade in 1988 and 1989. Untreated plots were the weedy-check plots of the 1985 to 1989 study that had never been treated with a herbicide. Soil samples from the field in early 1990 were treated with 2.00 ppm prometryn and bioassayed in the greenhouse with black nightshade at weekly intervals for 7 weeks. Seed from field plots, which had been collected earlier, was planted into soil freshly treated with 0.25, 0.50, 1.00, and 2.00 ppm prometryn.

In addition to the experiments described above, a final field study was initiated on April 18, 1990 to determine if nightshade had developed some resistance to prometryn or if previously treated soil was now degrading prometryn at some accelerated rate. Plots, 19 m long by 4 m wide, which were treated during 1985 to 1989, were treated in a perpendicular direction with a 4 m band of 2.0 lbs/A of prometryn. The soil was left flat after treating and the herbicide was incorporated into the soil with a mulcher operated at 10 cm deep. The area was sprinkle irrigated at 3 to 5 day intervals for the following 36 days. Total sprinkling time was 35 hours, and total amount of water applied was 9 cm. Black nightshade seedlings were counted in treated and untreated strips of all plots 4 weeks after treatment, and visual weed control ratings were recorded at 4 and 6 weeks after treatment.

RESULTS: Degradation of prometryn in the greenhouse appeared to occur at approximately equal rates in soil collected from field plots previously treated or untreated with prometryn. Residues from applications of 2 ppm of prometryn killed all nightshade seedlings for 3 weeks. When some plants began surviving at 5 and 7 weeks after treatment, dry matter production of nightshade was similar in soils previously treated and untreated with prometryn. Nightshade seedlings from seed collected from plots treated with prometryn responded similarly to increasing rates of prometryn under greenhouse conditions as seed collected from untreated plots. Herbicidal activity was sufficiently great from applications of as little as 0.25 to 0.50 ppm to kill most seedlings, and very little growth occurred at 1.0 ppm of prometryn.

When prometryn was applied in perpendicular strips 4 m wide across plots previously untreated and treated with prometryn, no black nightshade seedlings survived for 4 weeks (Table 2). Even at 6 weeks after treatment, visual control ratings of weed seedlings were still 99 to 100%. The fact that control in 1990 was complete for 6 weeks indicates that nightshades have not developed appreciable amounts of resistance to prometryn and degradation of prometryn probably occurred at normal rates. Furthermore, the excellent control obtained indicates that the herbicide was not readily leached from the upper 2.5 cm of soil where the majority of the weed seeds germinate. Since efforts failed to provide evidence for the movement of the herbicide with water, the development of weed resistance to prometryn, or accelerated degradation of this herbicide in soil, increasing weed populations were suspected of contributing greatly to the declining nightshade control from prometryn. It is suspected that, if numbers of seedlings estimated ha^{-1} in Table 2 represents only 10% or less of the soil seed reservoir, weed seed populations have increased from 85 million in 1985 to as much as 800 million in 1990.

FUTURE PLANS: A manuscript reporting the results of this study has been written and was submitted for consideration for publication in Weed Technology Journal.

Table 1. Emergence of black nightshade seedlings in field plots in 1990 when blocks of treatments from previous years were strip-treated in 1990 with 2.0 lbs/A of prometryn.[a]

Treatments in previous years[b]	Number of black nightshade counted 4 weeks after treatment: Treated strip	Untreated strip	Estimated[c]
lbs/A	no. 930 cm^{-2}		no. ha^{-1}
Prometryn (1.5 PPI-1)	0	554 ab	60×10^6
Prometryn (1.5 PPI-2)	0	545 ab	59×10^6
Prometryn (2.0 PPI-1)	0	687 a	74×10^6
Prometryn (2.0 PPI-2)	0	84 c	9×10^6
Hoe x 1	0	309 bc	33×10^6
Weedy control	0	750 a	81×10^6
Weed-free	0	85 c	9×10^6

[a]The actual count area for the treated strip in each plot was 4 m long by 4 m wide. Numbers of seedlings in untreated strips are averages of two counts/plot. Visual control ratings of black nightshades were still 99 to 100% 6 weeks after strip-treating plots in 1990.

[b]PPI-1 = Preplant incorporated into planting beds just prior to the preplant irrigation in middle of March. PPI-2 = Preplant incorporated into planting beds the day before cotton planting in early April.

[c]The factor used to convert the number of seedlings in the counted strip (930 cm^2) to the estimated number ha^{-1} was 107,593.

INTEGRATED MANAGEMENT SYSTEMS FOR THE CONTROL OF ANNUAL MORNINGGLORY IN COTTON

R. J. Thullen and P. E. Keeley

OBJECTIVES: To identify effective systems for the control of annual morningglory in cotton.

PROCEDURES: Several treatments were applied to field plots at the USDA Cotton Research Station in 1989 and 1990 for the control of annual morningglory in cotton. Herbicides were first applied to planting beds at cotton planting in early April and incorporated with a mulcher operated 5 cm or 10 cm deep in the soil. Rates for these early treatments were 2.0, 2.0, and 1.6 lbs/A, respectively, for cyanazine, methazole, and prometryn. Post emergence and layby treatments were applied as directed sprays to weeds in the drill row at the base of the cotton plants. Post-emergence treatments began soon after the middle of May, whereas the layby treatments were not applied until the end of June. Rates were 1.0 lb/A for cyanazine, 0.5 to 1.5 lbs/A for methazole, and 0.7 to 1.6 lbs/A for prometryn. Although all plots were conventionally cultivated, some were cultivated with special equipment (rods/torsion weeders/spring weeders) to remove small morningglory in the drill row of cotton. When rods were used, plots were cultivated in opposite directions. This cultivation and handweeding were both performed near the end of May. See Table 1 for more information about treatments.

RESULTS: The most successful herbicidal treatment for the control of annual morningglory in cotton was postemergence applications of 1.0 lb/A cyanazine + 2.0 lbs/A MSMA in early June (Table 1). Applications of cyanazine + MSMA to cotton at layby in late June was also helpful in reducing yield losses of cotton. The only other herbicide that provided significant postemergence activity was prometryn. Prometryn incorporated 10 cm deep provided the most consistent control of the soil-incorporated herbicides. But control with this treatment was incomplete based on both visual control ratings and harvested cotton (Table 1). Although the cultivator equipped with rods removed many small morningglory plants in the drill row of cotton, too many survived. Based on the results of the handweeding treatment in late May of 1989 and 1990, the weed-free period for morningglory will probably have to extend at least until the middle of June.

FUTURE PLANS: A manuscript of this two year study is being prepared. A second study will begin on the area of this morningglory nursery in the spring of 1991.

Table 1. Mean visual control ratings for annual morningglory at 1, 3, and 6 months after cotton planting and yields of cotton lint.

Treatment[b]	Control			Cotton lint yield
	1 month	3 months	6 months	
	%			kg ha^{-1}
Cyanazine 10	42 de	61 abc	31 defg	624 bcde
Cyanazine 5	18 efg	42 bcde	22 efgh	541 cde
Cyanazine post	--[c]	82 ab	66 b	1047 ab
Cyanazine layby	--	52 abcde	52 bcd	930 abc
Methazole 10	66 bc	49 abcde	26 efgh	594 cde
Methazole 5	16 fg	19 cde	8 hi	225 e
Methazole post	--	25 cde	18 fghi	414 de
Methazole layby	--	24 cde	13 ghi	448 cde
Prometryn 10	80 ab	82 ab	54 bc	789 abcd
Prometryn 5	48 cd	68 abc	44 cde	678 bcde
Prometryn post	--	54 abcde	50 bcd	827 abcd
Prometryn layby	--	41 bcde	31 defg	639 bcde
Rods + hand	--	64 abc	13 ghi	622 bcde
Rods	--	6 de	10 ghi	290 e
CCT + hand	--	57 abcd	13 ghi	395 de
CCT	0 g	1 e	0 i	261 e
Weed-free	100 a	100 a	94 a	1161 a

[a]Means in columns followed by the same letter do not differ significantly at the 5% probability level according to Duncan's multiple range test.

[b]Treatment code: Cyanazine 10 = cyanazine preplant incorporated 10 cm; Cyanazine 5 = cyanazine preplant incorporated 5 cm; Cyanazine post = cyanazine, MSMA tank mixed, 2 applications postemergent; Cyanazine layby = cyanazine, MSMA tank mixed, 1 application postemergent; Methazole 10 = methazole preplant incorporated 10 cm; Methazole 5 = methazole preplant incorporated 5 cm; Methazole post = methazole, DSMA tank mixed, 3 applications postemergent; Methazole layby = methazole, DSMA tank mixed, 1 application postemergent; Prometryn 10 = prometryn preplant incorporated 10 cm; Prometryn 5 = prometryn preplant incorporated 5 cm; Prometryn post = prometryn, DSMA tank mixed, 1 application postemergent; Rods + hand = conventional cultivation tillage plus rod or spring weeders plus 1 hand weeding; Rods = conventional cultivation tillage plus rod or spring weeders; CCT + hand = conventional cultivation tillage plus 1 hand weeding; CCT = conventional cultivation tillage; Weed-free = conventional cultivation tillage plus rod or spring weeders plus numerous hand weedings.

[c]Treatment not applied at this time.

COVER CROPS FOR ANNUAL CROPPING SYSTEMS

P. E. Keeley, R. J. Thullen, L. M. Carter, and J. Chesson

<u>OBJECTIVES</u>: To identify and research cover crops suitable for use in cotton production systems (major emphasis is to determine the beneficial aspects of cover crops in managing weeds in cotton).

<u>PROCEDURES</u>: Five cover crops (annual ryegrass, barley, hairy vetch, subterranean clover, and tall fescue) were seeded into four row plots that were 65 feet long on 11/7/89. Additional treatments included a non-cover crop treatment that would be no-till planted as the five cover crops, and several planting beds that would be conventionally planted to cotton. Cover crops were furrow-irrigated and grown until early April. On April 3, April 5, and April 20, the two south rows of all plots were sprayed with glyphosate or paraquat to kill covercrops. The two north rows of plots were flail-chopped on 4/5/90. After cotton was no-till planted on April 19, all rows of plots were flail-chopped on April 25. All plots were furrow-irrigated as needed during the summer of 1990. Soil samples were taken for N, P, and K analyses on 11/28/89 and 5/23/90. Cotton leaf petiol samples were taken for NO_3-N analyses on 6/25/90 and 7/30/90. Plant counts and heights were recorded on May 25, June 11, June 26, July 19, and August 13, 1990 just before the two south rows were handweeded on each date. Cotton was defoliated on 9/26/90 and harvested on 10/4/90.

<u>RESULTS</u>: Covercrops (barley, ryegrass, and vetch) that provided 90 to 100% ground cover by March 1 reduced winter annual weed populations the greatest (2-10 weeds/130 f. row). This compared to populations of 34, 150, and 250/130 ft of row for clover, fescue, and weedy-check plots, respectively. Flail-chopping was not successful in killing cover crops. Except for ryegrass, two applications of glyphosate and one application of paraquat provided 85%or greater control of covercrops until June 1. Control of ryegrass was only 55%. Costs of growing and managing cover crops ranged from $256 to $296/acre where herbicides were used and $116 where crops were flail-chopped. No-till planted cotton stands were adequate (2 plants/foot or greater) for vetch, clover, fescue, and non-cover crop plots where cover crops were chemically killed. Although residues from some covercrops temporarily delayed the emergence of summer annual weeds (pigweed, barnyardgrass, and nightshade), they provided little long-term control of these weeds. In plots where the cover crops were chemically killed and summer weeds were removed, yields of cotton were similar for no-till planted beds of clover, fescue, vetch, and non-cover crops as for conventionally planted beds. Because of poor crop stands, yields of cotton were reduced 50 and 75%, respectively, on no-till planted beds of barley and ryegrass.

<u>FUTURE PLANS</u>: The same covercrops were replanted in late October 1990, and the experiment will be conducted in 1991 as it was in 1990. If reasonable results are obtained from the second year of the study, the study will be discontinued and the results prepared for publication.

COMPARISON OF SUBSURFACE DRIP AND FURROW IRRIGATION OF COTTON ON VERY SANDY SOIL UNDER FUSARIUM-NEMATODE PRESSURE

W.R. DeTar, P.B. Goodell, L.F. Elliott

OBJECTIVES: To compare drip and furrow irrigation by measuring the emergence, plant growth characteristics, yield, rate of plant die-off, and water use of Acala cotton on very sandy soil with a great deal of pressure from nematodes and Fusarium wilt.

PROCEDURES: This experiment was started in the Spring of 1989 on a 0.4-ha plot of uniform loamy sand soil. The initial (main) treatments were Acala SJ-2 under (1) subsurface drip, (2) proper furrow irrigation, and (3) poor furrow irrigation. The experimental design was a randomized complete block of 3 treatments with 5 replications. The main treatments were split in 1990 into 4 cultivars: SJ-2, GC-510, N8577, and C4226 (now called Royale). Also in 1990, Telone II (a nematicide) was applied to main treatment #3, and proper irrigation was used. Each plot consisted of four 88-m rows of cotton, with a row spacing of 0.76-m. In the drip treatment, the dripperline was 15-mil T-Tape with outlets spaced every 0.3 m, each discharging 1.0 L/h. The dripperline was placed 0.20 m below grade in the plant row. The drip system was monitored with a flow meter and pressure gages. "Proper" furrow irrigation included a high initial inflow to the furrow and then a cut-back of flow just before the water reached the end of the furrow."Poor" irrigation consisted of a constant low inflow to the furrow, with the water reaching the end of the furrow at about the same time the inflow was turned off at the end of the set. Fertilizer was applied to the drip and furrow treatments through the water. Neutron probe readings of soil moisture were taken in the middle of every main plot; likewise tensiometers were located in every main plot. Leaf moisture potential was also measured periodically.

RESULTS: In 1989 the cotton was planted about a month late (May 5). By July 5, stunting due to nematodes was evident, and by August 2, plants began dying from Fusarium wilt. Inadvertently, the plot chosen had soil that was contaminated with both Fusarium wilt and nematodes, and to compound the problem, the variety of cotton chosen was very susceptible to wilt.

As can be seen in Table 1, both the furrow treatments had a little better early emergence than the drip treatment, but the difference disappears at about the fifth day after planting. Figure 1 shows that the plants in the drip treatment were 18 to 20 cm taller than plants in the furrow treatments in August (degree-days > 1356). Measurements of the areas damaged by Fusarium wilt were taken October 1, 1989. The percent of plot area damaged averaged 27.0, 0.4, and 1.8 % for treatments 1, 2, & 3 respectively. Fusarium wilt was much worse in the drip plots than in the furrow plots. Soil was sampled for nematodes, and a count of second-stage juvenile root-knot nematodes was taken in March of 1990, showing 5773 nematodes per liter of soil in the drip plots, and 2515 per liter in the furrow plots. Sandy soil that is kept moist seems to be an excellent environment for nematodes and Fusarium wilt.

In spite of the larger area of damage to drip compared to furrow by Fusarium in 1989, the yield from the drip treatment still exceeded that from the furrow treatment. The yields were 917, 642, and 636 Kg/ha for treatments 1, 2, an 3 respectively, with a CV of 14%, and an LSD(05) of 153 Kg/ha. The difference is highly significant. The poor result from the furrow treatment may be partially due to the leaching out of nutrients from the porous soil, but even more likely is the insidious nature of nematode damage. If the damage is due to nematodes alone (no Fusarium), the plants do not die and they may appear only slightly shorter than what one would expect on a sandy soil, but the stress can be extreme. Figure 1 shows that the nematode-Fusarium problem started late enough that we could get some fairly decent plant height measurements.

In 1989, one tensiometer was placed in each drip plot, located in the plant row, 11 cm horizontally from and 18 cm below an emitter. The time clock controller generally was set to apply the same amount of water daily for up to a week at a time. Figure 2 shows how the tensions changed relative to pan evaporation at our weather station whenever the daily application rate was too high or too low for the period of peak water use from mid-July to mid-August. It appears that the proper value of the pan coefficient at peak water use is about 82%, i.e., if 82% of the pan had been applied each day, the tensiometer readings would not have changed at all, indicating that the amount of water being applied was exactly the same as that being used by the plant.

It is fairly obvious in Table 2 that without Telone, SJ-2 plants were dying off rapidly in early 1990. And in general, without Telone, drip-irrigated SJ-2 did much worse that furrow-irrigated SJ-2. Dead-plant counts later on indicated that GC510 is not entirely resistant to wilt. The best yields were obtained, of course, where nematodes were controlled, and as seen in Table 3, Telone-treated SJ-2 did the best, with an average of 1620 Kg/ha (3.0 ba/ac), which is quite good for the sand streak in which it was planted. GC510 did not yield as well as SJ-2 in the Telone treatment, but it is well-known that GC510 is not as high-yielding as SJ-2 under no-wilt conditions. Another feature that may not be well-known is that N8577 is not completely resistant to nematodes, doing better under drip than furrow (both without Telone), but producing only 92 and 84% of the Telone treatment for drip and furrow respectively. Actually GC510, N8577, and C4226 all did better under drip irrigation than under furrow irrigation (both without Telone), but none yielding anywhere near the potential for the soil. Figure 3 shows again that drip-irrigated plants are taller than furrow-irrigated plants.

FUTURE PLANS: Vapam will be applied to treatments 1 & 3. The variety Acala Maxxa will be used for the entire plot.

Table 1. Seedling emergence, 1989 (percent).

Date=	8May	9May	10May	11May	12May	22May
Day=	3	4	5	6	7	17
Heat units=	58	75	81	81	83	162
Treatment number						
1	0	15	52	62	65	66
2	0	22	55	62	64	65
3	0	23	57	65	65	66
LSD(05)	ns	3.6	ns	ns	ns	ns
CV (%)		12.6	7.1	5.8	5.4	4.9

Table 2. Average dead plant count per plot, 1990.
(out of 744 seeds planted/plot)

May 11

Variety	Drip	Furrow	Telone
SJ-2	58.2	28.2	1.4
GC510	8.6	2.8	0.0
N8577	3.0	4.6	0.6
C4226	1.9	1.0	0.0
Additional dead plants found May 14.			
SJ-2	41.5	22.0	1.4
GC510	5.5	4.2	0.2
N8577	9.5	3.2	0.0
C4226	3.5	3.4	0.4

Table 3. 1990 yield, Kg/ha

Variety	Drip	Furrow	Telone
SJ-2	205	595	1686
GC510	778	474	1483
N8577	1466	1345	1601
C4226	885	628	1613

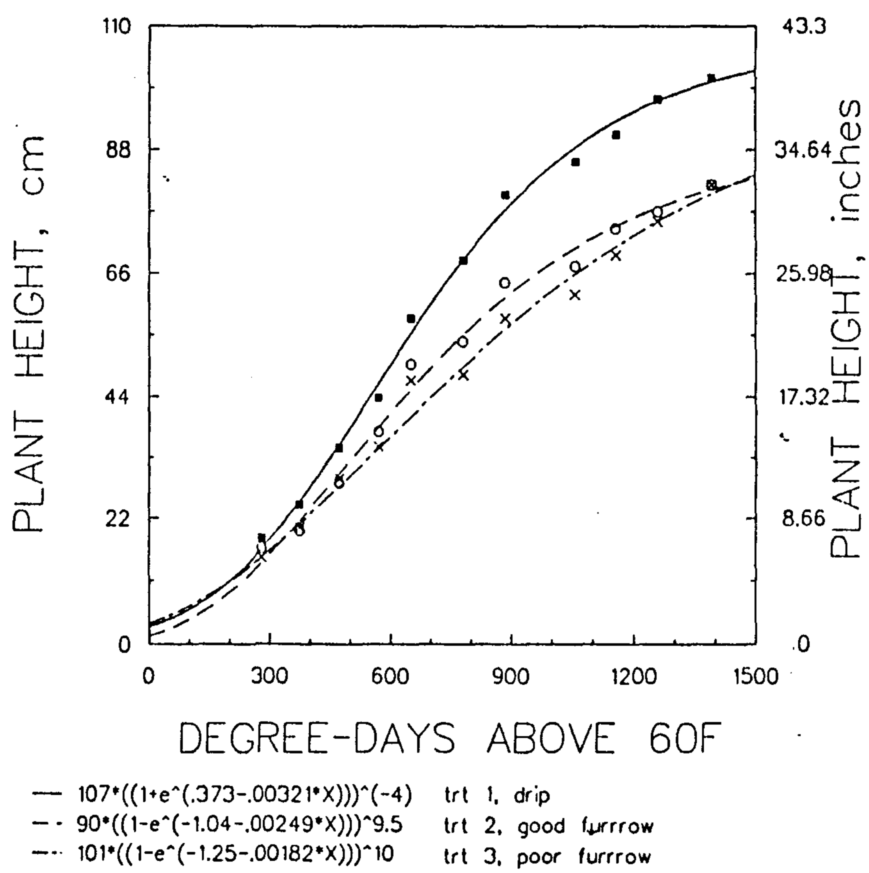

Figure 1. Plant heights, 1989

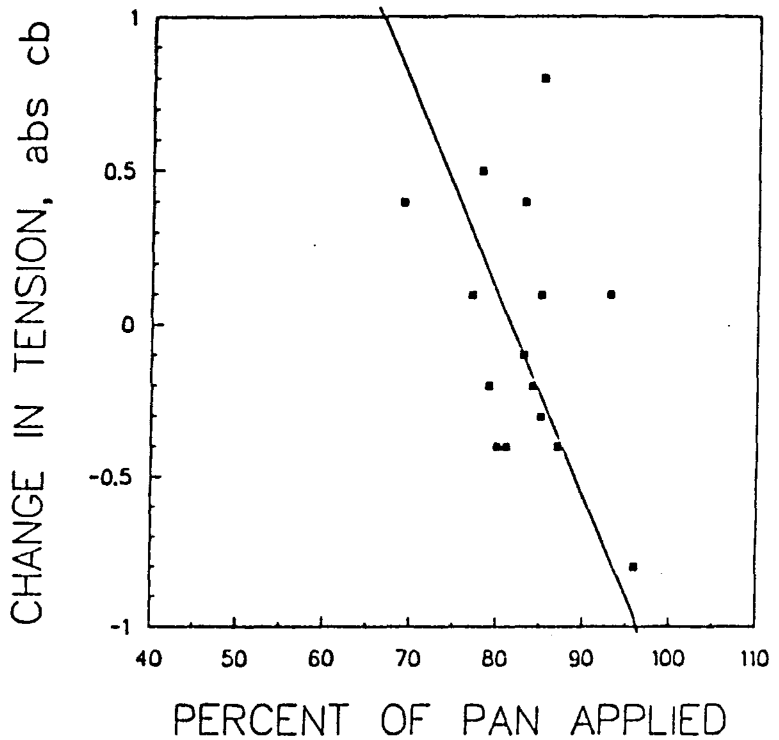

Figure 2. Tensiometer change vs pan evaporation

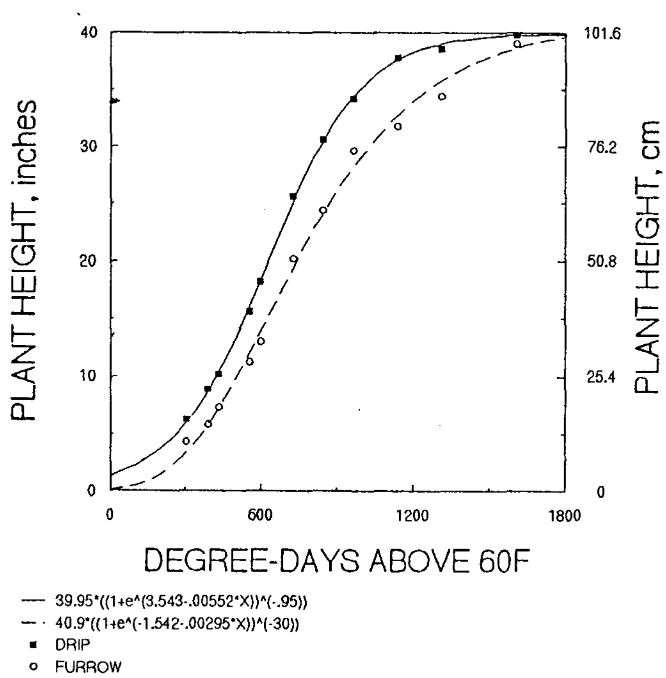

Figure 3. Plant heights 1990, N8577

FIELD TESTING OF VARIOUS SUBSURFACE DRIPPERLINES FOR USE WITH COTTON ON A VERY SANDY SOIL

W.R. DeTar and L.F. Elliott

OBJECTIVES: To evaluate various subsurface dripperlines for use with cotton on a very sandy soil, by measuring uniformity of emergence, plant growth characteristics, yields, and changes in flow rates.

PROCEDURES: Table 1 shows the various combinations of tubing types, depth of placement, emitter spacing, discharge rate, and wall thickness for some of the companies that felt that their product was suitable for subsurface drip irrigation of cotton. Dripperlines from five different were used. This experiment was started in the Spring of 1989 on an extremely sandy, but uniform, soil (loamy sand). All the dripperlines were placed in the plant row, and all row spacings were 0.76 m. Most of the dripperlines were placed at a depth of 0.20 m below grade, but one treatment had a depth of 0.30 m, and another had a depth of 0.46 m. Altogether there were 13 treatments, each consisting of one plot of four 88-m rows of cotton. Emitter spacings were either 0.30 m, 0.60 m, or continuous (two dripperlines were porous tubing). Each plot was equipped with a battery-operated water-timer, a flow meter, and a pressure gage. In both 1989 and 1990, Acala SJ-2 cotton was planted as an indicator crop.

RESULTS: Table 2 shows the percent of the seed that emerged for each treatment in 1989 and 1990. Almost no plants emerged in 1989 from treatment D6, where the dripperline was buried 0.45-m deep. The soil was loose and dry, a result of the recent installation. But in 1990, emergence was reasonably good in this treatment, starting very slowly, but with a good final stand. The soil had had a chance to settle, and there was some residual moisture near the surface from winter rains. Emergence from the 0.30-m depth, in treatment D5 was slow both years, and final count was a little low. The uniformity and speed of emergence was a lot better with the 0.30-m emitter spacing than with the 0.60-m spacing, but the final stand and yield seem not to be affected by emitter spacing. A 10-m section of one row of treatment D8 (porous tubing), did not support plant growth and was bare at the end of the first season. Lack of good control in manufacture was suspected. This section was replaced in 1990, and the new tubing seemed to discharge (initially) an excessively high flow rate.

In 1989 the cotton was planted about a month late (May 5). By July 5, stunting due to nematodes was evident, and by August 2, plants began dying from Fusarium wilt. It had been hoped that the uniformity of plant growth would be a major criteria in comparing treatments. Insufficient flow from clogged or partially clogged emitters would have been obvious. However, the problem with the Fusarium-nematode complex completely masked out the use of the plants as an indicator of how well the drip system was working. In 1990, the cotton was planted on time (April 4), but the plants started dying almost immediately from Fusarium wilt. There were almost no plants left at the end of the season, and no yield data was taken.

Pressure vs. flow rate data was taken periodically throughout both seasons, and in general, no change was noted. Treatment D2, with a wall thickness of only 4 mil, developed leaks at 2 locations, apparently from insect damage.

Figure 1 shows the yields and percent of area affected by Fusarium wilt for 1989. The correlation indicates that the yield would have been only about 996 Kg/ha (1.8 ba/ac) without the Fusarium wilt. This is a very low yield. The nematodes may have had some direct effect, but the low yield could also be due to the late planting.

FUTURE PLANS: The experiment will be repeated at least one more season using a cotton variety that is resistant to nematodes.

Table 1. Description of dripperlines used in test.

Treatment number	Name of tubing	Wall thickness (mil)	Discharge rate (L/h)	Emitter spacing (m)	Depth of placement (m)
D1	T-Tape	8	1.0	0.30	0.20
D2	T-Tape	4	1.0	0.30	0.20
D3	T-Tape	15	0.5	0.30	0.20
D4	T-Tape	15	1.0	0.60	0.20
D5	T-Tape	15	1.0	0.30	0.30
D6	T-Tape	15	1.0	0.30	0.45
D7	L.Pipe	1/4*	0.6/m	cont.	0.20
D8	L.Pipe	3/8*	0.1/m	cont.	0.20
D9	Biwall	15	1.5	0.30	0.20
D10	Biwall	7	1.5	0.30	0.20
D11	Typhoon	20	1.5	0.30	0.20
D12	Typhoon	16	1.5	0.60	0.20
D13	Turbo C.	15	1.4	0.60	0.20

*Nominal I.D. of porous tubing, in inches

Table 2. Seedling Emergence.

	1989							1990	
Date=	8May	9May	10May	11May	12May	22May	31May	11Apr	16Apr
Day=	3	4	5	6	7	17	26	7	12
Heat units=	58	75	81	81	83	162	217	30	74
Treatment number									
D1	0	30	61	66	68	70		57	100
D2	0	28	57	60	63	63		63	86
D3	0	43	63	68	70	70		14	88
D4	0	17	50	60	63	68		40	89
D5	0	13	30	35	38	56	56	19	89
D6	0	0	0	0	0	5	6	1	87
D7	0	12	21	22	23	52	50	22	88
D8	0	15	53	60	69	71		45	93
D9	1	22	60	65	67	69		52	86
D10	0	25	65	68	71	74		55	95
D11	0	19	56	65	67	68		31	55
D12	0	9	40	45	47	73		12	35
D13	0	11	44	51	54	64		30	78

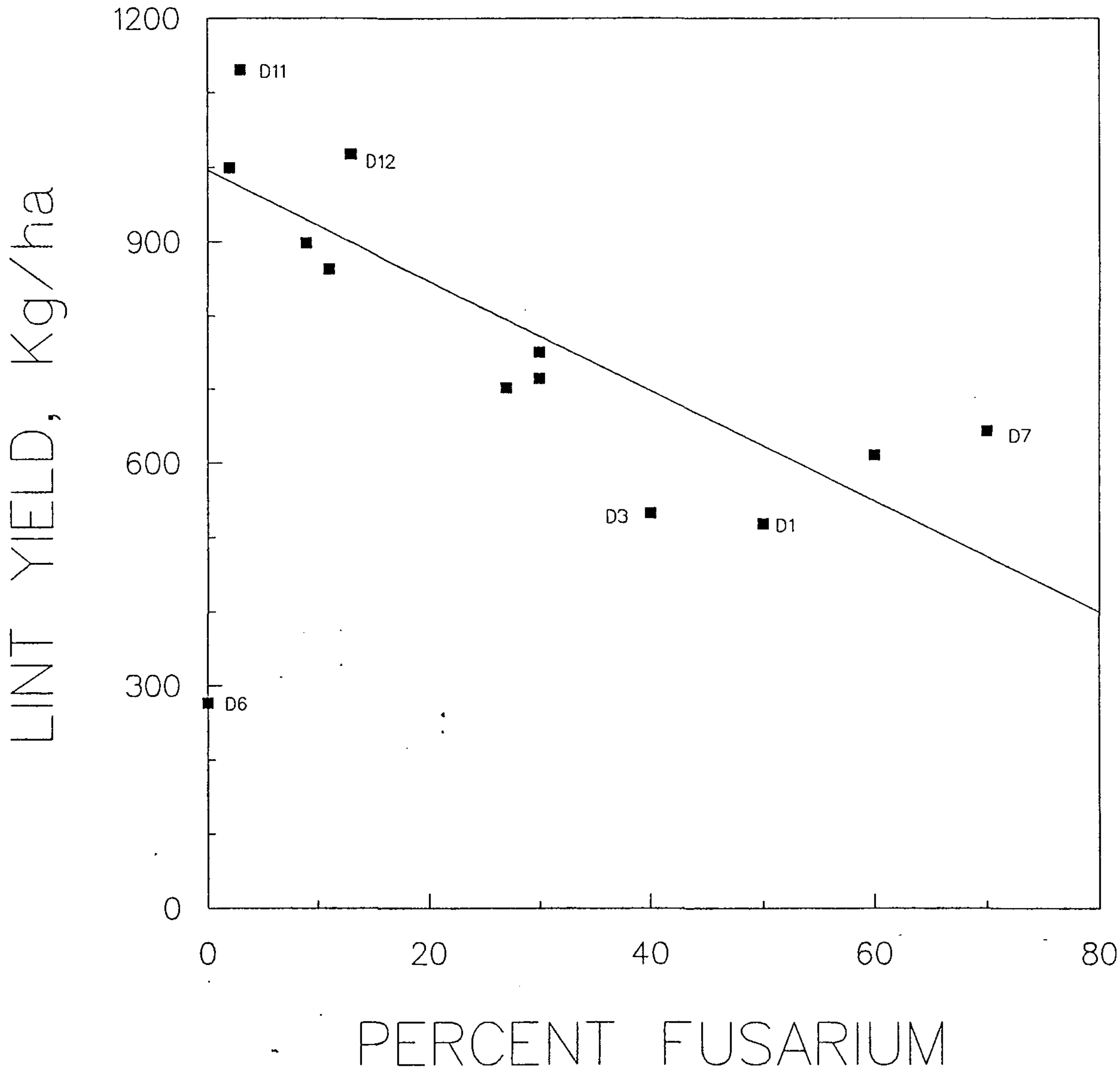

Figure 1. Lint yield as affected by the percent of the plot area that was damaged by Fusarium wilt.

Cover Crop Species Evaluations

W.C. Hofmann, N. Goodell, and N. Hudson

OBJECTIVES: To evaluate several plant species for their potential as winter cover crops in a cotton production system. Two dates of cover crop planting were investigated.

PROCEDURES: Eleven cover crops[1] and a control were planted on 30 inch beds on October 26 and November 27, 1990 (Table 1). The seed were broadcast by hand and raked into the soil. Visual observations of the percent of each plot covered with the cover crop, weeds, and bare ground were made in Mid-February, 1991.

Table 1. Cover crop species planted, code, planting rate, and inoculation in the 1990 evaluations at Shafter, CA. 1990-1991.

Cover Crop Species	Code	Planting Rate	Inoculation
Lana Vetch	LV	80	YES
Foenugreek	FG	50	YES
Annual Rye Grass	AR	50	
Green Manure Mix[1]	GM	125	YES
Austrian Winter Peas	WP	120	YES
Hairy Vetch	HV	60	YES
Berseem Clover (Top Cut)	BC	25	YES
Dryland Clover Mix[2]	DC	35	YES
Medic Mix[3]	MM	20	YES
Sub Clover (Mt. Barker)	SC	30	YES
Sweet White Lupine	LP	125	YES
Control	CT		

[1] 40% Bell Bean, 20% Austrian Winter Pea, 20% Vetch, 20% Annual Rye Grass.

[2] 16% Crimson Clover, 15% Kondinin Rose Clover, 15% Kenland Red Clover, 9% each of Geraldton, Nungarin, Mt Barker, Trikkala, and Woogenellup Subterranean Clovers, and 9% Jemalong Barrel Medic.

[3] 20% Sephi Barrel, 10% Paraggio Barrel, 15% Circle Valley Burr, 15% Paragosa Gama, 15% Sava Snail, and 15% Koala Subclover.

Results: These are results from a single growing season so the data are tentative. Significant differences in the amount of ground coverage were observed on both planting dates (Fig. 1). Lana Vetch and Annual Rye Grass were

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[1]Seed purchased from Peaceful Valley Farm Supply, PO Box 2209, Grass Valley, CA 95945.

top performers for early and late planting. The Green Manure Mix did well in the early planting but dropped off slightly in the late planting. Foennugreek did well in the late planting. Sweet White Lupine suffered from seedling diseases and did very poorly.

Future Plans: The plots have been turned under and will be planted to cotton this spring. We would like to re-establish the test next Fall with new entries to replace some of the entries which failed dismally.

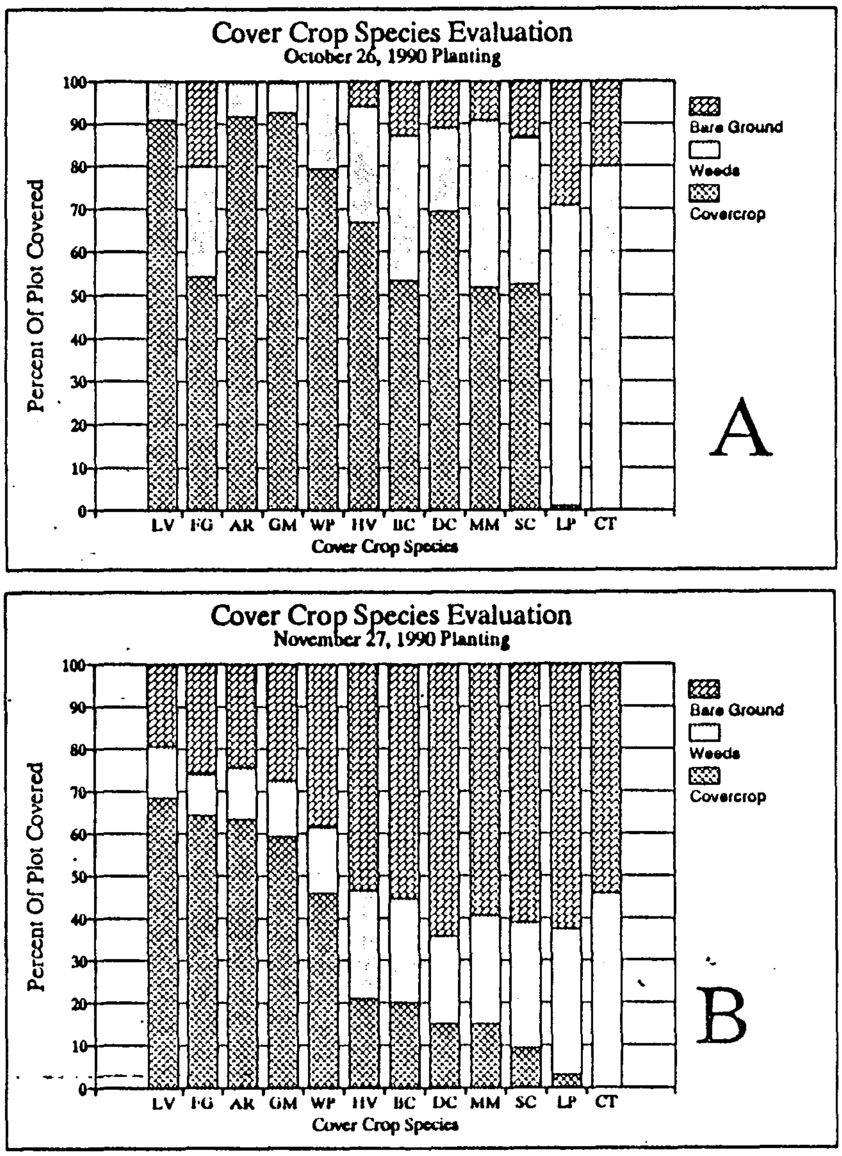

Figure 1. Proportion of plot covered in mid-February by the cover crop species, weeds, and bare ground for the October 26 planting (A) and the November 27 planting (B).

MINIMUM TILLAGE / RESIDUE MANAGEMENT

W.C. Hofmann, L.M. Carter, and N. Hudson

OBJECTIVES: Minimum tillage has received attention in recent years as a technique to reduce production costs, improve soil quality, and reduce erosion. This study was initiated to evaluate the effects of minimum tillage on cotton growth and soil quality.

PROCEDURES: The 1990 study was conducted at the U.S. Cotton Research Station in Shafter, CA. The treatments were established in a barley field prior to grain harvest. The barley had been drilled onto 40" beds in the Fall of 1989. The treatments included:

Strip Till	Barley flail chopped at approximately six inches above the bed. An eight inch strip was roto-tilled in the center of each bed.
Shallow	Flail chopped followed by a shallow incorporation with an Oppal roto-tiller.
Fallow	Most of the barley was removed from this treatment the previous winter. No tillage prior to cotton planting.
Deep Incorp	Barley flailed and deeply incorporated with a Howard rototiller.
Flailed	Barley flailed approximately six inches above the surface. No incorporation.

GC-510 was planted using an experimental minimum tillage planter (described elsewhere in this report) on April 5 and a stand failure caused a replant on April 19. It was impossible to move furrow irrigation water into the seed row because of the residue and the general condition of the beds. Sprinklers were used to obtain a stand. Stand counts were made after all seedlings had emerged.

UN-32 was water run with six irrigations for a total of 200 units N applied. Other than an application of sulfur dust, no insecticides were applied. No mechanical cultivation was performed. Weeds were managed with fusilade and hand hoeing.

A penetrometer was used to measure soil compaction in early July, 1990. Extensive plant mapping was done just prior to harvest. The plots were machine harvested for yield estimates.

RESULTS: This was the first year of the study, so these results are speculative at best. Seedling emergence was substantially reduced in the flail chopped plots (Table 1). The residue left on the surface impeeded the seedlings and in some cases the planter was unable to close the slot adequately. The strip till and deep incorporation treatments had better emergence than either the shallow incorporation or the fallow treatment. The penetrometer data (Table 1) detected a trend toward slightly more soil compaction in the fallow treatment. All plots received equal traffic throughout the season, so this would not explain the observed differences. The differences could be do to beneficial effects of the barley roots.

The plots were machine harvested and the flailed treatment had significantly lower yields than the other four treatments (Table 1). This was probably due to poor seedling emergence followed by reduced early growth. The stubble tended to shade out the seedlings and inhibited their early performance. The plant mapping data did not detect any consistent differences among any of the treatments (Fig.2). The fallow treatment tended to have more bolls on the first two positions.

FUTURE PLANS: Barley was in the Fall of 1990. The treatments will be re-established in the same plots in 1991 and the study will be repeated.

Table 1. Seedling emergence (number per meter), lint yield (bales per acre) and penetrometer data for the 1990 residue management study.

Treatment	Emergence	LSD	Lint Yield	LSD	Penetrometer	LSD
	(seelings / 2m)		(bales / A)		(resistance)	
Strip Till	11.75	ab†	2.5	a	1.94	b
Shallow Incorp	10.25	b	2.4	a	2.07	ab
Fallow	10.25	b	2.5	a	2.23	a
Deep Incorp	13.30	a	2.6	a	2.05	ab
Flail Chop	7.55	c	2.0	b	2.15	ab

† Values followed by the same letter are not statistically different at the 5% level of significance.

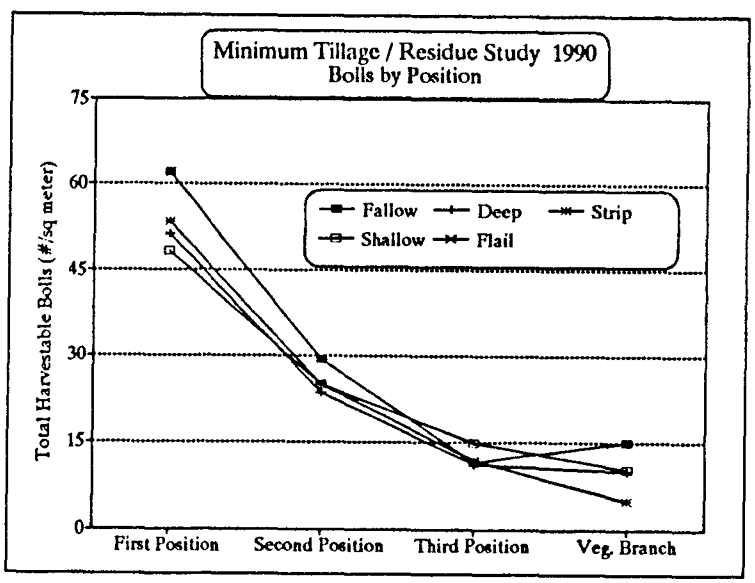

Figure 1. Total number of harvestable bolls by horizontal position on the plant. Shafter, CA. 1990.

WINTER COVER CROPS FOLLOWED BY COTTON

W.C. Hofmann, L.M. Carter, and N. Hudson

Objectives: Covercrops have been used for many years to improve soil quality, as a source of nutrients, improve water infiltration, suppress weeds, harbor beneficial insects, control nematodes, etc. Little work however has been directed towards their use in a cotton rotation. This study was initiated to investigate four fall-planted covercrop species on subsequent cotton growth.

Procedures: Fescue, annual rye, hairy vetch, and subterranean clover were planted on beds on November 14, 1989. The field was irrigated to encourage optimal growth. In March the cover crops were chemically killed. In late March, half the plots were incorporated using a Howard rototiller. The other half of the plots were flail chopped approximately six inches above the top of the beds. The flailed plots were treated with herbicides to terminate growth.

GC-510 was planted in early April using a modified minimum tillage planter (described in another report). The field was sprinkle irrigated to obtain a stand. Weeds were managed with caporal (for morning glory) and hand hoeing. The incorporated plots were cultivated as necessary. One application of sulfur dust was the only insecticide applied. Water run UN-32 was applied during five irrigations.

Results: This is the first year of this study so results are tentative. Based on visual observations, the annual rye grass produced the most dry matter and was best at winter weed suppression. The vetch and subterranean clover did not fully cover the ground until March and winter annual weeds were a problem. The fescue stands were overall the weakest.

Cotton seedling emergence was significantly better in the flailed plots as compared to the rototilled plots (Fig. 1). The cover crop species did not have an affect on emergence. After emergence, however, the seedlings in the flailed plots tended to develop more slowly due to shading caused by the surface residue.

Lint yields averaged 2.1 bales per acre across all treatments. Unfortunately, caporal damage to the cotton plants probably reduce lint yields. There was a tendency towards slightly reduced lint yields in the rye plots (Fig. 2). Though not statistically different, the vetch plots produce the most lint in both the rototilled and flailed plots. There was no significant difference in yield between the average of the flailed verses rototilled treatments.

Future Plans: The cover crop treatments were re-established on the same plots in the Fall of 1990. The study will be repeated. The penetrometer will be used to study soil compaction and plant mapping will be used to study cotton growth and development.

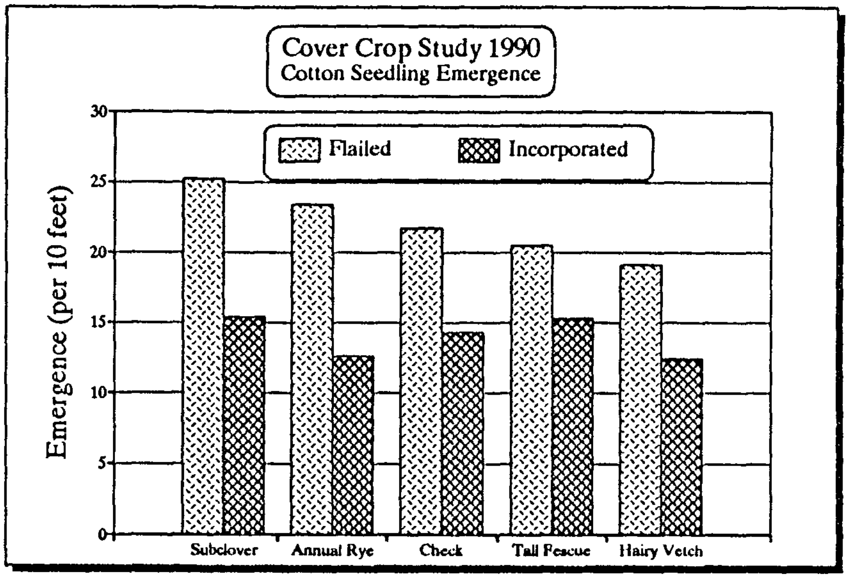

Figure 1. Cotton seedling emergence (per 10 feet of row) in the flailed and rototilled cover crop treatments. Shafter, CA. 1990.

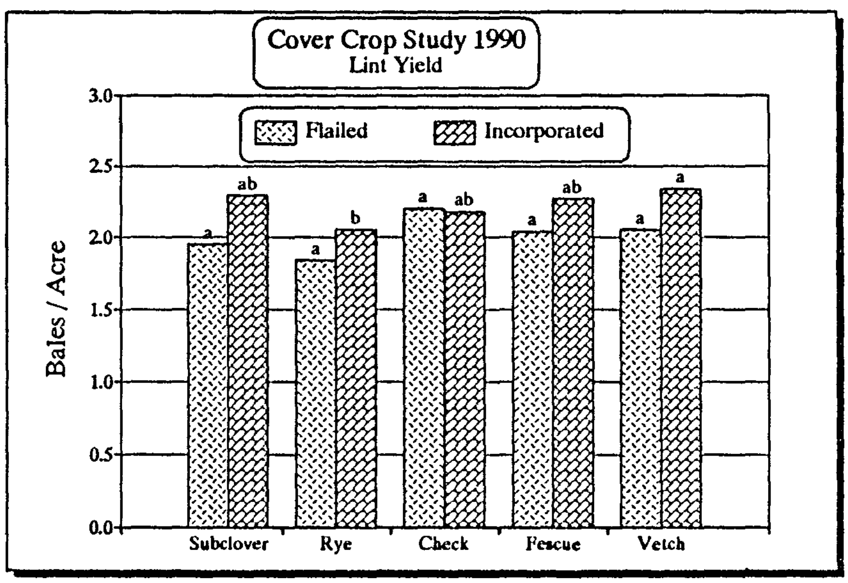

Figure 2. Cotton lint yields (bales / acre) in the flailed and rototilled cover crop treatments. Shafter, CA. 1990.

Agronomics of Cotton Production Systems

Tom Kerby, Wally Hofmann, and Mark Keeley

Objectives: Develop crop management guidelines which optimize production and quality of Acala and Pima cottons.

Procedure: Seven individual replicated trials were conducted at Shafter. Most trials had companion trials at the UC West Side Field Station, and many in similar trials in cooperation with Farm Advisors in grower fields. Eight approved Acala varieties were evaluated for yield performance; Pima S-6 and five other advanced lines from the USDA Pima program were tested; 19 experimental USDA Pima lines were tested in screening trials; Acala response to low dose multiple applications of the growth regulator Pix was measured; tests were initiated to develop plant map guidelines for scheduling defoliation; and the influence of canopy architecture on growth and development, yield, and fiber quality by position on the plant were under initiated.

Results:

Acala Varieties: Eight approved Acala varieties were tested at Shafter and five other locations in the SJV (Table 1). The Shafter location had the highest mean yield of all six locations which indicates we have been successful in refining our 30-inch production system at Shafter. Maxxa averaged 1825 lbs/A which was very similar to SJ-2 even though *Verticillium wilt* level was very low. New varieties are shorter, have a lower vigor index, and retain a larger percentage of early fruit than Acala SJ-2. Increased earliness and improved harvest index continues to account for yield improvement of varieties which are equally tolerant to *Verticillium wilt*.

Table 1. Lint yield (lbs/A) for approved Acala varieties tested at six locations in the San Joaquin Valley in 1990.

Variety	Shafter	WSFS	Madera	Kern	Kings	Merced (D-6)	Avg.
SJ-2	1830	1477	1317	1622	998	1109	1392
C-37	1566	1385	1238	1575	921	--	1303
Prema	1498	1345	1148	1604	914	1081	1265
Maxxa	1825	1577	1341	1673	962	1073	1409
Royale	1714	1395	1187	1729	971	1193	1365
GC-510	1663	1448	1214	1728	928	1102	1347
GC-356	1500	1309	1239	1560	977	1055	1273
DP-6166	1525	1290	1142	1491	856	1162	1244
Avg.	1640	1403	1228	1623	941	1112	1325
LSD 0.05	177	131	N.S.	88	N.S.	N.S.	72
CV%	7.4	6.3	13.0	3.7	7.0	6.2	4.6
p	0.001	0.003	>0.50	0.000	0.13	0.14	0.000
% wilt	7	21	22	56	0	0	
Row spacing	30	40	38	38	38	30	

Advanced USDA Pima Lines: Pima yields averaged 1179 lbs/A lint in 1990 compared to 947 lbs/A in 1989 (Table 2). Low soil saturation percentage continues to be associated with low yield of Pima S-6 across the SJV. Application of gypsum and ability to apply irrigation water uniformly to level basins is believed to be the major reason for yield improvement at Shafter. Drip irrigation of Pima on these sandy loam soils may improve yield levels to the level noted for clay loam soils at the UC WSFS (Table 2). P-74 has a larger leaf more typical of Acala cottons. It had the highest mean yield at Shafter.

Table 2. 1990 San Joaquin Valley Pima Variety Tests

Variety	Shafter	WSFS	Average
S-6	1140	1531	1336
P-67	1078	1508	1293
P-69	1189	1490	1340
P-71	1240	1629	1435
P-73	1121	1598	1360
P-74	1305	1520	1413
Average	1179	1546	1363
LSD 0.05	118	N.S.	80
CV %	8.4	8.4	7.0
V*L = N.S.			

Pima Screening: Pima S-6, two lines from Chaney Ranch, and 18 USDA Pima lines were tested on the South 40. Lint yield averaged 962 lbs/A. This was substantially lower than yields in North D. We believe much of the difference was related to irrigation management. Five of the USDA entries yielded at least 10 percent more than Pima S-6, with 89-394 (16.6 percent) and 89-220 (14.9 percent) yielding significantly more than Pima S-6 (table of data not presented).

Low Dose Multiple Applications of Pix: One test was conducted at Shafter and seven additional tests in the SJV. Use of Pix increased yield at Shafter and three additional locations (Table 3). Low dose multiple applications did not show an advantage over the single application of 0.5 pts/A applied at early bloom. The 1990 results were in agreement with the results obtained from 34 trials conducted from 1987 through 1990.

Table 3. Comparison of multiple low application rates of Pix to control or standard 0.5 pts/A single application in 1990.							
	Pts/A Pix applied at						Orthogonal
Early square:	0	0.13	0.25	0.25	0		Contrast
First bloom:	0	0.13	0.25	0.5	0.5	LSD	Control vs. Pix
10 days later:	0	0.13	0.25	0	0	0.05	(p)
In 1990:							
Shafter	1512	1639	1685	1639	1629	N.S.	0.06
WSFS	1721	1718	1705	1719	1728	N.S.	>0.50
Madera	1256	1332	1326	1404	1361	N.S.	0.16
Merced 19	1588	1609	1558	1554	1704	N.S.	0.04
Merced 20	1219	1309	1342	1313	1309	N.S.	0.14
Merced 21	1282	1384	1379	1405	1394	42	0.01
Kern	1408	1449	1359	1361	1459	59	0.01
Kings	1095	1115	1074	1088	1043	N.S.	>0.50
1990 Avg.	1385	1444	1429	1435	1453	42	0.01
34 tests 1987-1990	1330	1377	1378	1369	1386	--	--

Nodes Above Cracked Boll (NACB) as a Management Tool To Schedule Defoliation: Defoliation is recommended when 95 percent of the bolls are mature. Currently, this is estimated by one of three techniques: Cutting bolls with a sharp knife; cutting bolls and looking at the seed coat color; and percent of bolls that have opened. California cotton producers are beginning to use plant mapping in management decisions. All bolls on the same plant are related to each other in age according to their position on the plant. First positions on fruiting branches (FB-1) are the last bolls to be set at the top of the plant. Our goal was to related NACB with boll size and fiber quality loss due to premature defoliation. Acala SJ-2 plants with a FB-1 cracking boll were tagged on August 31 when the FB-1 number with a cracking boll averaged 3.25. There were three main treatment groups: All FB-1 bolls harvested on the day of defoliation beginning at the cracked boll (zero) up to 8 NACB (trt A); tagged plants defoliated and bolls allowed to develop as much as possible and harvested by NACB when all bolls were open (trt B); and tagged plants which were never defoliated and where all FB-1 bolls were harvested according to NACB (trt C).

Boll size for control plots (C) declined beginning at 6 NACB (Table 4). This corresponds to approximately FB# 9. Minimal reduction in boll size (5 percent) began at 4 NACB and increased steadily to a maximum value of 27 percent reduction at 8 NACB. When bolls were harvested on the day of defoliation (trt A), boll size was reduced 5 percent at 3 NACB. This treatment should have a similar effect as a killing frost or desiccation. The average differential between A as a percent of C, and B as a percent of C reaches a maximum at 5 NACB with an average difference of 14.5 percent for 5 to 8 NACB. This suggests when bolls are immature and defoliated versus desiccated, up to 14.5 percent of the normal boll dry weight accumulation can come from redistribution of assimilates. Using the regression line for rate of boll dry weight accumulation reported by Kerby et al. 1987 in UC Bulletin 1921 Fig. 19, this corresponds to 99 HU worth of boll growth during the linear phase of growth.

Table 4. Boll size and fiber quality as influenced by maturity at time of defoliation.

Nodes above cracked boll	Boll size (g)			Micronaire			Elongation %		
	A	B	C	A	B	C	A	B	C
0	7.58	7.37	7.47	4.6	4.8	4.8	6.40	6.35	6.30
1	6.95	7.30	7.10	4.5	4.3	4.8	6.30	6.35	6.30
2	7.15	7.21	7.03	4.4	4.6	4.8	6.15	6.35	6.60
3	6.65	6.94	7.00	4.2	4.2	4.6	6.35	6.50	6.60
4	6.07	6.74	7.09	3.7	4.4	4.4	6.20	6.35	6.50
5	5.53	6.44	7.14	3.3	3.8	4.8	5.95	6.40	6.40
6	4.85	5.85	6.39	3.0	3.9	4.5	5.70	6.20	6.30
7	4.34	5.29	6.02	2.7	3.3	4.2	5.70	5.95	6.20
8	3.75	4.57	6.27	2.3	2.9	4.3	5.70	5.85	6.30

A = harvested the day of defoliation; B = defoliated, same bolls allowed to develop as much as possible; C = never defoliated, opened on their own.
Fruiting branch no. of cracked boll at defoliation = 3.3
Date of defoliation = Aug. 31 % open bolls = 12%

Premature defoliation did not appear to influence fiber length, length uniformity, fiber strength, or reflectance. Micronaire values were slightly erratic and suggests even though we had at least 100 bolls in each category, some variation sample variation still remained (Table 4). It is possible this was a blending problem. We will have additional micronaire estimates from the same samples which were sent to New Orleans for spinning and knitting. At 5 NACB micronaire is reduced by defoliation and/or harvesting of bolls on the day of defoliation. Prior to this date there seems to be no consistent decrease in micronaire by premature defoliation. Fiber elongation appeared to have a small effect as early as 2 NACB. Differences were only about 0.15 percent prior to 5 NACB and would not be considered a problem.

Canopy Architecture and Fiber Quality: We have identified that fiber quality limiting factors are associated with a general carbohydrate deficit during the latter part of the season. The results also demonstrate that localized carbohydrate deficits exist even early in the season. We believe this is the result of shading of lower leaves which nourish these early set bolls. FB-1 bolls are always higher in quality that any other position. FB>2 and bolls on vegetative branches are always the lowest in quality. These positions have less leaf area to support boll growth and what leaf area they do have is deeper in the canopy (more shading) at the time of bloom than FB-1 bolls. These poor quality positions represent roughly 20 percent of the total crop.

Results suggest that average fiber quality, for the variety being grown, could be improved by eliminating long branches. This would allow greater light penetration into the canopy which should help leaves important to lower bolls remain more photosynthetically active. We have made selections within the germplasm of the late Dr. Hyer for such "columnar" type cottons. Likewise, some are available in commercial company germplasm.

Five treatments which varied in plant type were as follows: Acala SJ-2 modified, SJ-2, GC-510, columnar 2 (Shafter germplasm), and DP-895 (a columnar cotton). Acala SJ-2 was modified by pruning the fruiting branch after the first position on June 28, July 19, and August 13. Plant height, number of main stem nodes, leaf area ration, leaf area index, and biomass production and distribution were monitored by destructive sampling from row 7 of plots on June 14, July 9, July 30, and August 22. Solar radiation (PAR) penetration into the canopy was monitored at ground level, or at fruiting branch number 3, 7, and 11 on 11 July, 30 July, and 22 August. Seed cotton from 10 different was hand harvested. Zone 1 (vegetative branches) and zone 9 (FB position >2 on FB# 1-4) did not have sufficient size samples to obtain fiber analysis by replications.

This is such a large test with many tables it is not possible to include it in this summary. Acala SJ-2 and GC-510 yielded an average of 249 lbs/A more ($p=0.003$ for the orthogonal contrast) than the "columnar" (COL 2, DP-895, and SJ-2 modified) cottons. Removal of fruiting branches after the first position (SJ-2 MOD) resulted in an average decrease of 175 lbs/A lint (11 percent). This orthogonal contrast was significant only at $p=0.11$. Columnar cottons required an average of 15.6 fruiting branches for yield compared to an average of 13.9 for Acala SJ-2 and GC-510. This is an increase in the flowering cycle of approximately 9 days. Modifying Acala SJ-2 increased the flowering cycle 2.3 fruiting branches or 11 days ($p=0.044$).

Modification of SJ-2 resulted in increased PAR penetration to the ground on July 11 and July 30. GC-510 also tended to have greater PAR at the lower depths of the canopy during the first two sample dates. Genetic columnar cottons did not have increased PAR at the ground level or at fruiting branch number three. PAR interception by leaves above FB 7 was less for COL 2 than for SJ-2, GC-510, or DP-895 during July.

The interaction between variety and zone was significant for the percentage of total yield in a portion of the plant. Genetic columnar varieties averaged 74.6 percent of their total yield on FB-1 positions compared to 66.2 percent for the two Acala varieties. Modification of SJ-2 greatly increased the percentage of of total yield produced on the first eleven fruiting branches. Since retention percentage of the harvest zone was not greatly improved and boll size was not increased, yield decreases noted for the modified SJ-2 were associated with loss of yield from secondary positions. Although there was some compensation by FB-1 positions, it was not enough to sustain high yield levels. This suggests the need for more than one fruiting position per branch is important for yield potential.

On a complete plant basis modified SJ-2 had an average boll size that was 0.75 grams per boll greater than normal SJ-2. Genetic columnar cottons had boll sizes on vegetative positions which averaged 99 percent of the whole plant average while the Acala varieties averaged only 85 percent of normal size at the same position. Likewise, the Acala varieties showed more marked depression in boll size at FB3 1-4 than did the columnar cottons. Hence, columnar cottons produced a lower percentage of total yield in the previously identified "bad boll zones" of the plant, and based on boll size data it appears bolls in columnar "bad zones" were more fully developed than bolls at the same location for Acala varieties.

Changing canopy architecture by growing columnar cottons appeared to decrease fiber quality variation but was lower yielding that typical Acala cottons. Columnar cottons were excessively vegetative and this may have contributed to decreased yield.

Future Plans: Continue evaluations regarding the influence of canopy architecture on fiber quality variation. Columnar cottons may be less sensitive to water stress and will require different cultural practices to optimize their yield potential. Pima cotton is a new crop to the SJV. We will plan a wide range of Pima work designed to develop base line growth and development data, determine optimum plant density, monitor response to Pix, continue water management studies, and evaluate the USDA Arizona germplasm for cultivars which are superiorly adapted to the SJV. The focus of Pix work will be to evaluate its benefit from a compressed flowering cycle as a water saving strategy. We will continue to evaluate the currently approved Acala varieties for yield as well as collect the growth and development data which quantifies varietal determinacy level.

VARIETY EVALUATION FOR THE SAN JOAQUIN VALLEY COTTON DISTRICT

Dick Bassett, UC-Shafter

Objectives: **To identify newly developed lines which have a potential for improved yield and quality for the San Joaquin Valley Quality Cotton District**

Procedures:

The testing is an ongoing process carried out in two stages. Each year a new group of 36 cottons enters the first stage in small replicated plots at four representative locations. Measurements are made of yield, disease tolerance and other factors affecting production, and fiber quality. Also, miniature spinning tests are carried out to obtain a preliminary estimate of yarn quality. At the end of this first year a cotton is either advanced to the next stage or it is dropped from further testing. Typically, about six of the best performing cottons are advanced each year. These tests are conducted at eight locations in large field length plots. In addition to the previous measurements, large scale spinning tests using fine count yarns provide the ultimate test of processing performance. After three years of testing, one in the screening and two in the advanced, a cotton is eligible to be approved for production if it is found to meet or exceed the existing standard, currently GC-510.

Results:

Since the law change in 1979 providing for private breeding, more than 300 cottons from a half dozen firms have entered the testing program. Of these, eleven have been approved for commercial production. The latest of these, CPCSD C-2881 and Chembred CBX-7, received approval following the 1990 season. Yield and some of the important quality characteristics, averaged over two years of advanced testing, are shown in the following table.

Table 1.

Variety	Pounds lint per acre			
	Little or no Vert. wilt	Mod. wilt	Heavy wilt	Combined locations
	6 loc's	*2 loc's*	*8 loc's*	*16 loc's*
GC-510 standard	1260	1432	1555	1429
C-2881	1307	1408	1557	1445
CBX-7	1291	1455	1515	1424

Table 2. Fiber and yarn characteristics						
	Fiber				Yarn combed 50's	
Variety	Length inches	Strength gm/tex	Maturity %	Fineness millitex	Strength B.F.	Non-uniformity CV%
GC-510 standard	1.12	29.3	89.8	155	2604	22.2
C-2881	1.15	31.1	82.9	151	2770	21.8
CBX-7	1.15	30.2	83.3	155	2574	22.4

Future plans:

For 1991, thirty-six entries will be accepted into the screening tests and a total of 15 entries will be in the large scale tests. Four of these are advances from the 1990 screening tests, eight are carryovers entering the final year and, for comparison purposes, three are previously approved cottons including the standard.

With recent legislation permitting commercial Pima production, a testing program will be initiated in 1991 paralleling the Acala program but on a smaller scale. Seventeen entries, including Pima S-6, which has been designated the initial standard, will be in screening tests at the Shafter Field Station and the West Side Field Station. Nine entries will be tested at four locations in large scale tests. Measurements of production and fiber and yarn quality appropriate to Extra Long Staple cottons will be carried out.

BIOLOGY AND ECOLOGY OF INSECTS, MITES, AND SPIDERS ON COTTON AND CONTROL.

Report of Progress
University of California, Agricultural Experiment Station
Project Number: CA-D*-Ent-3003-H

Thomas F. Leigh, Entomologist

Report Period: 1/1/90 - 12/31/90

OBJECTIVES: Ascertain the efficacy of predatory mites as managed biological control agents against spider mites on cotton and strategies for their utilization.

Evaluate the relationship of alfalfa management systems to lygus bug infestation development and to utilization of alfalfa as a biological control agent preserve.

Assess cotton cultivar relationship (plant resistance) to cotton pest infestation development and pest impact on plant development and fruiting.

Evaluate cotton cultivar relationship to pesticide resistance in greenhouse whitefly

PROCEDURES: **Predacious Mite Studies.** Predatory mites obtained from a commercial insectary were distributed by hand onto cotton or onto alfalfa strips interplanted in cotton. Treatments compared two predatory mite species (western predatory mite (Metaseiulus occidentalis) and Amblyseius californicus), three release dates and three release rates. The alfalfa interplant experiment utilized the western predatory mite. Numbers of spider mites and predacious mites and thrips and their distribution within cotton plots were determined periodically throughout the late spring and summer period by a leaf wash technique. Distribution of generalist predators across the cotton sample areas was monitored by net sweeping.

Alfalfa Management for Lygus bug Entrapment and Predator Preservation. Alfalfa plantings within alfalfa fields were managed under three strategies; No harvest after a may cutting for weed control, alternate halves cut on a 28 day cycle (one half cut each 14 days), and complete harvest on a 28 day cycle. Lygus bugs and predators were collected approximately biweekly with a vacuum sampler and separated from trash through a berlese funnel. These were identified to developmental stage and counted.

Cotton Cultivar Resistance to Insect Pests. Four commercial cotton cultivars ('Acala SJ-2', 'Pima S-6', 'Prema' and 'C4226') were evaluated for susceptibility to spider mites and aphids in field tests. Development of spider mite infestations was monitored under three pesticide regimens: no treatment, predator elimination with acephate, and predator elimination with acephate but inclusion of an acaricide (abamectin). Spider mite and aphid numbers were determined by leaf wash.

Pesticide Resistance in Greenhouse Whitefly. The cotton cultivars Acala SJ-2, Pima S-6 and `Gumbo 500' were colonized with organophosphate insecticide susceptible and resistant greenhouse whitefly. Colonization success and life table data were recorded.

RESULTS: **Predatory mite research** indicated that western predatory mite (Metaseiulus occidentalis) and Amblyseius californicus, effectively colonized cotton and provided control of spider mite (Tetranychus spp.) infestations. Most effective suppression of spider mite infestations was achieved with early season (June) inoculative predator releases. Spider mite infestation level at which control was achieved with the predators was negatively correlated with numbers released and delay in date of release. A preliminary evaluation of western predatory mite for control of spider mites on corn indicated efficacy.

Experiments with interplanted alfalfa in cotton fields indicate that crop can be colonized with both tetranychid mites and with the western predatory mite. Inoculative releases of western predatory mite, made onto the interplanted alfalfa in early May, increased through early July, declined briefly following alfalfa harvest and peaked again in September. The western predatory mite populations appeared to be responsive to spider mite numbers. The western predatory mite colonized cotton within the 15-20 meter sample area downwind from the alfalfa strips, but did not disperse across the entire area.

In all experiments, throughout the sampling period, species purity of the predatory mite population remained virtually pure, with only a rare non M. occidentalis or A. californicus predatory mite collected.

Sweepnet evaluation of other predator types (big eyed bugs, Geocoris spp.;pirate bugs, Orius tristicolor (White); and thrips, Frankliniella occidentalis Pergande) revealed uniform distribution across the cotton sample areas with no apparent relationship to proximity of alfalfa.

Alfalfa harvest management comparisons resulted in major magnitude lygus bug infestations in alfalfa that was not cut after mid May, with as much as 10 fold greater numbers as in strip cut plots and 100 fold greater than commercial cut plots. Very low numbers were collected in the latter plots which were completely cut on a 28 day cycle. The predacious big eyed bugs and damsel bugs (Nabis americoferus) were common to all three harvest practices with greatest numbers of damsel bugs in the no cut plots, intermediate numbers in the strip cut plots' and low numbers in the commercial harvest practice. Big eyed bug numbers were usually greatest in the strip cut plots. Pirate bug numbers were usually greatest in the no cut and commercial cut practices.

Cotton Cultivar and Pest Interactions indicated resistance in the cultivar Pima S-6 to spider mites. Severe infestations of the cotton aphid developed on all four cultivars, but were significantly greater on Pima S-6 where they caused severe stunting of the plants. There did not appear to be significant variety x predator interaction with predator suppression or use of an acaricide for spider mite suppression having no impact.

Whitefly and cultivar interactions indicate that Gumbo 500 is very resistant to greenhouse whitefly as indicated by reduced colonization success on that cultivar and greatly suppressed oviposition after an initial three to five day period. By the same measures, whitefly were highly successful in colonizing Pima S-6 and were most fecund on that cultivar. Acala SJ-2 appeared to be a less suitable host than Pima S-6, but was not significant from it. Data concerning host effect on insecticide susceptibility has not been analyzed, but appears to indicate differences.

FUTURE PLANS: The predatory mite and alfalfa management aspects of this research program will continue, with inclusion of a full study of spider mite infestation development on silage cultivar corn. Methods for dispersal of predatory mites onto cotton and from alfalfa interplants to cotton will be developed.

EFFICACY OF TEMIK IN ENHANCING GROWTH AND CONTOLLING THRIPS IN COTTON.

E.A. Rechel and B.A. Roberts

OBJECTIVE: To determine if Temik has plant growth regulator qualities and quantifing its benefits to cotton when subjected to thrips.

PROCEDURES: Cotton was grown for 2 months in a growth chamber where insect populations could be controlled. The chamber was programmed to simulate the daily temperature fluctuation of April 6th based on a 7 year average. Every 2 weeks the chamber was reprogrammed to the average temperature of April 20, May 4, and May 18. The four treatments used were A) no Temik no thrips (control), B) Temik applied at seeding at a rate of 5 lbs per acre, C) thrips and no Temik, and D) thrips and Temik which was applied at seeding at 5 lbs per acre. Thrips were added daily to the growth chambers to treatments C and D from 2 days after emergence until the experiment ended. Plant height was recorded every 5 to 7 days. At the end of the experiment leaf area, leaf dry weight, stem dry weight, number of nodes, final height, tap root dry weight, and fine root dry weight were all determined.

RESULTS: There was no statistical difference in plant height among treatments (Fig. 5). However, at the end of the experiment the plants subjected to thrips were generally 1 to 3 cm smaller than the plants not subjected to thrips. Cotton grown with Temik and no thrips had no increase in plant growth above the control in any of the parameters measured (Fig. 1 - 4). As expected thrips caused a significant decrease in plant growth. When Temik was used to control the thrips the plants indeed had a greater biomass and leaf area, but the plants were statistically smaller than the control and Temik alone. The greatest differences were in tap root and fine root dry weights (Fig. 3-4).

FUTURE PLANS: This same experiment will again be conducted in the growth chambers. In addition to the plant growth parameters measured previously leaf area will be determined every 7-9 days, photosynthesis will be measured on the leaf at the 3rd and 4th node at the conclusion of the experiment, final fine root length will be determined, and N, P, and K concentrations in the leaves will be measured upon termination of the experiment. In addition field studies will be conducted to validate these results to a growers situation.

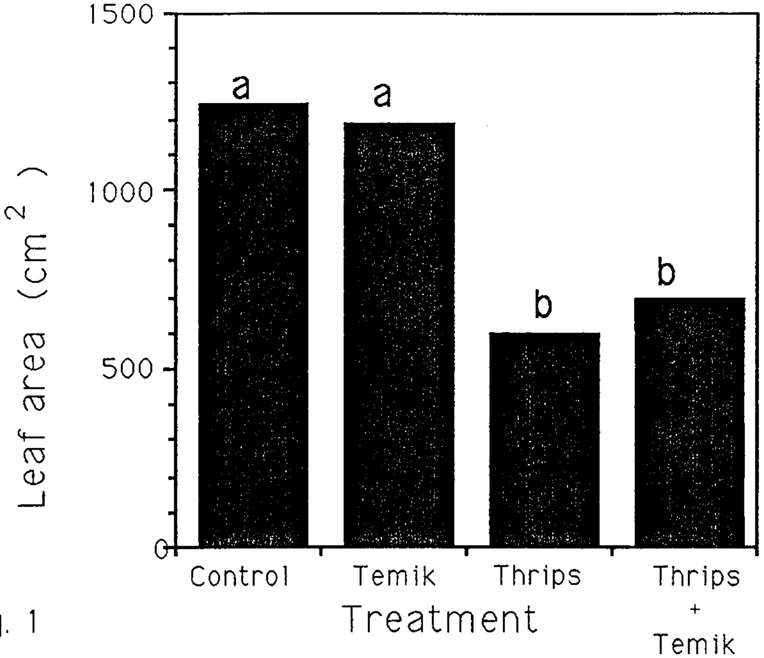

Fig. 1

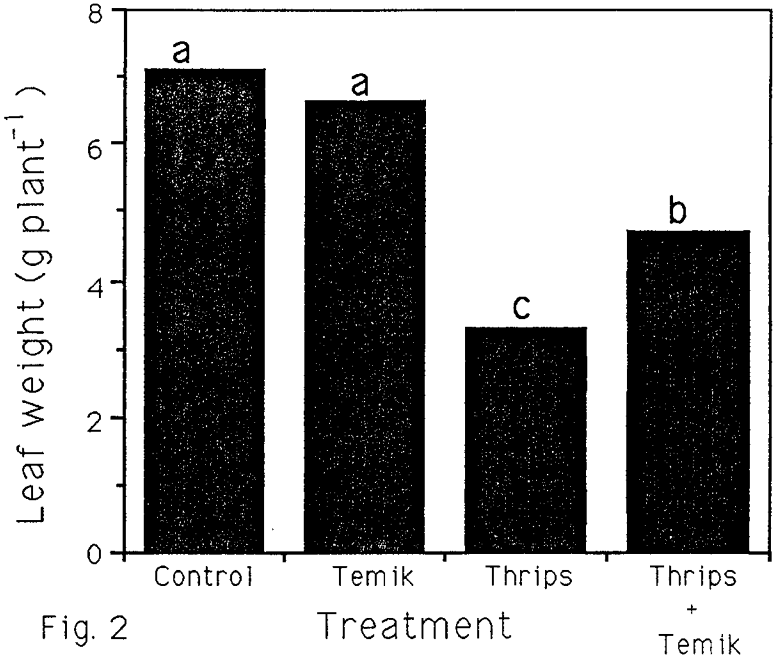

Fig. 2

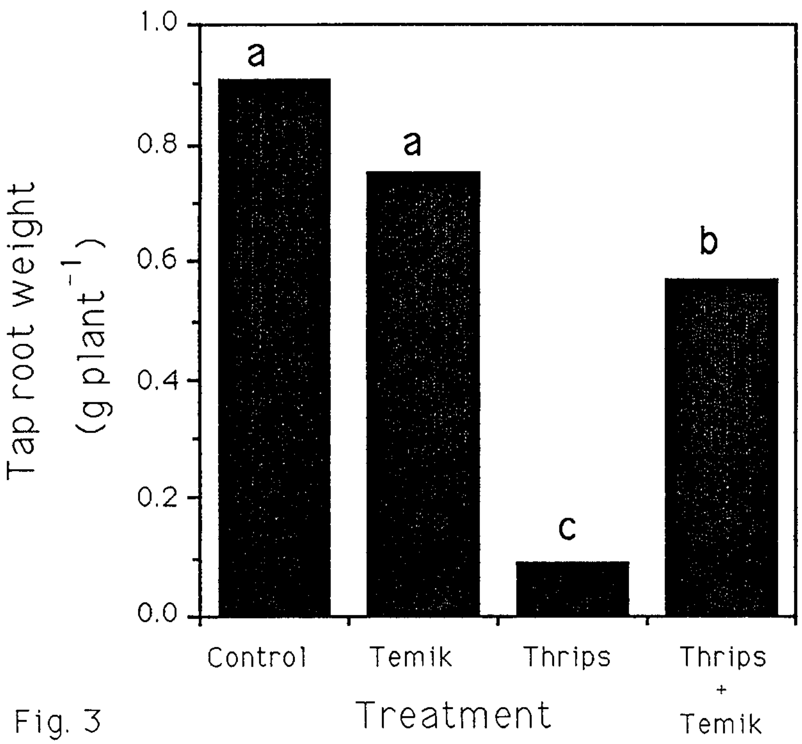

Fig. 3

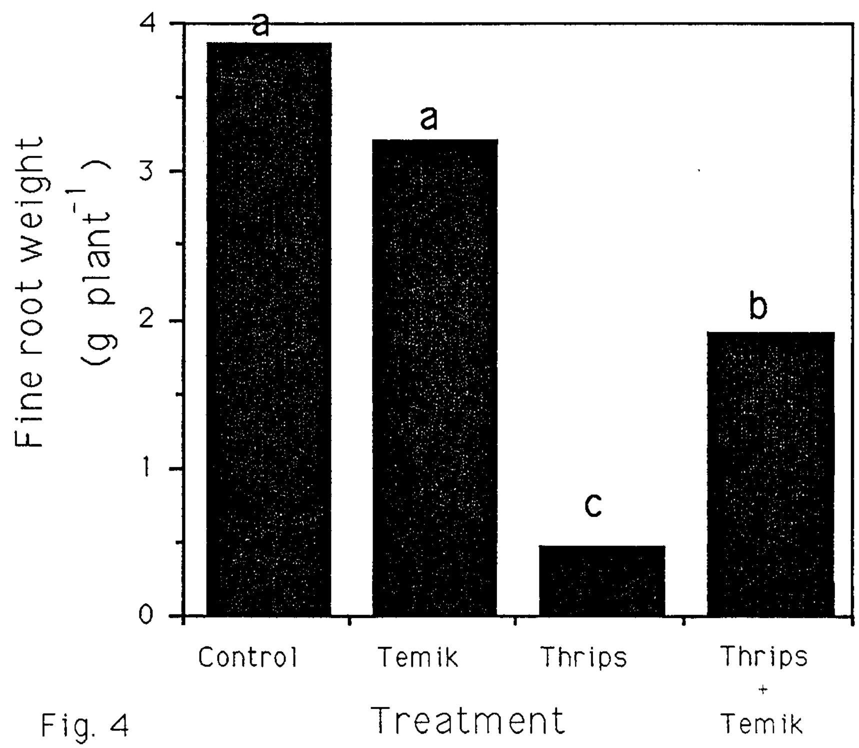

Fig. 4

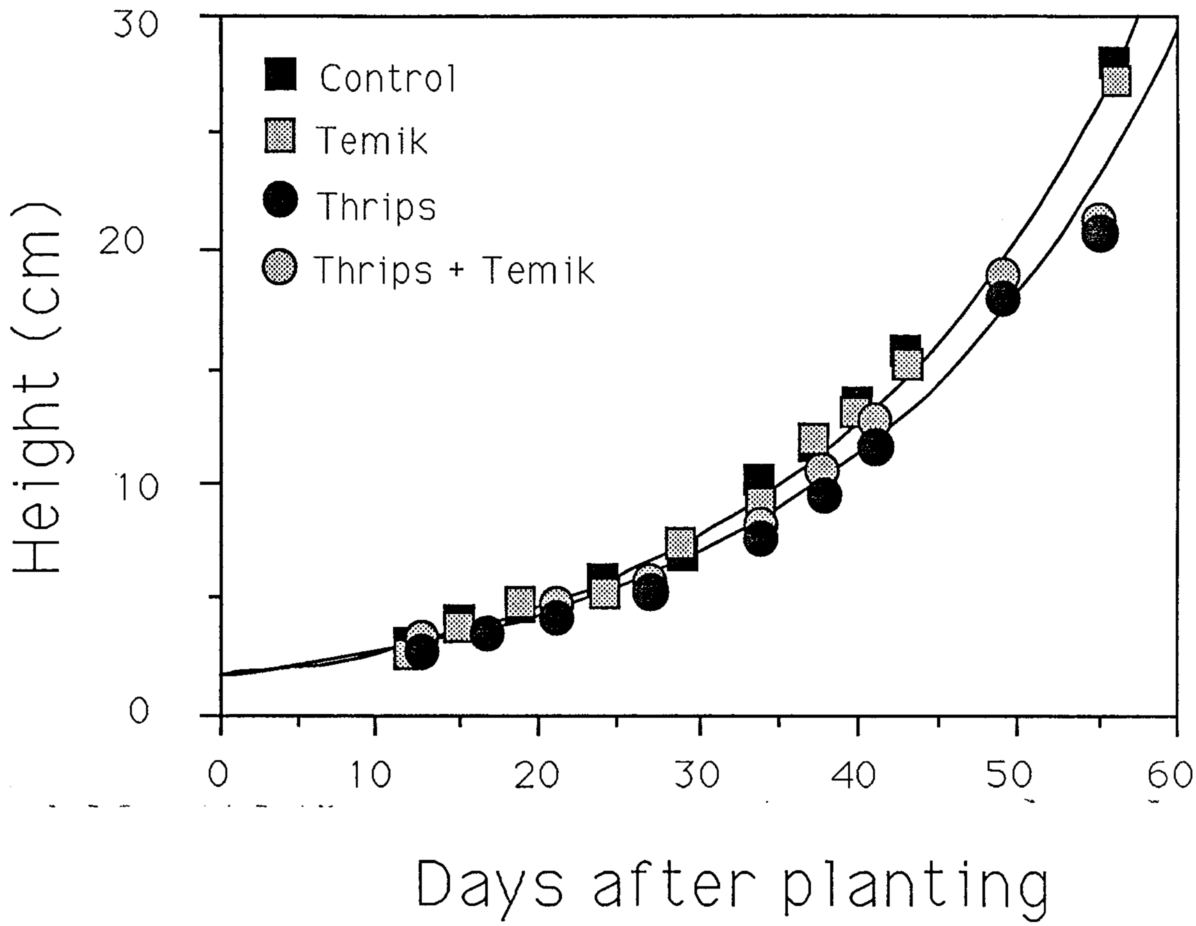
Control
Temik
Thrips
Thrips + Temik
Height (cm)
0
10
20
30
0
10
20
30
40
50
60
Days after planting

Fig. 5

COMPARISON OF SUBSURFACE DRIP AND FURROW IRRIGATION OF COTTON ON TWO SOIL TYPES USING DEEP EVERY-OTHER FURROW PLACEMENT OF DRIPPERLINE.

W.R. DeTar and C.J Phene

OBJECTIVES: To compare subsurface drip to furrow irrigation of Acala cotton on a good soil (uniform, high silt content) and a poor soil (non-uniform, sand streaks and pockets), by measuring growth characteristics, yields, and water use. Also to verify technical feasibility of drip irrigation and to determine problem areas.

PROCEDURES: Equipment procurement and installation began in the Fall of 1989 for a 1.2 ha field located near the southwest corner of our field South 40. Each plot consisted of eight 0.76-m rows 89 m long. There were 5 replications of the 2 treatments in each soil using a randomized complete block experimental design. In the drip treatment, 20 mm O.D. dripperline was used with 4 L/h in-line emitters spaced every 0.6 m. The emitters were of the labyrinth type and Treflan impregnated (to prevent root intrusion) and were placed in the tubing as it was extruded so that there were no joints in the field. The dripperline was placed 0.4 m below grade under every other furrow. The operating pressure was 136 kPa. Canal water was used for both the drip and furrow treatments. The drip water was filtered by sand-media filters and continuously treated with 20 ppm phosphoric acid. Nitrogen fertilizer was applied through the water for both the drip and furrow treatments. The first half of the season, calcium ammonium nitrate (CAN-17) was used and in the last half potassium nitrate was applied. Plans called for 225 kg/ha of N to be applied altogether, but equipment problems limited the N application to 153 kg/ha. At peak water use, furrow irrigation occurred once a week, the amount applied determined by neutron probe readings and a special computer program that helped track soil moisture. Probe readings were taken before and after every irrigation. Infiltration rates were also measured every irrigation using a modified stream advance method along with inflow-outflow measurements. The drip system applied water several times a day using an automated evaporation pan and a special program in a micrologger designed for pan control. A polynomial pan coefficient was multiplied by the hourly pan evaporation, and when the total reached 2 mm, that amount was applied to the field. Operation was limited to daytime application only. The micrologger was accessed by phone from desk-top computers both in Fresno and in the Shafter office. Daily printouts were made of the drip system activity, which included flow rates, pressures, irrigations, and pan levels. Status could be monitored at any time, and when needed, the micrologger program could be changed from our offices. At the beginning of the season 153 L/ha of Vapam was applied to the entire plot area through a sprinkler system to control nematodes.

RESULTS: The field with the "good" soil was about 98% good. The field with the "poor" had varying amounts of good soil in each plot, the amount determined by measuring the areas enclosed by a sharp line of demarcation seen in the height of plants. In the good soil, the drip plot yield was the same as the furrow plots at 1940 kg/ha of lint. In the poor soil the drip treatment out-yielded the furrow plots by 216 kg/ha, the LSD(05) being 162-kg/ha. Using the percent of good soil in each plot as a measured, but uncontrolled variable, it was possible to use covariance analysis to determine what the yields would have been if 100 percent of all plots were poor soil. The results were a lint yield of 1768 kg/ha for the drip treatment and 1563 kg/ha for the furrow treatment on the poor soil. The drip-irrigated plants were consistently taller than the furrow-irrigated plants, and near the end of the season the difference was 0.18 m on both the good and poor soils. The furrow irrigation procedure was as about as efficient as is possible, with only 89 m runs, set times of 8 hours or less, advance ratios of about 8, and a tail-water return system. Even so, the net amount of water applied to the furrow plots for the season was high, 1.17 m on the poor soil and 1.06 m on the good soil. By comparison, the drip treatments used very little water, 0.58 m being applied to on the poor soil and 0.61 m applied to the good soil. The season total for depth of water which infiltrated at the lower end of the fields was almost the same as the depletion measured by the neutron probe data, indicating accurate measurements of infiltration rates.
During the season there was no measurable change in the flow rate to the drip system indicating no clogging, and when the system was re-started in the following Spring there was still no sign of clogging, definitely no problem with root intrusion. There was a surface-sealing problem noted with some of the furrow-irrigated plots, generally occurring in those soils with the best yields.

FUTURE PLANS: Gypsum will be applied to both fields to try to solve the sealing problem. Leaf petiole analysis will be used to better control nitrogen application, and PIX will be applied to the drip treatments on good soil. Vapam will be applied to the furrow treatments through the pre-irrigation furrow water (rather than with sprinklers) at the same rate of 153 L/ha, and the drip treatments will receive 53 L/ha through the drip water. Sprinkler irrigation will be used for pre-irrigation of the drip treatments whenever winter rainfall is insufficient. An attempt will be made to control nitrogen and water on the drip system near the end of the season so that the plants cut out properly. The entire experiment will be repeated for up to 10 years.

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