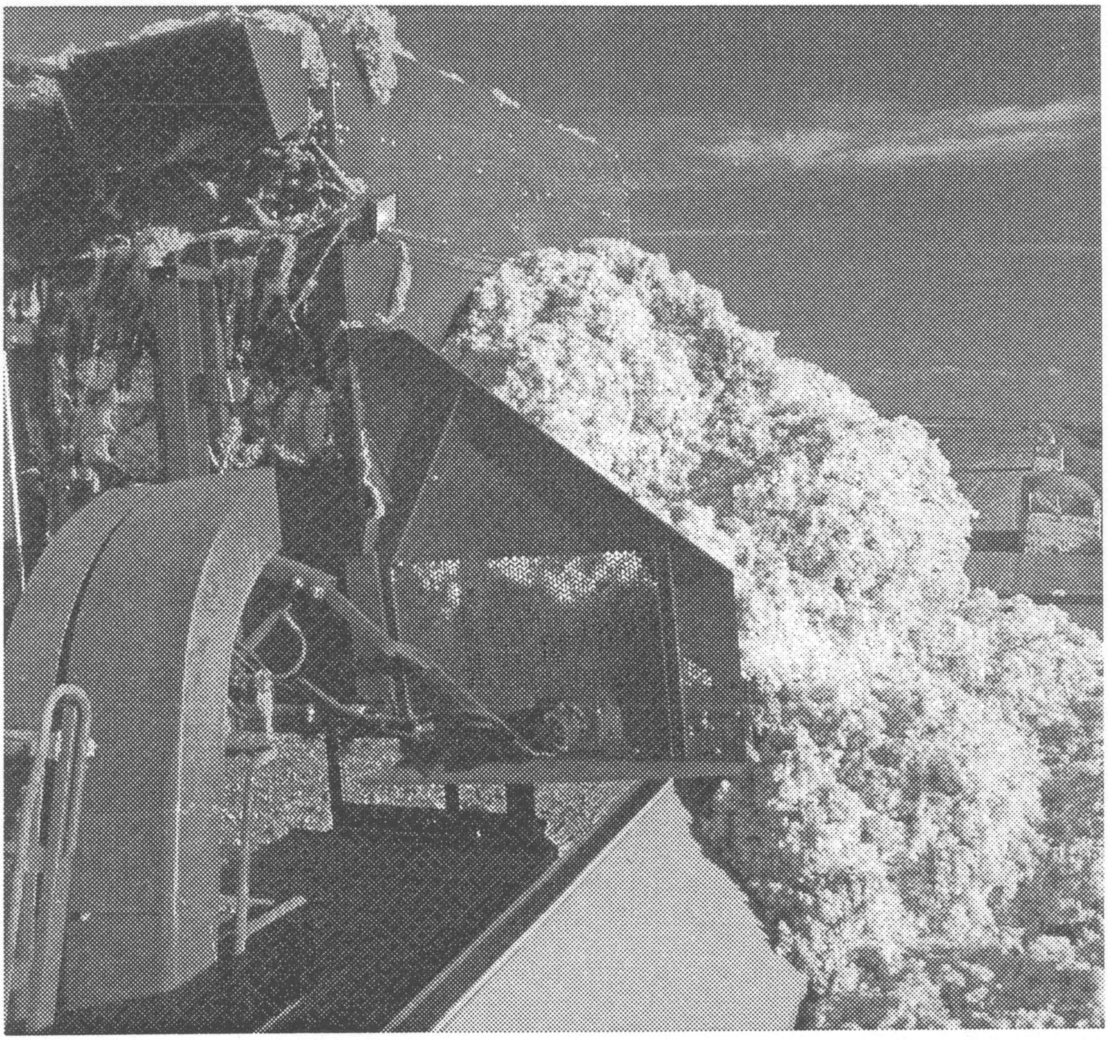

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2001 COTTON RESEARCH REPORT

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John Jensen, Interim Director

Auburn University Auburn, Alabama

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VARIETY TRIALS

Cherokee County Cotton Variety Trial

Charles Burmester and David Derrick

Cherokee County is a large cotton growing area in northeast Alabama with unique soil types that are not represented in the state cotton variety trials. Each year an Extension cotton variety trial is conducted in the area for farmers to use as a guide in conjunction with results from the Alabama Cotton Variety Tests.

In 2001, the trial was conducted on the farm of Randall and Nick McMichen on a Holston fine sandy loam soil. Cotton was planted no-till into a winter cover crop of wheat on May 7 and consisted of eight rows of each variety planted the length of the field.

A total of ten cotton varieties were planted. All varieties were genetically modified and contained the Roundup Ready gene that allows weed control applications with Roundup Ultra until the 4th leaf stage. The cotton variety Paymaster 1218 B/RR was used as a check variety between each plot to reduce field variability. All varieties were spindle picked, and seed cotton was weighed in a boll buggy. A seed cotton sample from each variety was ginned on a tabletop gin for lint percentage and quality.

Cotton growing conditions were excellent in 2001 and resulted in record yields (see table). Insect numbers were very low and only minimal control measures were required. All varieties tested produced more than two and one-half bales. Yields of Stoneville 4892 BR and Fibermax 989 BR led this test site in 2001. Cotton quality was also excellent with no varieties with micronaire reading below 3.5 or length reading below 1.11.

Yield and Quality of Cotton Varieties in the Cherokee County Trial

Variety	Seed cotton yield *lbs/ac*	Lint [1] *%*	Lint *lbs/ac*	Mic. [2]	Length	Unif. [3]	Strength
Stoneville 4892 BR	3,784	0.437	1,654	4.2	1.18	86.9	34.2
Fibermax 989 BR	3,827	0.423	1,619	3.7	1.16	84.3	32.2
Deltapine 436 RR	3,338	0.414	1,381	3.9	1.14	82.9	29.6
Deltapine 451 B/RR	3,427	0.401	1,374	3.5	1.22	85.3	31.2
Stoneville 4793 RR	2,972	0.460	1,367	3.9	1.15	85.9	31.6
Sure Grow 215 RR	3,195	0.423	1,351	4.3	1.14	85.1	29.5
Sure Grow 501 BR	3,070	0.435	1,335	4.3	1.16	85.9	30.6
Paymaster 1218 B/RR	3,102	0.430	1,334	3.9	1.15	85.9	31.6
Paymaster 1199 RR	2,995	0.439	1,315	4.6	1.15	84.3	29.2
Sure Grow 521 R	2,920	0.432	1,261	3.8	1.11	81.6	27.9

[1]Lint % determined on a small cotton gin without cleaners. This percentage is usually higher than normal turn-out at a cotton gin. [2] Mic.=micronaire. [3] Unif.=uniformity.

Black Belt Cotton Variety Trial

Dennis Delaney, C. Dale Monks, Rudy Yates, Jamey Clary, and Kathy Glass

Cotton acreage in the Black Belt region of Alabama has fallen from historic levels, but cotton is still important to the economy of the area and particularly important to the producers who grow it. Area cotton producers asked the Alabama Cooperative Extension System and Alabama Agricultural Experiment Station for help in obtaining up-to-date unbiased information on the unique soils on their farms. Since cotton production requires specialized equipment and experience not available at the area Research and Extension Center, a replicated on-farm variety test using commercial equipment and farm scale plots was established on a producer's field for the second year.

A field was selected on the Stanley Walters' farm near Gallion, Alabama, in Hale County on a Faunsdale clay loam soil. Rows were bedded during the winter, and allowed to settle. All plots were maintained throughout the season with standard, herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. All production practices were carried out across all varieties, regardless of technology or genetically engineered traits.

Twenty-four commercially available varieties were planted on April 30, 2001 with a twelve-row vacuum planter, with approximately three seed per foot of row. Six replications of each variety were planted in a modified randomized complete block design. Each plot consisted of two 38-inch rows approximately 900 feet long of a single variety. Soil moisture was good, and an excellent stand was achieved.

Rainfall was plentiful through most of the season, with only brief periods of dry weather. The plots were defoliated on September 6, when all varieties were ready. Heavy and repeated rains leading to wet soil conditions prevented harvesting until October 26, which led to some lint and quality loss, although overall yields were good. Two replications were combined at harvest, giving three harvested replications of 0.26 acre each for analysis. A weighing boll buggy was used to weigh each replication, and a grab sample was taken. One pound grab samples were ginned on a mini-gin, and analyzed with HVI equipment at the Auburn University Textile Engineering Physical Testing Laboratory.

Premature leaf discoloration and drop due to an undetermined cause has been a recurring problem on many area cotton fields. When similar (but less severe) symptoms occurred in this test, ratings were taken (see table) approximately two weeks before maturity.

The cotton industry has renewed emphasis on lint quality in recent years, and producers have asked to see value-per-acre data instead of just simply yield per acre. Results are presented in the following table, with varieties ranked by value in $ per acre, with lint yield, turnout, quality, and leaf ratings for each variety listed. Value per acre was determined from the USDA loan chart, assuming a base of $0.55 per pound of lint for SLM-41, leaf = 4, and adding or subtracting values from the loan chart for micronaire, length, and strength. No adjustments were made for seed costs or other cultural expenses to these figures. Producers can modify these numbers as needed for their particular situation.

Results showed that there was a range of total value of over $230 per acre from the lowest to highest valued variety, or 373 pounds per acre of lint. There were also significant differences in quality and other measurements. Earlier varieties were likely at a relative disadvantage in the 2001 season due to increased exposure to weathering between maturity and harvest, compared to later varieties.

Area producers can use these results to compare the performance of these varieties on Black Belt soils, with the potential for significantly higher returns from their crop. Producers should not rely on any one source, however, to guide their choices, but should also use other information such as the multi-year data from the Alabama Agricultural Experiment Station Cotton Variety Trials, and other public and private sources.

BLACK BELT COTTON VARIETY TRIAL, HALE COUNTY, ALABAMA

Name	Lint yield *lb/ac*	Turnout *%*	Lint mic. *units*	Lint length *in*	Lint strength *g/tex*	Leaf discoloration [1]	Value [2] *$/ac*	Lint value *cent/lb*
Deltapine DP 491	915	42	37	1.10	28.3	8.0	516.52	56.45
Deltapine DeltaPEARL	881	41	38	1.10	27.3	7.7	497.32	56.45
Deltapine DP 565	874	39	40	1.08	26.9	7.7	493.37	56.45
AgriPro HS 46	886	40	42	1.06	27.7	8.7	489.07	55.20
FiberMax FM 991 RR	815	40	39	1.08	28.5	8.7	460.07	56.45
FiberMax FM 989	792	43	38	1.09	29.5	7.3	449.46	56.75
FiberMax FM 989 BR	805	41	35	1.05	27.5	7.7	442.75	55.00
Deltapine DP 436 RR	753	39	43	1.07	25.9	5.3	414.15	55.00
Sure-Grow SG 215 BR	841	43	41	1.01	24.5	6.3	402.00	47.80
Phytogen PSC 952	757	42	45	1.02	26.2	7.7	389.86	51.50
Paymaster PM 1560 BG	754	43	42	1.03	26.0	6.7	389.82	51.70
Deltapine DP 451 B/RR	756	40	44	1.03	24.6	8.3	381.78	50.50
Phytogen PSC GA 161	675	39	35	1.11	29.1	7.3	381.04	56.45
Deltapine DP 655 B/RR	737	40	35	1.04	26.6	8.0	379.56	51.50
FiberMax FM 989 RR	729	43	36	1.03	28.4	7.3	375.44	51.50
Sure-Grow SG 747	690	43	41	1.05	25.2	7.3	373.98	54.20
Deltapine DP 425 RR	729	40	45	1.03	25.3	6.7	368.15	50.50
Phytogen PSC 355	699	42	46	1.02	26.3	6.3	359.99	51.50
Deltapine NuCotn 33B	701	40	38	1.03	25.2	7.3	355.41	50.70
Sure-Grow SG 501 BR	666	42	44	1.03	26.5	6.0	342.99	51.50
AgriPro HS 4600 RR	680	43	46	0.99	25.1	8.7	324.36	47.70
Sure-Grow SG 521 R	591	41	39	1.02	25.9	7.3	305.55	51.70
Stoneville ST 4892 BR	594	44	40	1.00	25.0	6.7	283.93	47.80
Stoneville ST 4691 B	542	43	40	1.03	25.5	5.7	280.21	51.70
LSD (P=0.10)	71	1.7	6	0.03	1.2	1.8		

[1] Visual rating of premature leaf discoloration approximately two weeks before defoliation; 10 = 100% defoliated.
[2] Value = $0.55/lb of lint for SLM41, lf =4, ± loan premiums and discounts.

COTTON VARIETY RESPONSE TO THE RENIFORM NEMATODE IN SOUTH ALABAMA

K. S. McLean, A. J. Palmateer, N. W. Greer, L. Carter, K. Glass, G. W. Lawrence, and J. R. Akridge

Cotton varieties were examined with and without Telone II for their response to the reniform nematode (*Rotylenchulus reniformis*) in south Alabama. The test was conduced in a producer's field naturally infested with the reniform nematode and monocultured in cotton. The soil was a silty loam. Telone II at a rate of 3 gallons per acre was applied two weeks before planting by injecting the chemical 12 inches deep with shanks directly in the row. Di-Syston at a rate of 7 pounds per acre was applied at planting in the seed furrow with chemical granular applicators attached to the planter.

Plots consisted of one row, 25 feet long with a 36-inch row spacing. All plots were arranged in a split plot design with six replications. Blocks were separated by a 20-foot alley. All plots were maintained with standard production practices recommended by the Alabama Extension System commonly used in the area. Plots were not irrigated.

Population densities of reniform nematode were determined at planting and at harvest. Ten soil cores, 1 inch in diameter and 8 inches deep were collected from the two center rows of each plot in a systematic sampling pattern. Nematodes were extracted using gravity sieving and sucrose centrifugation technique. Plots were harvested on October 18.

The season was cool and dry initially but adequate moisture through the season produced a good cotton growth. Reniform nematode numbers increased in all plots regardless of variety or nematicide (see table). DP 451B/RR, PM 1218BG/RR, SG 521R, and PM 1199RR all produced significantly higher final reniform populations compared to SG 501BR. In treated plots seed cotton yield varied 1034 pounds per acre for the DP 655B/RR and SG 501BR, respectively, without Telone II. Cotton seed yield varied 1087 pounds per acre for the DP 555BG/RR and PhytoGen Phy 72 Acala respectively with the application of Telone II. The application of Telone II increased yields averaged over all varieties by 298 pounds seed cotton per acre. Three varieties—DP 458B/RR, SG 501BR, and PM 1218BG/BR—produced numerically equal or greater yields without Telone II, thus indicating possible tolerance to the reniform nematode.

RENIFORM NEMATODE FINAL POPULATION AND SEED COTTON YIELD FOR SELECTED COTTON VARIETIES

Cotton variety	–Reniform/150cc of soil– Treated [1]	Untreated	—Yield seed cotton [2] — Treated	Untreated
Deltapine NuCotton 33B	5717 bcd	7648 abc	2407 c-j	1914 fgh
Deltapine NuCotton 35B	4017 bcd	7854 abc	2504 b-h	2286 cde
Deltapine DP 5415 RR/	4661 bcd	7081 abc	2281 f-j	2165 def
Deltapine DP 20B	7519 ab	4223 c	2330 e-j	1958 fgh
Deltapine DP 451B/RR	10738 a	7253 abc	2233 hij	2136 d-g
PhytoGen PSC 161	5605 bcd	9322 ab	2697 a-d	2132 d-g
Fiber Max FM 989	4996 bcd	4790 c	2175 ij	2083 efg
Sure-Grow 821	4275 bcd	6103 abc	2310 e-j	2030 efg
Sure-Grow 747	5227 bcd	6309 abc	2707 abc	2571 ab
Paymaster PM 1560BG/RR	5279 bcd	5717 abc	2509 b-h	2155 def
Deltapine DP 436RR	5768 bcd	6257 abc	2315 e-j	1861 ghi
Deltapine DP 458B/RR	4687 bcd	9364 ab	2504 b-h	2503 a-d
Deltapine DP 655B/RR	5279 bcd	5390 abc	2528 b-h	1571 j
PhytoGen PSC 355	4120 bcd	5450 abc	2262 h-j	2025 efg
PhytoGen HS 12	4067 bcd	6566 abc	2625 a-e	2194 def
Stoneville ST 4691B	4481 bcd	8163 abc	2397 c-j	2267 cde
Stoneville ST 4892BR	6978 abc	6232 abc	2649 a-d	2170 def
Sure-Grow 125BR	5176 bcd	5356 abc	2668 a-d	2484 abc
Sure-Grow 501BR	2318 d	7931 abc	2480 b-i	2605 a
Paymaster PM 1218BG/RR	6129 bcd	8025 abc	2146 jk	2286 cde
DP Delta Pearl	6051 bcd	5176 abc	2692 a-d	2504 abc
GARST/AgriPro 1500RR	6566 a-d	4893 bc	2320 e-j	2054 efg
Fiber Max FM 966	3863 bcd	8111 abc	2426 c-j	2093 efg
Sure-Grow 521R	7854 ab	4584 c	2586 b-f	2117 d-g
Deltapine DP 565	3039 cd	9656 a	2393 c-j	1924 fgh
Deltapine DP 491	3966 bcd	5047 bc	2562 b-g	2064 efg
Germain's GC-271	4017 bcd	7768 abc	2774 ab	2301 b-e
PhytoGen Phy 72 Acala	6824 abc	7056 abc	1842 k	1619 ij
Stoneville ST 580	5794 bcd	5974 abc	2383 d-j	2107 efg
Stoneville ST 580	7236 abc	5768 abc	2325 e-j	2146 def
Deltapine DP 555 BG/RR	7819 ab	6206 abc	2929 a	2397 a-d
LSD (P=0.05)	4348	4516	318	285
CV	49	42	11	12

[1] Di-Syston (7 lb/ac - at planting) added in all treatments without Telone II.
[2] See cotton yield in pounds per acre.
Means compared using Fisher's protected least significant difference test (P=0.05).

BIOLOGICAL CONTROLS

THE EFFECTS OF RED IMPORTED FIRE ANTS ON COTTON APHID OUTBREAKS IN ALABAMA COTTON

Ian Kaplan and Micky D. Eubanks

Red imported fire ants, *Solenopsis invicta*, are an invasive species found in high densities throughout the southeastern United States. Agricultural fields are particularly sensitive to fire ants due to their aggressive, predatory nature and the simplified insect fauna found in these systems. Fire ant presence in agricultural systems has been theorized to provide beneficial control of pest species. Alternatively, it has also been hypothesized that fire ants disrupt pest control through interference of natural enemies.

In Southeastern cotton fields, fire ants may interfere with predators of cotton aphids, *Aphis gossypii*. Fire ants and cotton aphids may engage in a mutually beneficial relationship whereby fire ants protect aphids from natural enemies in exchange for honeydew. Aphid honeydew is a sugary solution produced by aphids that ants may use as food.

In both caged greenhouse experiments and large scale field experiments, the following hypotheses were tested: (1) fire ants defend aphids from ladybird beetle larvae and green lacewing larvae, *Chrysoperla carnea*, and (2) this protection contributes to aphid outbreaks. Ladybird beetle and green lacewing larvae were chosen because they are abundant predators that consume large numbers of aphids in Alabama cotton fields. Their consumption rates may regulate aphid populations below levels that are economically damaging. Therefore, fire ant interference may release aphids from these biological control agents. The purpose of this experiment was to document the impact of aphid protection by red imported fire ants on cotton aphid survival.

Caged greenhouse experiments were performed to test the hypotheses. In choice experiments, fire ants more frequently foraged on cotton plants with aphids than on cotton plants without aphids (approximately 103 ants per plant with aphids; approximately five ants per plant without aphids). These data suggest that aphids attract fire ants into the canopy of cotton plants. In other caged experiments, aphids exposed to ladybird beetle or green lacewing larvae demonstrated a significantly higher rate of survival when simultaneously exposed to fire ants. Aphid populations were reduced by 45% in the presence of ladybird beetle larvae and 63% in the presence of green lacewing larvae.

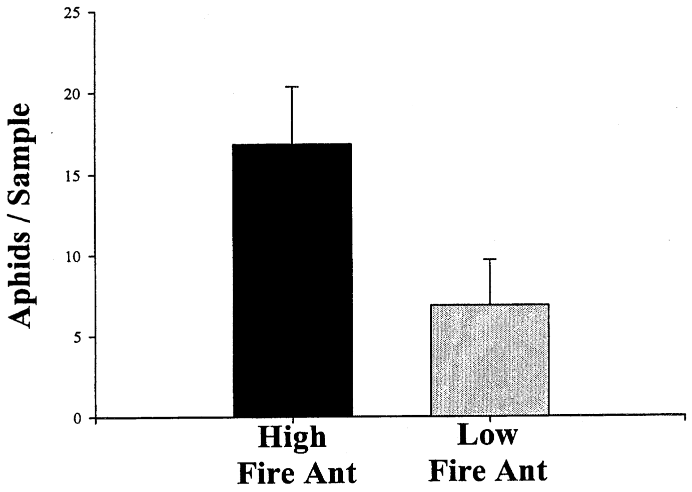
With the addition of fire ants to the aphid-predator treatments, aphid populations approximately doubled. Fire ant response to predator presence was similar between larval types; both types of predators were instantaneously attacked by multiple ants upon detection. Neither predator demonstrated an ability to endure fire ant exposure and subsequent attack; they both suffered significant mortality (approximately 96%). This strongly suggests that fire ants disrupt aphid predation by ladybird beetle and green lacewing larvae.

During the 2000 growing season, aphids were sampled weekly in cotton fields at the E.V. Smith Research Center. Three large fields that were planted with Stoneville BXN47 and one that was planted with Paymaster 1218 BG/RR were sampled. These fields were at least 20 hectares and separated by 1 to 2 kilometers. Two 1.2 hectare plots were established at opposite ends of each field. Plots were separated by at least 100 meters. Plots were divided into two treatments: high fire ant density or low fire ant density. Treatments were assigned randomly and established using Amdro®, a commercially available fire ant bait that decreases fire ant abundance. Amdro was applied manually (1 pound per acre) two to three times during the field season. This treatment was effective at reducing fire ant densities. In Amdro treated field plots, fire ant density was reduced by 72%.

Aphid sampling consisted of visually searching the upper six leaves of a cotton plant and counting all visible aphids on the top and bottom of each leaf. Ten plants per plot were randomly selected to be visually searched. Aphids were significantly more abundant in cotton plots with high densities of fire ants than in cotton plots with experimentally suppressed densities of fire ants (Figure 1).

Results from the greenhouse and field experiments suggest that fire ants promote aphid outbreaks by protecting them from predators. Aphid honeydew appears to be the stimulus for this interaction. Observational evidence and empirical data from greenhouse experiments indicate that fire ant presence alone does not

Figure 1. Numbers of aphids in relation to density of fireants.



have a negative impact on aphid populations. This suggests that fire ants found in the canopy of cotton plants are involved in honeydew retrieval. Aphids, therefore, may serve as a stimulus for ant presence in the canopy of cotton plants. Our data indicates that this may be detrimental to the biological control of aphid populations. Alternatively, fire ant presence on plant foliage has the potential to stimulate the biological control of other pest species through chance encounter. Pest insects in cotton, including caterpillars, stinkbugs, and tarnished plant bugs, can cause great amounts of damage. Therefore the cost of inflated aphid populations needs to be weighed against the benefit of enhanced biological control of alternative pest species. In future studies the effect of this fire ant-cotton aphid interaction on herbivorous insects will be examined.

EVALUATION OF PLANT GROWTH-PROMOTING RHIZOBACTERIA FOR CONTROL OF COTTON SEEDLING DISEASES IN NORTH ALABAMA

N.W. Greer, A.J. Palmateer, K.S. McLean, M.S. Reddy, and J.W. Kloepper

A cotton test was planted on April 11 at the Tennessee Valley Research and Extension Center near Belle Mina, Alabama. The field site was a Decatur silty loam. Two rows of each plot were also infested with millet seed inoculated with *Pythium* spp. and *Rhizoctonia solani*.

Treatments consisted of six plant growth-promoting rhizobacteria (PGPR) treatments and a non-treated control. Among these PGPR strains, GBO3 was produced as industrially formulated endospores, GBO3 plus IN937a was produced similarly and formulated with a chitosan powder, and *Azospirillum brasilense* was in a liquid formulation supplied by Ecosoil, Inc. PGPR strains C4-7-12, OCR7-8-38, and 89B61 were produced under laboratory conditions. All PGPR treatments were mixed with tap water to yield 1.7×10^7 cfu/ml. PGPR were applied as in-furrow sprays at the time of seeding with an 8002E nozzle mounted on the cotton planter and calibrated to deliver 6 gallons per acre at 18 pounds per square inch.

The cotton variety Paymaster PM 1218BG/RR was planted in plots consisting of four rows, 25 feet long with 40-inch row spacing. Plots were arranged in a randomized complete block design with six replications. A 20-foot alley separated blocks. Temik 15G (5 pounds per acre), was applied in-furrow at planting as a nematicide. Plots were maintained with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand health was recorded at two, four, and seven weeks after planting (WAP) and skip index was recorded at seven WAP to determine the percent seedling loss and stand density due to cotton seedling diseases. Plots were harvested for yield on September 27. Data were analyzed using ANOVA and means were compared using Fischer's protected LSD.

Cotton seedling disease incidence was high in 2001 due to cold, wet conditions. Seedling emergence at two WAP ranged from 72% to 64% for the non-treated control and *Camomonas acidovorans* (C4-7-12), respectively (see Table 1). By seven WAP cotton stand ranged from a high of 64% to a low of 54% in the *Azosporillum brasilence* and *C. acidovorans* (OCR7-8-38), respectively. There was no effect by any of the PGPR used, however, on healthy stand of cotton at two, four, and seven WAP compared to the non-treated control. Also, PGPR did not have any effect on

TABLE 1. EFFECT OF SELECTED PGPR STRAINS ON COTTON STAND, SKIP INDEX, AND YIELD UNDER NATURAL DISEASE PRESSURE

Treatment/concentration	Healthy stand[1] plants/25ft April 26	May 9	May 30	Skip index[2] May 30	Seed cotton[3] lb/ac Sept. 27
Non-treated control	73	81	78	2	3762
Bacillus subtilis (GBO3) 1.7×10^7 cfu/ml	74	78	80	1	3498
B. subtilis (GBO3) 1.7×10^7 cfu/ml + *B. amyloliquifaciens* (IN937a) 1.7×10^7 cfu/ml	77	83	74	1	3654
Azosporillum brasilense 1.7×10^7 cfu/ml	63	71	73	3	3489
A. brasilense 1.7×10^7 cfu/ml + *Pseudomonas putida* (89B61) 1.7×10^7 cfu/ml	54	69	67	3	3571
Comamonas acidovorans (C4-7-12) 1.7×10^7 cfu/ml	67	80	76	2	3417
C. acidovorans (OCR7-8-38) 1.7×10^7 cfu/ml	70	83	73	2	3568
LSD (P = 0.05)	20	20	16	3	319

[1] Mean from six replications with 125 seed per row.
[2] Mean skip index per 25 ft of row from six replications based on the rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3 ft gap;...25 = no plants.
[3] Mean seed cotton yield from six replications.

skip index rated at seven WAP. No treatment effects were observed on yield of cotton under the conditions tested, although seed cotton yields ranged from 3762.0 to 3416.6 pounds per acre for the non-treated control and *C. acidovorans* (C4-7-12), respectively.

Under high disease pressure, seedling emergence at two WAP ranged from 34% to 23% for the non-treated control and *A. brasilence*, respectively (see Table 2). By seven WAP cotton stand ranged from a high of 17% to a low of 10% in the *Azosporillum brasilence plus Pseudomonas putida* (89B61) and *A. brasilense*, respectively. There was no effect, however, by any of the PGPR used on healthy stand of cotton at two, four, and seven WAP compared to the non-treated control. PGPR also did not have any effect on skip index rated at seven WAP. No treatment effects were observed on yield of cotton under the conditions tested, although seed cotton yields ranged from 2241.8 to 1837.0 pounds per acre for the non-treated control and *C. acidovorans* (C4-7-12), respectively.

TABLE 2. EFFECT OF SELECTED PGPR STRAINS ON COTTON STAND, SKIP INDEX, AND YIELD UNDER HIGH DISEASE PRESSURE

Treatment/concentration	Healthy stand[1] plants/25ft April 26	May 9	May 30	Skip index[2] May 30	Seed cotton[3] *lb/ac* Sept. 27
Non-treated control	42	29	22	14	2242
Bacillus subtilis (GBO3) 1.7 x 10^7 cfu/ml	30	19	15	16	1861
B. subtilis (GBO3) 1.7 x 10^7 cfu /ml + *B. amyloliquifaciens* (IN937a) 1.7 x 10^7 cfu /ml	33	23	15	15	1956
Azosporillum brasilense 1.7 x 10^7 cfu /ml	29	17	13	16	1929
A. brasilense 1.7 x 10^7 cfu /ml + *Pseudomonas putida* (89B61) 1.7 x 10^7 cfu /ml	36	30	22	13	1929
Comamonas acidovorans (C4-7-12) 1.7 x 10^7 cfu /ml	39	25	17	16	1837
C. acidovorans (OCR7-8-38) 1.7 x 10^7 cfu /ml	37	20	18	15	2141
LSD ($P = 0.05$)	12	13	9	5	374

[1] Mean from six replications with 125 seed per row.
[2] Mean skip index per 25 ft of row from six replications based on the rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3 ft gap;... 25 = no plants.
[3] Mean seed cotton yield from six replications.

EVALUATION OF PLANT GROWTH-PROMOTING RHIZOBACTERIA FOR CONTROL OF COTTON SEEDLING DISEASES IN CENTRAL ALABAMA

N.W. Greer, A.J. Palmateer, K.S. McLean, M.S. Reddy, and J.W. Kloepper

A cotton test was planted on April 19 at the E.V. Smith Research Center near Shorter, Alabama. The field site was a sandy loam. Two rows of each plot were also infested with millet seed inoculated with *Pythium* spp. and *Rhizoctonia solani*.

Treatments consisted of six plant growth-promoting rhizobacteria (PGPR) treatments and a nontreated control. Among these PGPR strains, GBO3 was produced as industrially formulated endospores, GBO3 plus IN937a was produced similarly and formulated with a chitosan powder, and *Azospirillum brasilense* was in a liquid formulation supplied by Ecosoil Inc. PGPR strains C4-7-12, OCR7-8-38, and 89B61 were produced under laboratory conditions. All PGPR treatments were mixed with tap water to yield 1.7 x 10^7 cfu/ml. PGPR treatments were applied as in-furrow sprays at time of seeding with an 8002E nozzle mounted on the cotton planter and calibrated to deliver 6 gallons per acre at 18 pounds per square inch .

The cotton variety Paymaster PM 1218BG/RR was planted in plots consisting of four rows, 25 feet long with an in-row spacing of 40 inches. Plots were arranged in a randomized complete block design with six replications. A 20-foot alley separated blocks. Temik 15G (5 pounds per acre), was applied in-furrow at planting as a nematicide. Plots were maintained with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Healthy stand was recorded at two, four, and six weeks after planting (WAP) and a skip index was recorded at six WAP to determine the percent seedling loss and stand density due to cotton seedling diseases. Plots were harvested to determine yield on September 10. Data were analyzed using ANOVA and means were compared using Fisher's protected LSD.

Cotton seedling disease incidence was high in 2001 due to cold, wet conditions. Seedling emergence at two WAP ranged from 72% for the non-treated control and *Bacillus subtilus* (GBO3) plus *B. amyloliquifaciens* (IN937a) treatment, to 64% for the *Camomonas acidovorans* (C4-7-12) treatment (see Table 1). By six WAP, cotton stands ranged from a high of 64% to a low of 54% in the *Azosporillum brasilence plus* 89B61 and *C. acidovorans* (OCR7-8-38) treatments, respectively. There was no effect, however, by any of the PGPR treatments used on healthy stand of cotton at two, four, and six WAP compared to the non-treated control. PGPR treatments also did not have any effect on skip index rated at six WAP. No treatment was observed to have a higher yield than the non-treated control although there were differences between treatments under the conditions tested. The *A. brasilense*, *A. brasilense* plus *Pseudomonas putida* (89B61), and the *C. acidovorans* (C4-7-12) treatments all had yields significantly (P = 0.05) lower than the non-treated control. Additionally, the *C. acidovorans* (C4-7-12) treatment had a significantly lower yield than both the *B. subtilis* and the *C. acidivorans* (OCR7-8-38) treatments.

Under high disease pressure, seedling emergence two WAP ranged from 71% to 55% for the *A. brasilence* and *A. brasilence* plus *Pseudomonas putida* (89B61) treatments, respectively (see Table 2). By six WAP cotton stand ranged from a high of 65% to a low of 46% in the *Comamonas acidovorans* (C4-7-12) and *A. brasilense* plus *P. putida* (89B61) treatments, respectively. There was no effect, however, by any of the PGPR treatments used on healthy stand of cotton at two, four, and six WAP compared to the non-treated control. PGPR treatments also did not have any effect on skip index rated at six WAP. No treatment effects were observed on yield of cotton under the conditions tested, although seed cotton yields ranged from 3736 to 3326 pounds per acre for the *C. acidovorans* (OCR7-8-38) and *C. acidovorans* (C4-7-12), respectively.

TABLE 1. EFFECT OF PGPRS ON COTTON STAND, SKIP INDEX, AND YIELD UNDER NATURAL DISEASE PRESSURE

Treatment/concentration	Healthy stand[1] plants/25ft May 3	May 16	May 31	Skip index[2] May 31	Seed cotton[3] lb/ac Sept. 10
Non-treated control	90	84	78	1	4070 a
Bacillus subtilis (GBO3) 1.7 x 10^7 cfu/ml	89	77	74	2	3973 a
B. subtilis (GBO3) 1.7 x 10^7 cfu/ml + *B. amyloliquifaciens* (IN937a) 1.7 x 10^7 cfu/ml	90	75	78	2	3590 abc
Azosporillum brasilense 1.7 x 10^7 cfu/ml	83	79	75	2	3375 bc
A. brasilense 1.7 x 10^7 cfu/ml + *Pseudomonas putida* (89B61) 1.7 x 10^7 cfu/ml	86	82	80	1	3366 bc
Comamonas acidovorans (C4-7-12) 1.7 x 10^7 cfu/ml	80	77	80	1	319 c
C. acidovorans (OCR7-8-38) 1.7 x 10^7 cfu/ml	88	78	68	3	381 ab
LSD (P = 0.05)	16	15	16.	2	570

[1] Mean from six replications with 125 seed per row.
[2] Mean skip index per 25 ft of row from six replications based on the rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3 ft gap;...25 = no plants.
[3] Mean seed cotton yield from six replications.
Means within columns followed by the same letter are not significantly different according to LSD (P = 0.05).

TABLE 2. EFFECT OF PGPRS ON COTTON STAND, SKIP INDEX, AND YIELD UNDER HIGH DISEASE PRESSURE

Treatment/concentration	Healthy stand[1] plants/25ft May 3	May 16	May 31	Skip index[2] May 31	Seed cotton[3] lb/ac Sept. 10
Non-treated control	83	72	69	2	3441
Bacillus subtilis (GBO3) 1.7 x 10^7 cfu/ml	81	69	74	1	3379
B. subtilis (GBO3) 1.7 x 10^7 cfu/ml + *B. amyloliquifaciens* (IN937a) 1.7 x 10^7 cfu/ml	85	77	77	1	3555
Azosporillum brasilense 1.7 x 10^7 cfu/ml	88	80	78	0	3687
A. brasilense 1.7 x 10^7 cfu/ml + *Pseudomonas putida* (89B61) 1.7 x 10^7 cfu/ml	69	58	57	0	3648
Comamonas acidovorans (C4-7-12) 1.7 x 10^7 cfu/ml	85	77	81	1	3326
C. acidovorans (OCR7-8-38) 1.7 x 10^7 cfu/ml	77	57	60	1	3736
LSD (P = 0.05)	21	28	27	1	552

[1] Mean from six replications with 125 seed per row.
[2] Mean skip index per 25 ft of row from six replications based on the rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3 ft gap;...25 = no plants.
[3] Mean seed cotton yield from six replications.

EVALUATION OF COTTON TRANSPLANTS TREATED WITH PLANT GROWTH-PROMOTING RHIZOBACTERIA IN NORTH ALABAMA

N.W. Greer, A.J. Palmateer, K.S. McLean, M.S. Reddy, and J.W. Kloepper

A cotton test was planted on April 11 at the Tennessee Valley Research and Extension Center near Belle Mina, Alabama. The field site was a Decatur silty loam.

Treatments consisted of four transplant treatments, two with a commercial preparation, BioYield™, which contains *Paenobacillus macerans* strain GBO3 and *Bacillus amyloliquifaciens* strain IN937a, and two without BioYield™. A non-treated direct seeding control and an in-furrow spray direct seeding control with BioYield™ were also used. BioYield™ transplant treatments were mixed with a soil-less medium, and cotton was planted into Styrofoam trays with an individual cavity size of 1.6 in^2 and a volume of 2.1 in^3. Non-treated transplants were planted the same way. All transplants were grown in the greenhouse until they were three to four weeks old. They were then manually planted in the field. The BioYield™ in-furrow spray was mixed with tap water to yield 1.7×10^7 cfu/ml and was applied with an 8002E nozzle mounted on the cotton planter and calibrated to deliver 6 gallons per acre at 18 pounds per square inch. Cotton was transplanted at a rate of two plants per foot and seeded at a rate of five seed per foot of row.

The cotton variety Paymaster PM 1218BG/RR was planted in plots consisting of four 25-foot long rows with only one row being transplanted. There was a between row spacing of 40 inches. Plots were arranged in a randomized complete block design with four replications. A 20-foot alley separated blocks. Plots were maintained with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Percent stand and skip index were recorded at two, four, and seven weeks after planting (WAP) to determine the percent seedling loss and stand density due to cotton seedling diseases. Plots were harvested to determine yield on September 27. Data were analyzed using ANOVA and means were compared using Fischer's protected LSD.

Cotton seedling disease incidence was high in 2001 due to cold, wet conditions. Seedling survival at two WAP ranged from 100% to 46% for the four-week-old transplants without BioYield™ and the two seeded controls, respectively (see table). By seven WAP cotton stand ranged from a high of 99% to a low of 48% in the four-week-old transplants without BioYield™ and the two seeded controls, respectively. There were differences from the control by all of the transplant treatments on healthy stand of cotton at two, four, and seven WAP. No treatment effects were observed on yield of cotton under the conditions tested, although seed cotton yields ranged from 3155 to 2752 pounds per acre for the three-week-old transplants with BioYield™ and the three-week-old transplants without BioYield™, respectively.

EFFECT OF BIO YIELD™ ON COTTON AS MEASURED BY PERCENT SURVIVAL AND YIELD

Treatment	Healthy stand [1] % survival April 26	May 9	May 30	Seed cotton [2] *lb/ac* Sept. 27
4-week-old transplants with BioYield™	81 b	81 b	79 b	3102
3-week-old transplants with BioYield™	94 ab	92 ab	90 ab	3155
4-week-old transplants without BioYield™	100 a	100 a	99 a	2759
3-week-old transplants without BioYield™	98 a	97 a	95 a	2752
Non-treated control	45 c	50 c	51 c	3102
Seeding with BioYield™	46 c	50 c	48 c	2871
LSD (P = 0.05)	15	14	14	703

[1] Mean from four replications with seeding rate at 125 seed per row, and transplanting rate at 50 plants per row.
[2] Mean seed cotton yield from four replications.
Means within a column followed by the same letter are not significantly different according to LSD (P = 0.05).

EVALUATION OF COTTON TRANSPLANTS TREATED WITH PLANT GROWTH-PROMOTING RHIZOBACTERIA IN CENTRAL ALABAMA

N.W. Greer, A.J. Palmateer, K.S. McLean, M.S. Reddy, and J.W. Kloepper

A cotton test was planted on April 19 at the E.V. Smith Research Center near Shorter, Alabama. The field site was a sandy loam.

Treatments consisted of four transplant treatments, two with a commercial preparation, BioYield™, which contains *Paenobacillus macerans* strain GBO3 and *Bacillus amyloliquifaciens* strain IN937a, and two without BioYield™. A non-treated direct seeding control and an in-furrow spray direct seeding control with BioYield™ were also used. BioYield™ transplant treatments were mixed with a soil-less medium, and cotton was planted into Styrofoam trays with an individual cavity size of 1.6 square inches and a volume of 2.1cubic inches. Non-treated transplants were planted the same way. All transplants were grown in the greenhouse until they were three to four weeks old. They were then manually planted in the field. The BioYield™ in-furrow spray was mixed with tap water to yield 1.7 x 10^7 cfu/ml and was applied with an 8002E nozzle mounted on the cotton planter and calibrated to deliver 6 gallons per acre at 18 pounds per square inch.

The cotton variety Paymaster PM 1218BG/RR was transplanted at a rate of two plants per foot and seeded at a rate of five seed per foot. Plots consisted of four 25-foot long rows with only one row being transplanted. There was a between row spacing of 40 inches. Plots were arranged in a randomized complete block design with six replications. A 20-foot alley separated blocks. Plots were maintained with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Percent stand and skip index were recorded at two, four, and six weeks after planting (WAP) to determine the percent seedling loss. Plots were harvested to determine yield on September 10. Data were analyzed using ANOVA and means were compared using Fisher's protected LSD.

Cotton seedling disease incidence was high in 2001 due to cold, wet conditions. At two and six WAP, the four-week-old transplants without BioYield™ had a significantly (P = 0.05) higher stand count than the seeding with BioYield™ control (see table). At four WAP, the four-week-old transplants without BioYield™ had a significantly higher stand count than both seeded controls. There were no differences in yield among the transplant treatments, but all had significantly lower yields than the seeded controls.

EFFECT OF BIO YIELD™ ON COTTON STAND AND YIELD

Treatment	Healthy stand [1] % survival May 3	May 16	May 31	Seed cotton [2] lb/ac Sept. 10
4-week-old transplants with BioYield™	79	76	75	2728 b
3-week-old transplants with BioYield™	84	77	77	2803 b
4-week-old transplants without BioYield™	91	88	86	2807 b
3-week-old transplants without BioYield™	81	75	73	2812 b
Non-treated control	81	74	77	3309 a
Seeding with BioYield™	76	64	68	3441 a
LSD (P = 0.05)	11	11	12	452

[1] Mean from four replications with seeding rate at 125 seed per row, and transplanting rate at 50 plants per row.
[2] Mean seed cotton yield from six replications.
Means within columns followed by the same letter are not significantly different according to LSD (P = 0.05).

CROP PRODUCTION

ROW SPACING AND SKIP ROWS FOR COTTON IN CENTRAL ALABAMA

Dennis Delaney, C. Dale Monks, Bob Goodman, and Bobby Durbin

An experiment was established in central Alabama to investigate the potential for 30-inch row cotton compared to 40-inch rows, as well as the potential for skip row planting to reduce seed and other costs of production.

Cotton was planted on May 2, 2001 at the E.V. Smith Research Center Field Crops Unit on a Compass silt loam soil. Sure-Grow 125 BR cotton was planted in 30- and 40-inch rows, with and without a full skip every two rows ("2 and 1"). The experimental design was a randomized complete block with four replications. Plot size was 25 feet long and eight row widths wide for the respective treatment. Recommended production practices, such as fertility, weed and insect control, and growth regulators were followed. Seeding rate and in-furrow insecticides and fungicides at planting were adjusted to supply equivalent rates per acre, while pre-emergence herbicides and fertilizers were broadcast.

Cotton was harvested from the two center rows of each plot on September 17 with spindle pickers adapted for plot harvesting and their respective row spacings. Seed cotton was weighed and approximately 1-pound grab samples were taken. Samples were processed on a 10-saw mini-gin, and lint samples analyzed by the Auburn University Textile Engineering HVI Laboratory. Returns above variable costs were calculated using Alabama Cooperative Extension System Cotton Budgets adjusted for expenses with each system.

Yields and returns above specified variable costs are shown in the table. Lint yield was highest with 40-inch solid cotton, followed by 30-inch solid, 30-inch skip, and then 40-inch skip. Net returns nearly followed yields with 40-inch solid ≥ 30-inch skip ≥ 30-inch solid > 40-inch skip. Yields and returns for 40-inch cotton were reduced by using a skip row, while those of the 30-inch rows were not statistically different @ P = 0.10. There were statistically significant interaction effects of row spacing and of net returns ($P \leq 0.05$) for the treatment combinations.

YIELDS AND RETURNS FOR 30- AND 40-INCH ROWS, WITH AND WITHOUT FULL SKIPS

Row spacing	Lint yield *lb/ac*	Net return [1] *$/ac*
30-inch solid	1285	377
30-inch skip	1222	387
40-inch solid	1391	435
40-inch skip	1031	281
LSD @ P = 0.10	150	83

[1] $/ac above variable costs.

Lint turnout was slightly increased by solid planting (40.6% vs. 39.2% for skip). Uniformity, micronaire, length, and strength were not affected by row spacing or skip row treatments or their interactions.

These data indicate that in a year with relatively good weather and high yields, the traditional 40-inch solid row spacing offered the highest lint yields and returns to producers, and that lint quality was not affected by any of the treatments.

SPRINKLER AND SUBSURFACE DRIP IRRIGATION, TENNESSEE VALLEY RESEARCH AND EXTENSION CENTER

Larry M. Curtis, Charles H. Burmester, David H. Harkins, B. E. Norris, and James W. Baier

Three experiments involving application and use of sprinkler and subsurface drip irrigation continued in 2001 at the Tennessee Valley Research and Extension Center, Belle Mina, Alabama. The experiments were as follows:

Sprinkler irrigation water requirements and irrigation scheduling. This experiment was established in 1999 to evaluate a range of irrigation application capabilities to identify the minimum design flow rate that will produce optimum yields. Treatments included four sprinkler irrigation capabilities and a nonirrigated treatment. Irrigation was managed using soil moisture sensors and Moiscot (a spreadsheet-based scheduling method). The irrigation capabilities were (1) 1 inch every 12.5 days, (2) 1 inch every 6.3 days, (3) 1 inch every 4.2 days, and (4) 1 inch every 3.1 days.

The results for 1999, 2000, and 2001 are presented in Figure 1. Minimal yield differences were noted in 2001 while significant differences were measured in 1999 and 2000. Rainfall variability and treatment effects accounted for the wide range of yield responses for each of these years.

Subsurface drip irrigation (SDI) placement and irrigation water requirements. This experiment was initiated in 1998 to evaluate placement of SDI relative to crop row direction and row spacing and to evaluate water requirements for cotton production us-

Figure 1. Sprinkler irrigated cotton yield results.

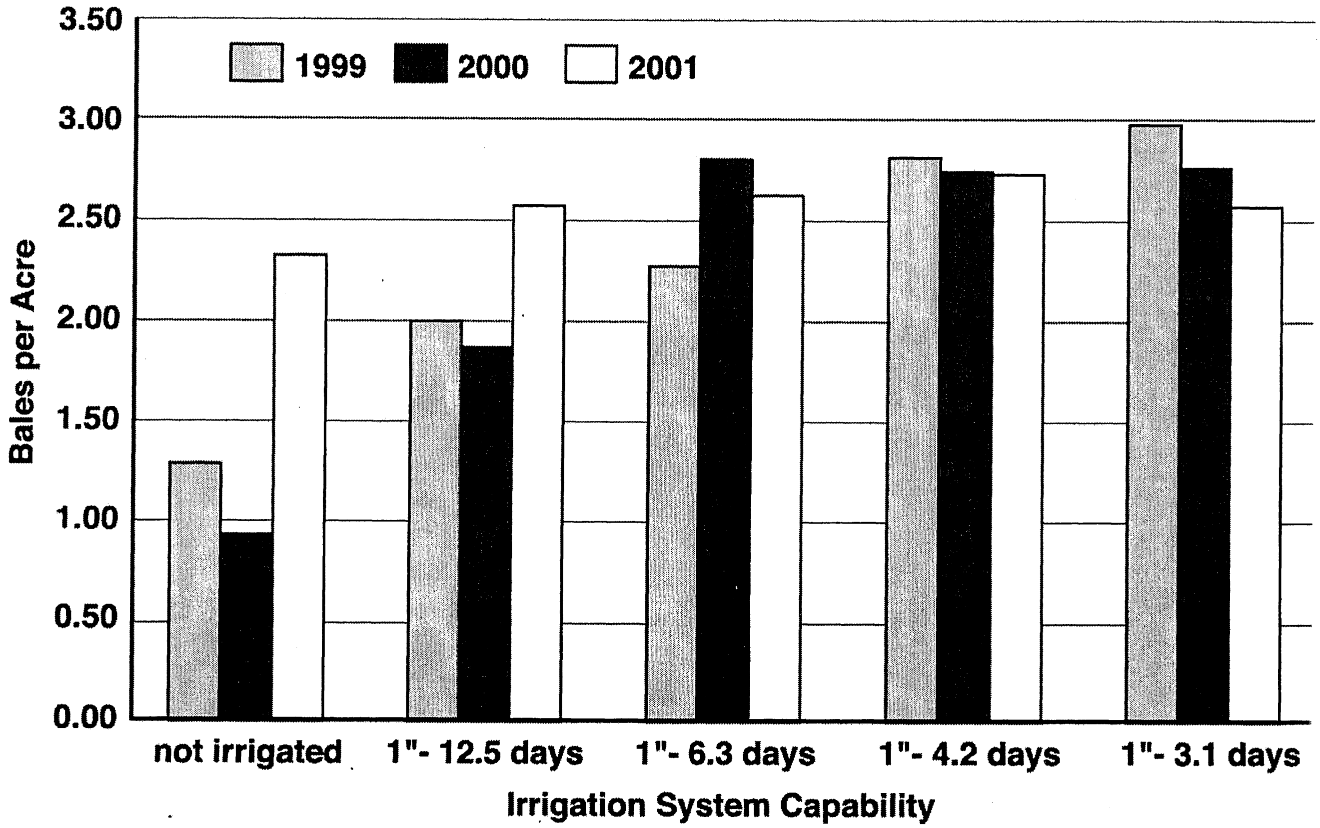
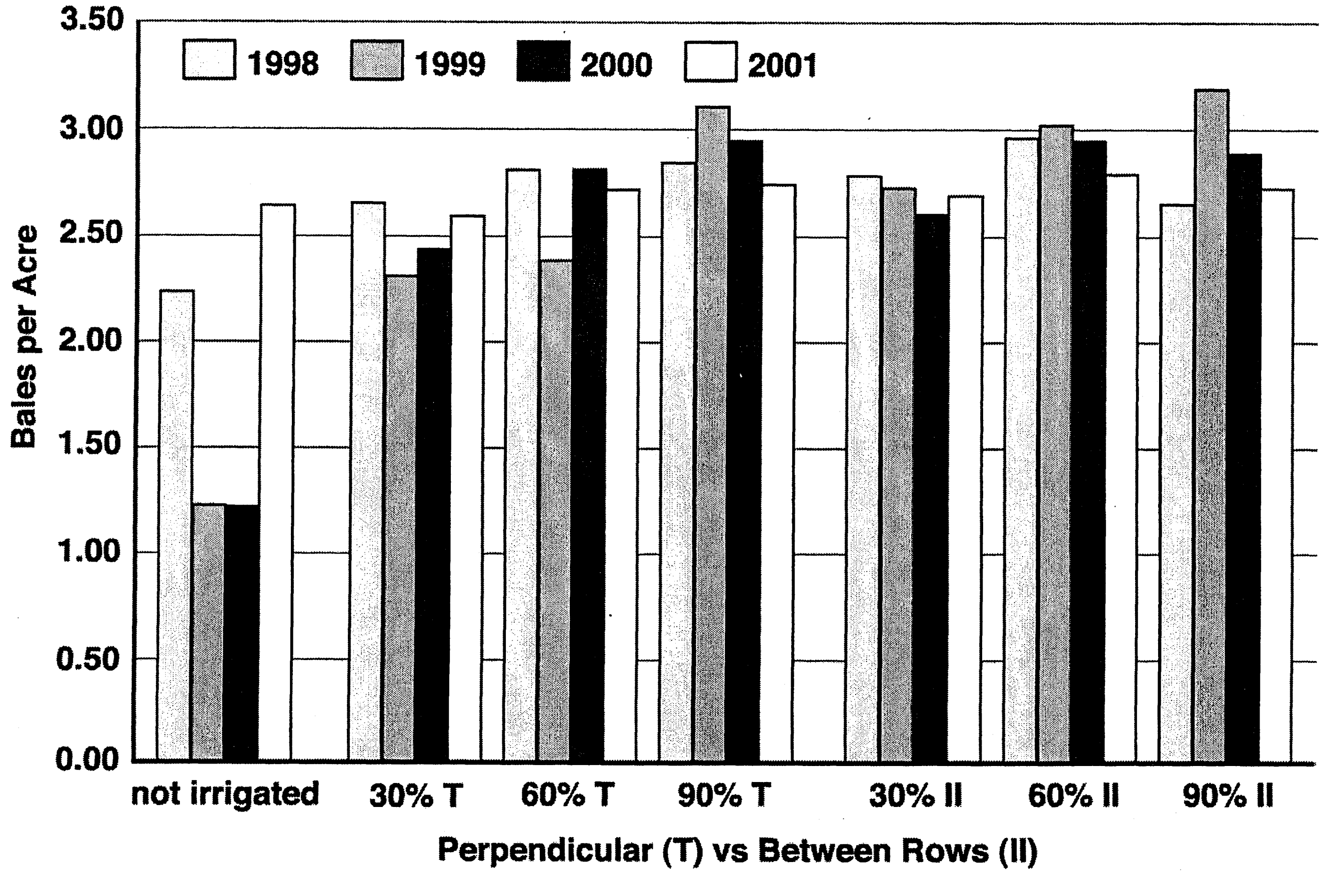


Figure 2. Drip placement and irrigation scheduling.



ing SDI. Drip tubing was buried 15 inches deep with emitters at two-foot intervals along the tubing. Tubing placement treatments were (1) between every other row—80 inch spacing between drip lines and (2) perpendicular to rows—80-inch spacing between drip lines

Irrigation treatments were based on daily applications equal to 30%, 60%, and 90% of pan evaporation after full crop canopy with adjustments based on percent canopy prior to full canopy cover. Yield results for four years (1998 through 2001) are presented in Figure 2.

Subsurface drip irrigation (SDI) tape products and fertigation. A SDI study initiated in 1998 was designed to compare five different drip irrigation tape products with a fertigation component included. This study was installed in an area where continuous crops have been produced for many years. Emitters were located two feet along the tape with tape buried 15 inches between every other row. Rows 340 feet in length were used to better simulate field conditions. Each tape product was evaluated using a single (conventional) surface applied sidedress versus multiple sidedress applications injected through the SDI system. (see table). A tape product was also used on the surface using a conventional fertilizer treatment.

In 1998 little difference between fertility treatments was observed. In 1998 sufficient rainfall occurred late in the growing season so that fertilizer in the upper layers of the soil was more readily available. In 1999, extremely dry conditions in the upper layers of the soil profile made conventional applied fertilizer less available resulting in yield reduction compared to fertilizer applied through the irrigation system. In 2001 initiation of fertigation was inadvertently delayed more than two weeks. Even though the fertigation schedule was modified to insure that all scheduled fertilizer was applied, the delay reduced fertigated yields.

Significant yield differences were observed each year between nonirrigated plots and tape plots with fertility treatments. Figures 3 and 4 illustrate yield results for 1998 through 2001 for conventional and fertigated treatments. To date only minimal differences have been observed between the different drip irrigation tape products.

VARIOUS APPLICATIONS USED TO EVALUATE TAPE PRODUCTS

	——Irrigated——			Nonirrigated
	Fertigated	Conventional	Drip tape on surface	
Preplant	75#N + 60#K	75#N + 60#K	75#N + 60#K	75#N + 60#K
Sidedress [1]	60#N + 60#K	60#N + 60#K	60#N + 60#K	60#N

[1] All sidedress was applied at early to mid-square for the conventional and surface drip tape treatments; the sidedress treatment was divided into eight equal applications for the fertigated treatments beginning at early to mid-square.

Figure 3. Conventional fertility program and tape comparison.

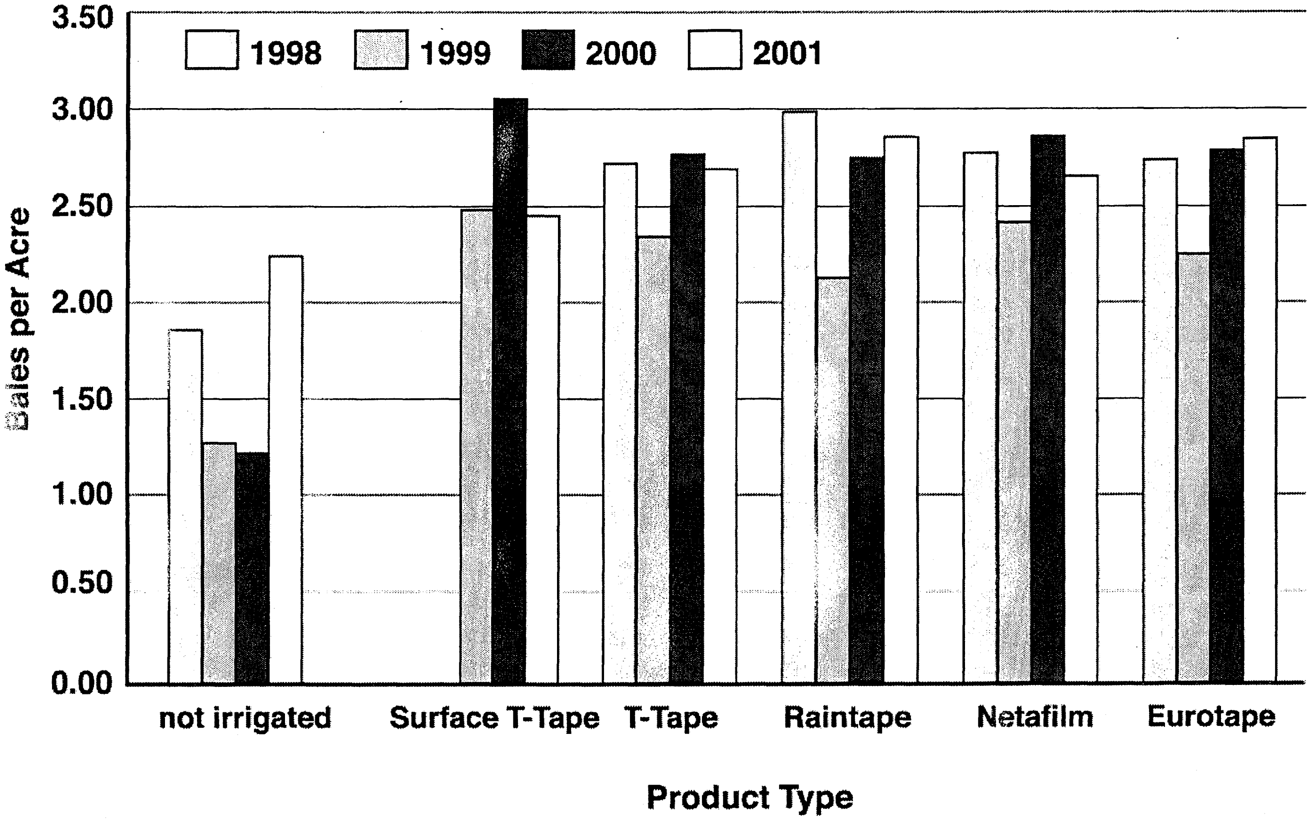
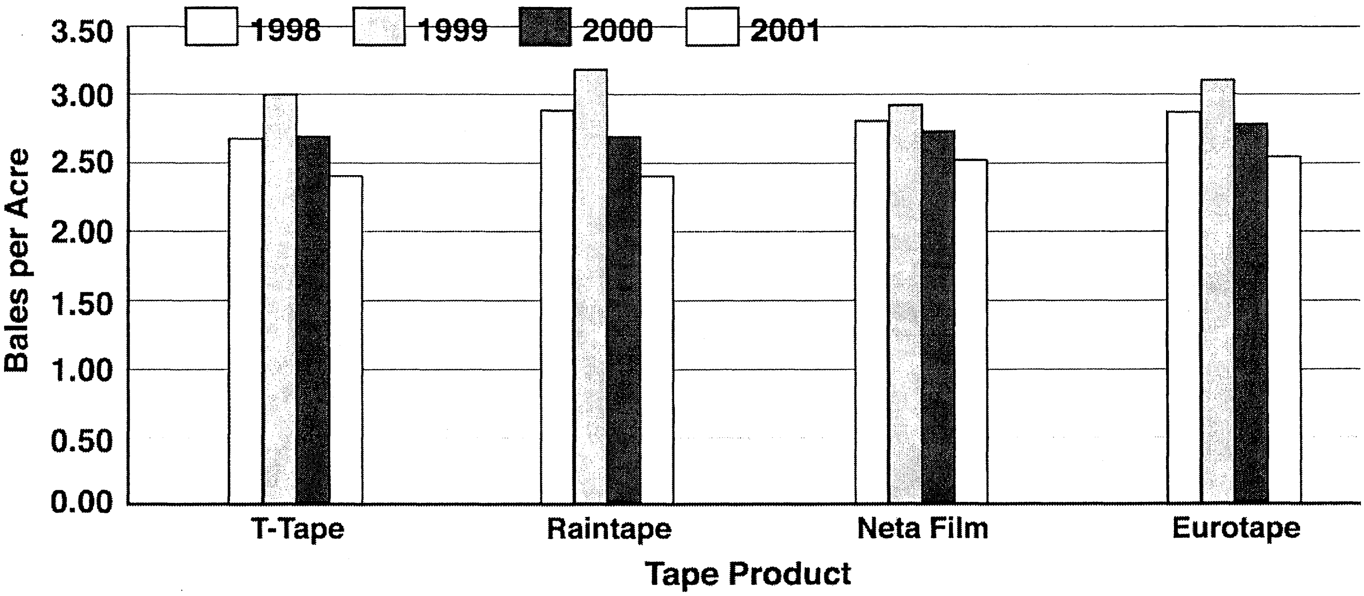


Figure 4. Fertigated program and tape comparison.



WATER RESOURCE DEVELOPMENT FOR IRRIGATION IN THE TENNESSEE VALLEY

Larry M. Curtis, Marshall M. Nelson, and Perry L. Oakes

In conjunction with the Natural Resources Conservation Service (NRCS), construction requirements (including cost) for off-stream irrigation storage reservoirs were investigated. This report presents a procedure useful for estimating off-stream water storage reservoir construction costs in Alabama under various conditions. Exact costs of particular installations will vary to some extent from costs predicted by any generalized estimating procedure. However, the estimates produced by the procedure outlined should prove useful to anyone considering such an undertaking and wanting to determine the least cost approach suitable to their site, conditions, and needs. This estimation procedure should also be useful to funding agencies and private of governmental agencies interested in irrigation as a planning tool for agricultural development in Alabama. The procedures also should be applicable to other states or regions with appropriate adjustments to suit conditions.

The spreadsheet program developed in this investigation allows a competent user to quickly explore various scenarios in reservoir construction and compare construction cost estimates by changing various dimensions and land contour inputs. The program will be available for use by qualified NRCS and Extension personnel assisting farmers and others interested in the possibilities of off-stream irrigation storage reservoirs. This program should be used only by individuals familiar with the engineering principles involved in reservoir construction.

Personnel using the program should be aware of the need for a geological study of any site considered for an off-stream storage reservoir, in order to determine whether a liner might be needed. Qualified NRCS personnel or professional engineering firms can provide the best possible evaluation of a site's water-holding capacity, and recommendation as to the type of liner needed, if any.

The results of this investigation are published by the Alabama Agricultural Experiment Station (Bulletin 647) "Estimated Cost of Off-stream Irrigation Storage Reservoirs."

This publication is available on the Web at http://www.ag.auburn.edu/resinfo/publications/bull647irrigreservoircosts.pdf

EVALUATION OF TERRA CONTROL SC 823 ON IRRIGATED AND NONIRRIGATED COTTON

Edward Sikora, Larry Wells, Bobby Durbin, Don Moore, B. E. Norris, and Malcomb Pegues

The soil conditioner Terra Control SC 823 is an ecologically compatible polymer dispersion for stabilizing topsoil layers. Terra Control forms a three-dimensional matrix in the soil profile that is permeable to water and oxygen but is stable against soil erosion due to wind or rain. Terra Control retains moisture longer in the soil and protects soil and plants from drying out, allowing for economical water management.

The objective of these studies was to determine if a single application of Terra Control SC 823 after planting would provide long-term water retention in the root zone that would benefit plants during extended periods of drought. A secondary objective was to determine if this long-term water retention would increase incidence of seedling blights.

Irrigated cotton trials were established at the Wiregrass Regional Research and Extension Center, the Tennessee Valley Research and Extension Center, and the E. V. Smith Research Center. Trials were conducted using overhead center-pivot irrigation. Nonirrigated cotton trials were established at the Wiregrass Regional Research and Extension Center, the Tennessee Valley Research and Extension Center, the Gulf Coast Research and Extension Center, and the Prattville Experiment Field.

Each trial consisted of three treatments, replicated six times, in a randomized complete block design. Each treatment/replication consisted of a four-row plot, 30 feet long.

The cotton variety Sure Grow 125 BR was used at all locations. Trials were planted during the months of April and May, depending on their location in the state. Terra Control treatments were applied as a broadcast spray at planting at 7.5 or 10 gallons per acre. Fertilizer applications were determined by soil test information. Insect and weed control required applying insecticide and herbicides as needed. Stand counts were taken at 21 and 35 days post planting and a skip index was made at 35 days post planting. Seed cotton yield was determined at harvest.

There were no apparent differences in stand count or skip index among treatments at any location (data not shown). There were no significant differences in yield among the three irrigated cotton treatments at any of the three locations (see table). Nor were there any significant differences in yield among the three nonirrigated cotton treatments at any of the four locations (see table). Alabama received unusually heavy rains in June (13 cm), July (10 cm), and August (24 cm), which likely diminished any positive effect the Terra Control may have had on cotton production in 2001.

EFFECT OF TERRA CONTROL SC 823 UNDER IRRIGATED AND NONIRRIGATED CONDITIONS ON COTTON SEED YIELD

Treatments	E.V. Smith	Prattville	Gulf Coast	Tennessee Valley	Wiregrass
	Seed cotton yield (pounds/plot)				
Irrigated					
Control	5.7 a	—	—	10.8 a	9.9 a
Terra Control 7.5 gal/ac	6.3 a	—	—	11.0 a	10.4 a
Terra Control 10 gal/ac	6.1 a	—	—	10.6 a	9.9 a
Nonirrigated					
Control		14.0 a	10.2 a	11.7 a	9.6 a
Terra Control 7.5 gal/ac		14.3 a	10.1 a	11.5 a	8.6 a
Terra Control 10 gal/ac		14.0 a	9.8 a	11.6 a	9.4 a

Numbers followed by the same letter are not significantly different.

SURFACE-APPLIED BROILER LITTER IN REDUCED TILLAGE COTTON

C. C. Mitchell and W.C. Birdsong

Research with broiler litter on cotton has been conducted since 1991 on a Norfolk fine sandy loam in central Alabama (E.V. Smith Research Center) and since 1999 on a Dothan sandy loam in south Alabama (Wiregrass Research and Extension Center). The objectives of both studies were to (1) determine the effect of surface-applied broiler litter as a source of nitrogen (N) for reduced tillage cotton and (2) determine the residual effects of poultry broiler litter application on N availability for cotton production.

The central Alabama study was in conventionally tilled cotton from 1991 to 1994, conservation tilled corn from 1995 to 1997, and conservation tilled cotton since 1998. Both studies compared the effects of total N rates from poultry broiler litter with total N from ammonium nitrate and the residual effects of broiler litter N the year after application. At the central Alabama location, non-irrigated cotton yields during the 11-year study ranged from 855 pounds lint per acre in 1998 to 1520 pounds of lint per acre in 2001 (Tables 1 and 2 provide average lint yields from 1991 to 2001). At the south Alabama locations, yields ranged from 1010 pounds of lint per acre in 2000 to 1170 in 2001 (Table 3). Average total N in broiler litter used in these studies was 2.98% on a fresh weight basis (60 pounds total N per ton).

These tests on Coastal Plain soils have demonstrated that broiler litter can be used as the sole N source for cotton. All broiler litter may be applied at planting and rates can be based upon the total N in broiler litter. Rates do not need adjusting when litter is surface applied and not incorporated as in conservation tillage systems. Residual N from broiler litter on cotton is small but significant ranging from 66% relative yields at broiler litter rates of 120 pounds total N per acre to 76% relative yield at 240 pounds N per acre. The "no-nitrogen" check treatment produced an average of 52% relative yield the last four years of the study in central Alabama.

On fields that have not received previous applications of broiler litter, an N availability factor of one-half should be assumed for south Alabama and an N availability factor of two-thirds should be assumed for central Alabama. However, because of the residual effect of N two years after application, long-term availability factors will be around 90% at recommended N rates. When broiler litter is used as a source of N, more than the recommended rates of P and K will be applied.

TABLE 1. MEAN COTTON LINT YIELDS FOR CONVENTIONALLY TILLED COTTON, 1991-1994, AT E.V. SMITH RESEARCH CENTER IN CENTRAL ALABAMA

N source	Total N rate *lb/ac*	Cotton, 1991-1994 *lb lint/ac*
No N	0	550 d
Am. nitrate	60	840 bc
Am. nitrate	60 + Pix	840 bc
Am. nitrate	120	940 abc
Am. nitrate	120 + Pix	940 abc
Broiler litter	120	880 abc
Broiler litter	120 + Pix	850 bc
Broiler litter	180	960 a
Broiler litter	180 + Pix	950 ab
Broiler litter	240	970 a
Broiler litter	240 + Pix	940 abc

Values followed by the same letter are not significantly different at $P<0.05$.

TABLE 2. MEAN YIELDS FOR CONSERVATION TILLED CORN (1995-1997) AND CONSERVATION TILLED COTTON (1998-2001) AT E.V. SMITH RESEARCH CENTER IN CENTRAL ALABAMA

N source	Total N rate *lb/ac*	Corn,1995-97 *bu/ac*	Cotton,1998-01 *lb lint/ac*
No N	0	46 e	540 c
Am. nitrate	60	99 bc	940 a
Am. nitrate	120	107 ab	1030 a
Am. nitrate	180	103 abc	990 a
Am. nitrate	240	98 bc	940 a
Broiler litter	120	107 ab	990 a
Broiler litter	180	103 abc	1020 a
Broiler litter	240	117 a	1040 a
Broiler litter	120 Residual	58 e	680 b
Broiler litter	180 Residual	73 d	760 b
Broiler litter	240 Residual	89 c	780 b

Values followed by the same letter are not significantly different at $P<0.05$.

TABLE 3. ANNUAL COTTON LINT YIELDS AT WIREGRASS RESEARCH AND EXTENSION CENTER, 1999-2001

Treatment	Yield, pounds lint per acre 1999 [1]	2000 [1]	2001[1]	Mean [1]	Mean relative yield (%) [2]
Check	580 b	570 e	470 f	540 g	50 f
Commerical fertilizer, 120-90-90	1080 a	1010 a	1170 ab	1080 a	100 a
BL x	950 a	840 cd	940 bcd	910 bc	84 bc
BL 1.5x	950 a	860 bc	860 cd	890 cd	82 bcd
BL 2x	1130 a	980 ab	980 abc	1030 ab	95 ab
BL 2.5x	—	1050 a	1230 a	1140 a	104 a
Residual BL x	—	710 d	540 ef	630 fg	58 ef
Residual BL 1.5x	—	710 d	700 def	700 ef	65 ef
Residual BL 2x	—	830 cd	690 def	760 def	71 cde
Residual BL 2.5x	—	—	800 cde	800 cde	68 de

[1] Means different at P<0.10. [2] Means different at P<0.05

CHANGES IN CENTRAL ALABAMA COTTON SOILS, 1991 AND 2001

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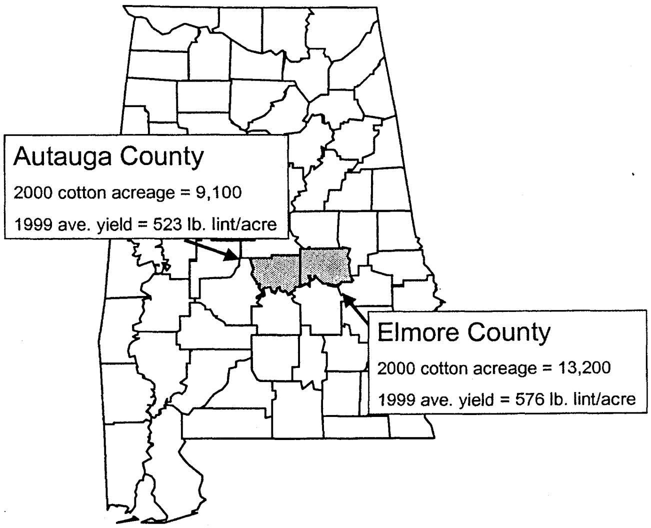
In 1991, Autauga and Elmore Counties in Central Alabama participated in a statewide cotton survey. These counties planted 29,200 acres of cotton with an average yield of 711 pounds lint per acre in 1991. In 2001, cotton was still the major agricultural crop in this region although rural development, urban sprawl, and a weak agricultural economy had reduced the total planted cotton acreage in 2001 to 22,300 acres. Average yield in 1999 was 550 pounds lint per acre due primarily to an extended drought in 1998 to 2000. However, during this same period, planted cotton acreage increased 46% statewide.

All cotton planted in Autauga and Elmore Counties is on Upper Coastal Plain soils or on related alluvial soils of river terraces. The 1991 survey identified several soil-related concerns in cotton fields in the Upper Coastal Plain region of Central Alabama. Sixty-two percent of the fields surveyed in 1991 had pronounced traffic pans (hard pans) within 10 inches of the soil surface. This compared to 41% statewide. In 1991, tillage practices were not noted because all fields were conventionally tilled. This included use of a chisel or moldboard plow, disking, and harrowing followed by mechanical cultivation for weed control. Very few practiced any form of deep tillage such as subsoiling. Tillage practices were responsible for extensive traffic pans identified in cotton fields.

The major plant nutrition concern identified in 1991 was a potential for potassium (K) deficiency. Sixty-eight percent of cotton leaf samples taken at early bloom were below the sufficiency level of 1.5% K. On the other hand, soil test K levels in the plow layer were all "medium" or higher. However, 90% of the subsoil samples were "medium" or "low" in extractable K. Low subsoil levels were probably influencing K in cotton leaves.



The objective of this study was to revisit the same fields that were surveyed in 1991 in order to assess any changes in land use patterns, tillage systems, and soil fertility status of cotton soils in Central Alabama. The 2001 survey was limited to Autauga and Elmore Counties.

The 1991 survey involved 36 randomly chosen fields in Autauga and Elmore Counties. These same fields were revisited during the winter of 2001. An additional 32 fields that were not part of the 1991 survey were included in the 2001 survey. In 1991, the survey was conducted during the summer and fall and included cotton leaf samples. The 2001 survey included soil samples at depths of 0 to 2 inches, 2 to 8 inches, and 12+

inches (subsoil sample). The reason for sampling at different depths was to assess the impact of tillage practices on soil nutrient stratification.

Random sub-samples were taken within a 1-acre area representative of the entire field. The entire field was not sampled. Detailed maps were made in 1991 so each site could be revisited. In 2001, GPS was used to identify each site for future surveys. The area sampled was the same area sampled in 1991. Each soil sample consisted of 15 to 20 sub-samples, which were combined by depth. The samples were dried and analyzed by the Auburn University Soil Testing Laboratory for pH, estimated cation exchange capacity (soil group), and Mehlich-1 extractable P, K, Mg, and Ca. Some of the samples were tested for Mehlich-1 extractable micronutrients and metals. Some of the surface samples (0 to 2 inch) were also tested for total organic matter.

Tillage practices, previous crop, cover crop, depth to an argillic horizon (clay layer), and presence and depth of a traffic pan were recorded for each field.

Land use. Both Autauga and Elmore counties are experiencing population increases and urban sprawl associated with the cities of Montgomery, Prattville, and Wetumpka, Alabama. However, of the 36 cotton fields surveyed in 1991, all but four were still being planted in cotton. One field had been converted to a subdivision, one was planted in pine trees, and two were planted in crops other than cotton.

Soil type. Where cotton is planted in Autauga and Elmore Counties, soils are very typical of Coastal Plain soils throughout Central and South Alabama. Half of the fields surveyed were in the Lucedale series, which is described as a deep, well-drained, moderately permeable soil of the Southern Coastal Plain Major Land Resource Area. Local farmers refer to Lucedale soils as "red land" because of the red surface color of these soils. Lucedale soils may be found on slopes of 0 to 15% but cotton is planted mainly on the more level sites. Surface soil textures of the soils in this survey were mostly fine sandy loams. Depth to argillic horizon is referred to as "depth to clay" by most farmers in this region. However the argillic horizon texture is usually sandy clay, sandy clay loam, loam, or silty clay loam rather than "clay." This depth is a reflection of the major soil series present (Table 1) but may also influence the formation and depth of traffic pans.

Traffic pans. Traffic pans or hard pans were found in 63% of the fields surveyed in 2001 (62% in 1991). This was a surprise considering that 51% of the farmers practiced some form of conservation tillage with subsoiling, usually paratilling or paraplowing. Traffic pans were identified using a soil penetrometer within the rows of cut cotton stalks. Since the survey was during the winter of 2001, soil moisture at the time of the survey was high. Many of the fields where traffic pans were found had no in-row subsoiling or paraplowing the previous season. However, some that had deep tillage prior to planting had recreated traffic pans within the row. Traffic pans are a known impediment to deep rooting and may be a major yield-limiting factor in drought years. The situation has not improved since 1991.

Tillage practices. The most dramatic change in the 10 years since 1991 has been in tillage practices. In 1991, all fields surveyed were conventionally tilled. In 2001, 56% of the fields surveyed had some form of conservation tillage, usually strip tillage. However, only 15% of the fields had a winter cover crop planted, usually wheat or rye. This is reflected in the very low value for mean soil organic matter of 0.6% in the surface 2 inches of soil. Seventy-five percent of the fields surveyed had soil organic matter less than 0.8% in the surface 2 inches (Table 2). Based on soil organic matter data published from Alabama's Old Rotation experiment, this low level of soil organic matter results in poor soil quality and a very low cotton yield potential.

Soil pH. Central Alabama cotton farmers appear to be doing a very good job of maintaining an optimum soil pH (5.8 to 6.9) in the rooting zone. One of the thoughts behind taking a 0- to 2-inch sample and a 2- to 8-inch sample was to identify any stratification that may be developing as a result of the dramatic increase in conservation tillage practices over the past 10 years. Overall, there does not appear to be a dramatic pH stratification effect beyond what would be expected in these naturally acid, Coastal Plain soils. No differences due to tillage practice could be identified in this survey. However, there does appear to be a trend toward higher pH values in the surface soils due to liming. This tendency may become more pronounced as producers lime surface soils under conservation tillage practices.

Phosphorus. The 1991 survey found no evidence that phosphorus was a yield-limiting concern in Upper Coastal Plain cotton fields. The 2001 survey confirms this conclusion with 92% of the

TABLE 1. SOIL AND CROPPING CHARACTERISTICS OF 68 CENTRAL ALABAMA COTTON FIELDS

Soil or cropping characteristic	Percent of fields surveyed
Soil classification (Ex. of series)	
Rhodic Paleudults (Lucedale fsl)	50
Typic Paleudults (Bama fsl)	3
Plinthic Paleudults (Bowie sl)	6
Arenic Paleudults (Lucy ls)	4
Typic Kandiudults (Norfolk sl)	13
Typic Hapludults (Wickham fsl)	22
Others (Roanoke fsl)	2
Depth to argillic horizon (subsoil "clay")	
0-6 inches	13
7-12 inches	78
>12 inches	5
Not applicable	4
Depth to traffic pan (hardpan)	
0-6 inches	36
7-12 inches	27
>12 inches	0
No traffic pan present	37
Tillage practices	
Conventional tillage	44
Conservation tillage with subsoiling	51
Conservation tillage without subsoiling	5
Cover crops planted	
Yes	15
No	85

surface soils testing high or very high in extractable P. There does appear to be a trend toward stratification of P in the surface 2 inches of soil as would be expected with increasing conservation tillage and surface P application.

Potassium. Potassium also appears to be accumulating in surface soils with decreasing extractable K with depth. Soils tested high or very high in K in 86% of the surface 2 inches, 67% of the 2- to 8-inch layer, and 31% of the subsoil. As noted in the 1991 survey, low K in the subsoil could aggravate a K deficiency during a drought if roots are unable to get adequate K from the subsoil. However, research in 1997 and 1999 in Alabama concluded that broadcast K applications and high plow layer K are more efficient than trying to increase subsoil K for cotton production. Recent research from long-term potassium studies confirms that extractable plow-layer K is well correlated with cotton yield.

Magnesium and calcium. Regardless of sampling depth, 97 to 98% of the fields had "high" levels of extractable soil Mg for cotton. Calcium is not rated for cotton in Alabama because maintaining an optimum soil pH through liming generally assures sufficient Ca for most Alabama cotton soils. This survey indicated that 95% of the fields had extractable Ca levels above 250 mg Ca per kg (500 pounds Ca per acre). Soil test values above 150 mg Ca per kg (300 pounds per acre) would be considered "high" for peanuts, one of the most calcium-sensitive crops grown in Alabama.

Micronutrients and metals. Mehlich-1 (dilute double acid) is not the best extractant for estimating plant availability of micronutrients. In fact, there are few studies that show significant correlation between M1 extractable micronutrients and plant response to micronutrients over a range of soils. The same would be true of M1 extractable metals in soils. However, because of the convenience of analytical technology, the micronutrients and metals listed in Table 3 were analyzed using inductively coupled argon plasma (ICAP) spectroscopy on the soil extracts. The values serve as a broad benchmark. Very

TABLE 2. SOIL TEST VALUE DISTRIBUTION IN COTTON FIELDS IN AUTAUGA AND ELMORE COUNTIES, 2001

Analysis and rating	—Sample depth (inches)— 0-2	2-8	12+ [1]
Soil organic matter (n=44)			
0 to 0.4%	55	—	—
0.4 to 0.8%	20	—	—
0.8 to 1.2%	9	—	—
>1.2%	16	—	—
Cation exchange capacity (n = 68)			
<4.6 cmol/kg	15	18	8
4.6-9.0 cmol/kg	81	78	85
>9.0 cmol/kg	4	4	7
Soil pH_w (n=49)			
<5.0	2	0	3
5.0-5.7	13	21	34
5.8-6.9	81	75	63
7.0+	4	4	0
Extractable P (n=68)			
Very low/low (<12 mg/kg)	4	13	69
Medium (13-25 mg/kg)	4	21	21
High (26-50 mg/kg)	37	50	6
Very high (>50 mg/kg)	55	16	4
Extractable K (n=68)			
Very low/low (<45 mg/kg)	1	3	23
Medium (46-90 mg/kg)	13	30	46
High (91-180 mg/kg)	62	63	31
Very high (>180 mg/kg)	24	4	0
Extractable Mg (n=68)			
Low (<25 mg/kg)	3	2	2
High (25+ mg/kg)	97	98	98
Extractable Ca (n=68)			
<250 mg/kg	5	4	6
250-500 mg/kg	38	47	61
501-750 mg/kg	38	38	30
750-1,000 mg/kg	16	9	3
>1,000 mg/kg	3	2	0

[1] 12 + inhces = subsoil. [2] n = number of samples analyzed.

TABLE 3. MEHLICH-1 EXTRACTABLE SOIL MICRONUTRIENTS AND METALS FROM AUTAUGA AND ELMORE COUNTIES

Analysis	Mean	Std. Dev.	Minimum	Maximum
	mg/kg			
0-2 inch depth				
Cu	0.5	0.4	0.0	1.6
Mn	30.5	19.3	4.0	72.1
Zn	2.6	1.7	0.7	6.4
B	0.4	0.3	0.1	1.5
Ba	2.5	0.9	0.2	3.9
Co	0.2	0.1	0.1	0.5
Cr	0.6	0.5	0.2	2.3
Pb	0.8	0.3	0.5	1.5
Na	7.8	8.0	0.0	28.0
2-8 inch depth				
Cu	0.6	0.7	0.0	2.4
Mn	26.5	16.4	4.6	59.1
Zn	1.9	1.2	0.2	5.3
B	0.5	0.3	0.0	1.2
Ba	2.8	1.2	0.2	5.7
Co	0.2	0.1	0.1	0.5
Cr	0.7	0.5	0.2	2.4
Pb	0.9	0.3	0.5	1.6
Na	8.3	8.3	0.0	31.0
12+ inch depth (subsoil)				
Cu	0.6	0.6	0.0	1.9
Mn	18.7	11.1	1.4	42.1
Zn	1.4	1.7	0.2	6.5
B	0.4	0.2	0.0	0.8
Ba	2.6	0.7	0.0	3.5
Co	0.2	0.1	0.0	0.5
Cr	0.6	0.4	0.3	2.4
Pb	0.9	0.3	0.5	1.5
Na	11.2	9.9	0.0	34.9

large and very low values for a particular micronutrient or metal may be reason for concern.

The only micronutrient routinely recommended for cotton is boron (B). In general, hot water extractable B values above 0.1 mg/kg are sufficient for cotton. This is near the detection limit for ICAP analyses using the M1 extract. Zinc values above 0.6 mg/kg are generally considered sufficient for most crops. Values above 10 mg Zn/kg may be toxic to sensitive crops such as peanuts. The mean values and ranges for extractable micronutrients and metals in these soils do not present any evidence that producers should be overly concerned about micronutrient or metal deficiencies or toxicities in cotton or any other crop.

In spite of a dramatic shift toward conservation tillage in the past decade, traffic pans remain a potential yield-limiting factor in cotton fields of Central Alabama. Increased use of paratilling and in-row subsoiling has not eliminated the presence of traffic pans within the surface 12 inches of soil. This situation is aggravated by poor overall soil quality as indicated by very low soil organic matter (mean=0.6%). The situation could be improved by using winter cover crops more extensively and allowing more biomass to accumulate on the soil surface.

In general, soil fertility does not appear to be a limiting factor in cotton production. Most fields sampled had optimum soil pH and high P and K in the surface 8 inches of soil. While the extractant used for micronutrients and metals is not ideally correlated with plant availability, it does provide some indication that micronutrient availability and metal contamination of cotton fields is not a major concern at this time.

THE OLD ROTATION AND CULLARS ROTATION - 2001

Charles Mitchell, Wayne Reeves, and Dennis Delaney

The Old Rotation Experiment (circa 1896) and the Cullars Rotation Experiment (circa 1911) on the campus of Auburn University are the two oldest, continuous experiments in the world in which cotton in grown. The Old Rotation was placed on the U.S. National Register of Historical Places in 1988 and the Cullars Rotation will be nominated for this prestigious honor in 2002.

The Old Rotation is primarily a crop rotation study with and without winter legumes as a source of nitrogen. It is on a Pacolet fine sandy loam, a transition soil from the Piedmont to the Coastal Plain. The Cullars Rotation is a much larger study with 14 soil fertility variables (N, P, K, S, lime, and micronutrients) replicated three times on a Marvyn loamy sand Coastal Plain soil. The three replications are rotated each year to (1) cotton followed by (2) corn followed by winter wheat that is harvested for grain and is double-cropped with (3) soybean. Since 1996, both experiments have been in conservation tillage with either in-row subsoiling or paratilling prior to planting. Before then, they were planted using conventional tillage and mechanical cultivation. Both experiments are non-irrigated.

The 2001 growing season produced the highest wheat yields on record for the Old Rotation and the all-time record cotton yield. Dry weather late in the growing season reduced the yield potential of soybeans. Interestingly, since 1996 when the two tests were switched to conservation tillage, record yields have been produced by all crops grown in these tests. Record yields have been attributed to better soil quality (higher soil organic matter and better structure), greater rainfall infiltration, less pesticide use, boll-weevil eradication, Bollgard® and Roundup Ready® or Liberty-Link® varieties, less weed pressure, less insect pressure and diseases, and good growing conditions (except for a drought in 2000). Highest crop yields are shown in Table 1.

Treatments and crop yields from the 2001 growing season are presented in Table 2 (The Old Rotation) and Table 3 (The Cullars Rotation). Plans for the 2002 growing season include establishing an irrigation system on half of all plots on the Old Rotation.

TABLE 1. RECORD YIELDS ON THE OLD ROTATION AND CULLARS ROTATION EXPERIMENTS AT AUBURN UNIVERSITY

Crop	Rank	Year	Yield
Cotton	1	2001	1600 lb lint/acre
	2	1994	1490
	3	1993	1270
Corn	1	1999	236 bu/acre
	2	2001	193
	3	1997	148
Wheat (1961-present)	1	2001	94 bu/acre
	2	2000	81
	3	1999	79
Oat (before1960)	1	1958	109 bu/acre
	2	1937	97
	3	1956	87
Rye (1978-present)	1	1981	55
	2	1988	48
	3	1979	40
Soybean(1957-present)	1	1996	67 bu/acre
	2	1992	61
	3	1983	55

TABLE 2. CROP YIELDS ON THE OLD ROTATION EXPERIMENT (CIRCA 1896) IN 2001

Plot	Cropping system	Crimson clover dry matter *lb/ac*	Cotton lint *lb/ac*	Corn grain or soybean or wheat *bu/ac*
1	Cotton-no N/ no winter legume	—	250	—
2	Cotton- winter legume	940	1360	—
3	Cotton-winter legume	2320	1030	—
4	Cotton-Corn with winter legume	2070	—	168 (corn)
5	Cotton-corn with winter legume + 120 lb. N/acre	2550	—	193 (corn)
6	Cotton-no N/ no winter legume (same as #1)	—	280	—
7	Same as #4	1090	1210	—
8	Same as #2 and #3	2570	**1600**	—
9	Same as #5	2440	1440	—
10	3-year rotation (cotton-corn-small grain-soybean)	—	—	**94 (wheat)** 38 (soybean)
11	Same as #10	—	1240	—
12	Same as #10	3090	—	187 (corn)
13	Cotton with 120 lb. N/acre/ no cover crop	—	1270	—

Numbers in **bold** represent an all-time record yield for experiment.

TABLE 3. CROP YIELDS ON THE CULLARS ROTATION (CIRCA 1911) SOIL FERTILITY EXPERIMENT AT AUBURN UNIVERSITY, 2001

		East tier	Middle tier		West tier	
Plot	Treatment [1]	Cotton lint	Crimson clover dry matter	Corn	Wheat grain	Soybean
		lb/ac	*lb/ac*	*bu/ac*	*bu/ac*	*bu/ac*
A	No N/+ winter legume	840	2400	96	18.9	29.5
B	No N/no winter legume	960	4080 [2]	102	4.8	27.4
C	No lime or fertilizer	0	0	0	1.6	0
1	+ N fertilizer/ no winter legume	1040	3690 [2]	159	49.1	23.6
2	No P	480	1030	51	22.3	5.7
3	Complete fertilization without micronutrients	880	3140	152	30.4	27.4
4	4/3 K rate	930	3340	153	49.2	26.2
5	Rock phosphate	980	3220	138	66.9	27.8
6	No K	0	1710	49	38.1	7.6
7	2/3 K rate	1170	3350	149	50.5	26.5
8	No lime (pH=4.8)	690	0	77	8.9	0
9	No S	940	3520	168	49.6	22.8
10	+ micronutrients	940	3310	167	51.2	25.8
11	1/3 K rate	980	2650	162	70.0	15.3

[1] N rate = 90 lb/acre on cotton; 120 lb/acre on corn; none on soybean; 60 lb/acre on wheat.
P_2O_5 rate = 100 lb/acre per 3-year rotation.
K_2O rate = 270 lb/acre per 3-year rotation.
All treatments receive sulfur as gypsum except treatments C and 9. All plots limed to pH 5.8 to 6.5 except treatments C and 8.
[2] Crimson clover was planted by mistake on these treatments in the fall of 2000.

GROWTH REGULATORS, DEFOLIANTS, AND HERBICIDES

EVALUATING NEW GROWTH REGULATORS FOR COTTON

Dennis Delaney, C. Dale Monks, and Don Moore

Growth regulators are often used in cotton to control vegetative growth and encourage early fruit set, which can lead to reduced boll rot, easier picking, and earlier harvest. They are most effective when applied early in the season to relatively small cotton plants, but can cause too much growth reduction if the crop encounters drought or other stresses. Each year, trials are conducted to compare established products with new products that are, or soon will be, available to producers. A study was conducted at the Prattville Experiment Field to compare Pix Plus, and a new (as yet unnamed) product, BAS 130 01W, at different rates of application to an untreated check treatment.

Sure-Grow 125BR was planted on May 23, 2001 in 36-inch rows. All plots were maintained throughout the season with standard, herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plots were not irrigated. The experimental design was a randomized complete block with six replications; plots were six rows wide and 30 feet long. Treatments were applied using a CO_2 backpack sprayer (15 gallons per acre) to all six rows of each plot. Application was made once at the matchhead square stage when cotton was about 15 inches tall and vigorously growing. Treatments were applied at either 6.4 or 8 fluid ounces per acre of formulated product (see table), with Activate Plus added to each treatment as a surfactant.

Data were taken on height from cotyledon to terminal at early bloom and 30 days after early bloom, position 1 (closest to the stalk) fruit retention, and open/closed boll counts. The center two rows were harvested with a spindle picker and weighed. A composite sample was ginned to calculate lint yield, while plants from rows two and five were mapped for fruit retention (data not shown).

Results are presented in the table. Although moisture conditions and plant growth were good at the time of application, the lack of rain for the next two weeks of hot weather visibly stunted plants that had been treated with the 8-ounce rate. Late summer rains allowed the cotton to recover, but yield was slightly affected. There was no difference in fruit retention or earliness (% open bolls) between treatments. These results show the difficulty that producers face when deciding if they should apply growth regulator materials early in the season and at what rate they should apply them.

FIELD PERFORMANCE OF NEW GROWTH REGULATOR COMPOUNDS, PRATTVILLE EXPERIMENT FIELD

Treatment	Rate	Height — early bloom	Height — 30 days after bloom	Position 1 retention	Open bolls	Lint yield
		in	*in*	*%*	*%*	*lb/ac*
Check	—	26	41	87	33	1278
Pix Plus	8 fl oz/ac	19	32	90	38	1178
BAS 130 01W	8 fl oz/ac	20	32	92	33	1193
BAS 130 01W	6.4 fl oz/ac	20	32	87	35	1232
LSD (P=0.10)		1	2	NS	NS	94

NEW HARVEST AIDES FOR COTTON

Michael G. Patterson, C. Dale Monks, and Wilson H. Faircloth

Aim 40 DF (carfentrazone) from FMC Corporation and LeafLess 4L (a mixture of Harvade and Dropp) from UniRoyal Company are two new harvest aides recently registered for use in cotton. These materials were tested in small plot research trials during the fall of 2001 to evaluate their potential in Alabama cotton production. Aim is used at the rate of 2/3 to 1 ounce of product per acre, while LeafLess is used at the rate of 10 to 12 fluid ounces per acre. Both products require the addition of crop oil concentrate (COC) for optimum activity. Treatments were applied in 10 gallons of water per acre to cotton that was approximately 50% open on August 31at the E.V. Smith Research Center Field Crops Unit. Air temperature was in the high 80s (°F) at the time of treatment.

Aim plus COC provided 82% defoliation 14 days after treatment (DAT). Aim plus Harvade plus COC provided excellent (>90%) defoliation at 14 DAT. LeafLess plus COC provided 84% defoliation at 14 DAT. Both Aim and LeafLess treatments provided defoliation equal to Def plus Dropp at 14 DAT. Aim plus Finish plus COC and LeafLess plus Finish plus COC both provided excellent boll opening at 14 DAT. Cotton dessication was less than 4% with all treatments at 14 DAT (data not shown). Terminal regrowth was 30% or lower with all treatments at 21 DAT. Aim plus Harvade plus COC was evaluated for weed dessication in other field trials and provided good to excellent dessication of annual morningglory, sicklepod, and pigweed (data not shown).

COTTON DEFOLIATION, BOLL OPENING, AND REGROWTH FOLLOWING AIM AND LEAFLESS APPLICATIONS

Treatment	Rate/ac	—14 days after treatment— Defoliation	Open bolls	21 days regrowth
		———————	%	———————
Aim + COC	0.7 oz + 1 pt	82	83	28
Aim + Harvade + COC [1]	0.5 oz + 0.5 pt + 1 pt	93	80	18
Aim + Finish + COC	0.7 oz + 1 pt + 1 pt	84	92	29
Aim + Dropp + COC	0.7 oz + 0.2 lb. + 1 pt	88	84	15
LeafLess + COC	10 fl. oz + 1 pt	84	85	20
LeafLess + Finish + COC	10 fl. oz + 1 pt + 1 pt	92	92	30
Def + Dropp	1 pt + 0.15 lb.	79	84	18
Untreated	—	43	75	22
LSD (P=0.05)		9	8	NS

[1] COC = crop oil concentrate.

EVALUATION OF A WICK APPLICATOR FOR APPLYING MEPIQUAT CHLORIDE TO COTTON

Charles H. Burmester

This study was conducted to determine the feasibility of using a wick applicator to apply mepiquat chloride to cotton. A replicated field experiment was conducted on the Tennessee Valley Research and Extension Center, Belle Mina, Alabama, on a Decatur silt loam. All plots consisted of eight rows, 40 feet long. Half the area was supplemented with irrigation to provide two moisture regimes. Mepiquat chloride treatments included the following: none, standard rate broadcast sprayed at early bloom as determined by plant monitoring, and one-half and two-thirds of the standard rate applied using a wick applicator. Irrigated treatments received an additional 5.7 inches of water in five applications during the season. All cotton received one treatment of 8 ounces of mepiquat chloride at early bloom while the irrigated cotton received an additional 8-ounce application at mid-bloom.

A four-row wick applicator was obtained from Dixie Wick Company of Grifton, North Carolina. This applicator consisted of perforated plastic pipe covered with a cotton canvas over each row. A metering air orifice was used to control the flow rate. Differences between the wick applicator and a broadcast sprayer were determined by height and nodes above white flower (NAWF) measurements and by final yields.

The 2001 growing season was excellent for cotton production in northern Alabama. This is reflected in the excellent rain-fed cotton yields of between 3,270 and 3,710 pounds of seed-cotton per acre. Although mepiquat chloride treatment did slightly reduce heights, nonirrigated cotton yields were not effected by mepiquat chloride treatments (either sprayed or applied with the wick applicator).

FIELD COMPARISON OF MEPIQUAT CHLORIDE TREATMENTS BROADCAST SPRAYED OR APPLIED WITH A WICK APPLICATOR, BELLE MINA, ALABAMA

Mepiquat chloride	Height Aug. 15 *in*	Seed cotton yield *lb/ac*	First picking *%*
Nonirrigated			
Check	49	3,460	88
8 oz. broadcast	45	3,710	87
5.3 oz. Wick	47	3,270	93
4.0 oz. Wick	45	3,500	90
Irrigated			
Check	64	3,270	75
8 oz. + 8 oz. broadcast	51	3,680	80
5.3 oz. + 5.3 oz. Wick	52	3,570	80
4.0 oz. + 4.0 oz. Wick	52	3,780	80

Irrigated cotton grew much taller and mepiquat chloride treatments greatly reduced height (see table). Little difference in height or yield was found between mepiquat chloride treatments applied either as a spray or through the wick applicator. Although irrigated cotton without mepiquat chloride had slightly lower yields than irrigated cotton treated with mepiquat chloride, irrigated cotton yields were comparable to the nonirrigated treatments. Irrigation in this high rainfall year caused rank growth and delayed maturity without mepiquat chloride treatment and resulted in lower yields.

Rain-fed cotton produced an earlier crop with nearly 90% of the cotton open at the first picking. The irrigated cotton was 80% open at first picking when mepiquat chloride was applied and only 75% open when mepiquat chloride was not applied.

LIBERTY-LINK COTTON WEED MANAGEMENT PROGRAMS

Michael G. Patterson, Wilson H. Faircloth, and C. Dale Monks

Liberty-Link cotton is genetically modified for tolerance to the herbicide Liberty (glufosinate). Liberty herbicide is similar to glyphosate (Roundup, Touchdown, etc.) in that it has activity only on emerged weeds and grasses with little or no soil activity. A field study was conducted during 2001 at the E.V. Smith Research Center Field Crops Unit to evaluate several cotton weed management programs using Liberty-Link technology. Cotton was planted in mid May. Some programs received Treflan and/or Cotoran preplant incorporated (PPI) followed by two or more applications of Liberty postemergence (see table). These were compared to an untreated check and to a program using Liberty only without soil-residual herbicides.

All treatments of Treflan at 0.5 pound (1 pint) per acre followed by two or more applications of Liberty at 0.32 pound active per acre provided excellent late-season control of pigweed, goosegrass and large crabgrass, sicklepod, and coffee senna. Cotoran preemergence followed by two applications of Liberty applied at the 6 leaf and 10 leaf cotton stage provided lower pigweed and grass control than treatments containing Treflan. The Liberty only program provided lower sicklepod and coffee senna control than programs containing Treflan or Cotoran. No visual crop injury was found with any of the programs. Liberty-Link technology is anticipated to be commercially available for the 2003 growing season on a limited basis.

WEED AND LIBERTY-LINK COTTON RESPONSE TO LIBERTY-BASED PROGRAMS

Treatment	Rate/ac	Growth stage	CI [1]	PW	GR	SP	CS
			July 11, 2001 %				
Untreated	—	—	0	0	0	0	0
Liberty Liberty	1.5 pt 1.5 pt	6 leaf 10 leaf	0	92	94	88	88
Treflan Liberty Liberty	1.0 pt 1.5 pt 1.5 pt	PPI 6 leaf 10 leaf	0	98	99	99	99
Treflan Liberty Liberty Liberty	1.0 pt 1.5 pt 1.5 pt 1.5 pt	PPI 3 leaf 6 leaf 14 leaf	0	97	99	97	99
Cotoran Liberty Liberty	2.5 pt 1.5 pt 1.5 pt	PPI 6 leaf 10 leaf	0	87	88	98	98

[1] CI = crop injury, PW = pigweed, GR = annual grass (50% goosegrass, 50% large crabgrass), SP = sicklepod, CS = coffee senna. Note: ammonium sulfate (AMS) was added to Liberty treatments at the rate of 3 pounds per acre for 10 and 14 leaf applications.

INSECTICIDES

TARNISHED PLANT BUG CONTROL IN COTTON

Barry L. Freeman

This trial compared insecticide treatments for tarnished plant bug control in cotton. The trial was conducted on the Tennessee Valley Extension and Research Center in Limestone County, Alabama. Cotton, Stoneville 474, was planted on April 10, 2001 and was under irrigation. Plots were eight rows by 100 feet and unreplicated. Treatments were applied on June 15. To estimate plant bug populations and damage, post treatment samples were taken on June 21, June 25, and June 29 and consisted of 10, 6-foot drop cloth samples and the examination of 100 pinhead squares per plot.

Whole field examinations three days prior to insecticide applications revealed an average pinhead square retention of 88%, a high degree of adult plant bug activity, and a low number of plant bug nymphs.

All treatments reduced plant bug numbers as compared to the control plot (Table 1). The Karate, Capture, Leverage, and high rate of Centric treatments lowered average plant bug populations by more than 90%. Over the same period the low rate of Centric and Assail provided an 83% reduction in bug numbers. Other treatments provided less than 60% control.

Pinhead square retention was improved by most insecticide treatments with the highest levels being found in the Calypso, Karate, Capture, Asana, and low rate of Assail treatments (Table 2).

TABLE 1. NUMBERS OF PLANT BUGS PER 100 FEET OF ROW

Treatment	Plant bugs				% change
lbs a.i./ac	June 21	June 25	June 29	Average	from control
Karate 0.0348	3	0	3	2	-98
Capture 0.05	3	3	6	4	-96
Leverage 0.0625	0	3	13	5	-95
Centric 0.0625	3	3	10	5	-95
Centric 0.0473	7	7	33	16	-83
Assail 0.075	3	20	26	16	-83
Calypso 0.09	3	30	60	31	-67
Calypso 0.047	10	33	53	32	-66
Assail 0.1	3	43	57	34	-64
Orthene 0.33	13	63	47	41	-57
Vydate 0.33	3	40	97	47	-51
Steward 0.11	13	136	60	70	-26
Asana 0.04	17	133	100	73	-23
Control —	43	120	123	95	—

TABLE 2. PERCENT PINHEAD SQUARE RETENTION

Treatment	Pinhead square retention				% change
lbs a.i./ac	June 21	June 25	June 29	Average	from control
Calypso 0.09	96	92	88	92	+18
Karate 0.0348	86	90	94	90	+15
Capture 0.05	90	88	90	89	+14
Calypso 0.047	84	90	92	89	+14
Assail 0.075	86	90	86	87	+12
Asana 0.04	82	88	90	87	+12
Assail 0.1	84	86	86	85	+9
Leverage 0.0625	76	90	80	82	+5
Centric 0.0473	74	84	84	81	+4
Centric 0.0625	72	78	88	79	0
Control —	76	78	80	78	—
Orthene 0.33	68	84	80	77	-1

EVALUATION OF INSECTICIDES FOR CONTROL OF INSECT PESTS IN BT COTTON AND SELECTIVITY AGAINST BENEFICIAL SPECIES

Ron H. Smith

Foliar sprays of insecticides to cotton in Alabama are greatly reduced from historical acreages. Most fields go weeks at a time with no insect control necessary. In this low-spray environment, tarnished plant bugs and fleahoppers may build to damaging levels at any point in the season. In mid- to late-season, stink bugs show the same trends.

Most growers are greatly concerned about the preservation of beneficial insects and are, therefore, hesitant to apply insecticides to control plant bugs and or stink bugs. Several new insecticides will be available in the near future for bug control. The following tests were undertaken to determine how effective these new chemicals are on the plant bug–stink bug complex and how selective they are on beneficial species.

Three plant bug tests were implemented on the Segrest farm in Macon County, Alabama, and the Prattville Experimental Field, Prattville, Alabama. A stink bug test was conducted at the Wiregrass Regional Research Farm, Headland, Alabama.

The first test on the Segrest farm was initiated on June 25 in blooming stage cotton to a dominantly adult plant bug population. Adjacent eight-row strips were treated through a 20-acre field. Treatments were not replicated; however, four replicate counts were taken in the center four rows along the entire 500-foot treated area. Application was made with a conventional tractor-mounted boom at 10 gallons per acre and 30 pounds per square inch pressure. Samples were made with traditional sweep net technique on June 26, June 28, and July 2.

The second test was conducted at the Prattville Experiment Field on July 17 against a marginal plant bug population that was primarily in the nymphal stage. Treatments were applied to eight rows by 60 feet with two replicates. Application was by hiboy at10 gallons per acre and 60 pounds per square inch pressure. Evaluation was done by drop cloth on July 14 and July 23 from the center four rows of each plot.

The stink bug test was conducted at the Wiregrass Research and Extension Center on September 13. Treatments were made to eight row adjacent strips 400 feet in length by Spray Coupe at 10 gallons per acre and 45 pounds per square inch pressure. Five replicate samples were taken from the center four rows of each plot by drop cloth on September 17, four days post treatment.

All treatments suppressed adult plant bugs when compared to the untreated control in test number one on the Segrest farm. The pyrethroid Karate gave the greatest level of control followed by the experimental pyrethroid XR-225. Bidrin, Decis, Steward, and Calypso gave similar levels of control, with Assail and Centric being slightly less effective. The addition of Dibrom to Bidrin and Orthene appeared to reduce their effectiveness against adult plant bugs. In general, the pyrethroids (Decis and Karate) showed the least selectivity against big eyed bugs. The most selective insecticides against big eyed bugs in this test were Centric, Assail, and Bidrin plus Dibrom. Against the pirate bug, Karate was again the least selective followed by Bidrin plus Dibrom, Bidrin, XR-225, and Assail. Treatments that had as many or more pirate bugs than the untreated were Centric, Decis, Calypso, Orthene plus Dibrom, and Steward.

In the plant bug test at the Prattville location, all treatments gave excellent control of plant bugs except Steward. All treatments suppressed lady beetles by 50% or more except Orthene and Bidrin, which were applied as a tank mixture with Dibrom. The pyrethroids Karate, XR-225, Bidrin, Orthene, and Decis were the least selective treatments against lady beetles.

The third test was conducted at the Wiregrass Research farm against stink bugs. All treatments gave good control of stink bugs in this test except the two rates of Calypso. Other treatments that had low levels of stink bugs in the post treatment count were Novaluron, Assail, Orthene (at 0.75 pound per acre), Provado, and Asana.

THRIPS MANAGEMENT IN COTTON

Barry L. Freeman

This test compared insecticide treatments for thrips management in cotton. The test was located on the Tennessee Valley Research and Extension Center in Limestone County, Alabama, and was planted on April 26, 2001. Plots were four rows by 25 feet and were replicated four times each. Foliar applications (Karate and Orthene) were applied at the first true leaf stage, but due to poor growing conditions this was not until May 23.

Thrips were sampled on May 21, June 2, and June 11, or 25, 37, and 46 days after planting. The samples were collected by rinsing five plants from each plot in 70% ethyl alcohol, filtering the contents, and counting the resulting larval and adult thrips. Cotton plants were rated visually for thrips injury on May 25, June 4, and June 11. Plant populations were determined on June 6 by counting all living plants in the center two rows of each plot. Yields were determined by mechanically harvesting the center two rows of each plot on October 22. Weather problems delayed stand emergence, seriously impacted stands and aggravated sampling.

All treatments, except the control, kept thrips numbers below one per plant on May 21 (Table 1). By June 2 thrips populations had increased, but reproduction was not high in any of the insecticide treatments. On June 11 the Adage treatments and the Gaucho 480 treatment had fewer thrips than other treatments.

Thrips damage ratings showed all treatments to be better than the control (Table 2). After Orthene and Karate were applied to Adage treatments, those plots had the least amount of thrips injury.

The Adage treatment had the lowest plant population and the Temik 0.75 treatment had the highest stand density, but there was less than a 15% difference among all treatments (Table 2). A poor stand existed in all plots and the poor growing conditions very likely outweighed any effects on stand that the treatments may have had.

Seed cotton yields are presented in Table 2. Both Adage treatments, which received an additional foliar insecticide application, outyielded other treatments. Yields from other treatments were very similar. Some treatment effects on yield were undoubtedly masked by the poor stands and poor growing conditions.

TABLE 1. NUMBERS OF THRIPS PER FIVE PLANTS

	—May 21—		—June 2—		—June 11—		——Seasonal average——		
Treatments	Adult	Larva	Adult	Larva	Adult	Larva	Adult	Larva	Total
Adage 0.3 lbs. a.i./cwt	2	0	4	1	3	4	2.67	1.50	4.17
Adage 0.3 lbs. a.i./cwt + Karate 0.016 lbs. a.i./ac.	2	0	2	1	2	8	2.00	3.08	5.08
Adage 0.3 lbs. a.i./cwt + Orthene 0.2 lbs. a.i./cwt.	1	0	6	1	4	6	3.25	2.33	5.58
Gaucho 480 0.25 lbs. a.i./cwt.	2	0	9	6	2	12	4.33	5.77	10.10
Temik 0.5 lbs. a.i./ac.	2	0	8	3	3	25	4.17	9.25	13.42
Temik 0.75 lbs. a.i./ac.	1	0	9	4	2	25	3.67	9.77	13.44
Gaucho 600 0.25 lbs. a.i./cwt.	3	0	9	2	4	23	3.67	9.77	13.44
Control	6	5	10	17	4	53	6.25	25.12	31.37

TABLE 2. THRIPS DAMAGE RATINGS, PLANT POPULATION, AND YIELD

	Damage ratings [1]				Plants/	Seed cotton
Treatment	May 25	June 4	June 11	Average	row ft.	*lbs/ac*
Adage 0.3 lbs. a.i./cwt + Karate 0.016 lbs. a.i./ac.	1.25	2.00	2.00	1.75	1.73	2610
Adage 0.3 lbs. a.i./cwt + Orthene 0.2 lbs. a.i./cwt.	1.50	2.00	2.00	1.83	1.54	2604
Temik 0.75 lbs. a.i./ac.	1.00	3.00	2.25	2.08	1.74	2202
Gaucho 480 0.25 lbs. a.i./cwt.	1.25	3.00	2.25	2.17	1.53	2195
Adage 0.3 lbs. a.i./cwt.	1.50	2.50	2.75	2.25	1.52	2055
Gaucho 600 0.25 lbs. a.i./cwt.	1.75	2.75	2.75	2.42	1.54	2189
Temik 0.5 lbs. a.i./ac.	1.25	3.00	3.00	2.42	1.56	2228
Control	3.25	4.75	4.75	4.25	1.68	2205

[1] 0 = no injury, 5 = extreme injury.

STATEWIDE MONITORING OF BOLLWORM/BUDWORM POPULATIONS WITH HELID

Ron H. Smith

HELID kits were available to monitor egg populations during the 2001 cotton-growing season. (HELID is a test to identify eggs of bollworm, *Helicoverpa zea* [Boddie] and budworm, *Heliothis virescens* [F.])Technical help was employed from May 14 to August 17 to assist with this project. In addition, this project was coordinated with the FMC Corporation, which cooperated in this statewide effort. Private consultants from all regions of the state also cooperated in this project.

The 2001 year was the third consecutive season of overall light bollworm/budworm pressure in Alabama. However, economical levels of each species did occur at several different times of the season in all regions of the state. Therefore, growers in all areas utilized the results from the HELID tests in selecting the appropriate type chemistry for the species mix in their fields. Since pyrethroids are not effective on budworms, and the newer chemistry is more effective, growers can reduce damage to bollworm/budworm populations and make more efficient use of their inputs by utilizing information from the HELID results.

More than 100 key cooperators (extension agents, consultants, agricultural distributors, and growers) were identified to receive fax messages within a few hours after completion of a HELID sample. This same information was placed on a toll free 800 line available to all interested parties within the state and region. Since Alabama growers made a significant shift back to conventional varieties in 2001 (approximately 50% Bollgard), this information assisted in selecting the appropriate chemistry on approximately 300,000 acres of conventional cotton. The price differential between pyrethroids ($3.50-5.00) and newer chemistry ($9.00-$14.00/acre application) was greater than in previous years.

Results presented in the table indicate the species mix varied by time (date). In general, the "worm" population was predominantly budworm during the early fruiting season (June 1-July 10), bollworm during a two- to three-week July window, and a mix of both species in August, with majority of the population budworm. Numerous eggs showed up as "unknown" in early season and were likely other non-economic species.

RESULTS OF HELID TESTS IN ALABAMA, 2001

Date	Location	BW [1]	TBW	Other
			%	
June 4	Covington Co.	5	53	42
June 5	Macon Co.	0	50	50
June 5	Elmore Co.	13	62	25
July 1	Talladega Co.	25	75	0
July 18	Houston Co.	57	31	12
July 27	Macon Co.	50	50	0
August 3	Limestone Co.	45	55	0
August 9	Tallapoosa Co.	60	40	0
August 9	Limestone Co.	28	62	9
August 9	Macon Co.	38	62	0

[1] BW = bollworm, TBW = budworm, Other = cutworms, true armyworms, or yellow striped armyworms.

EVALUATION OF BOLLGARD II AND PHYTOGEN VARIETIES FOR CONTROL OF FALL ARMYWORM AND BOLLWORM SPECIES

Ron H. Smith

Plans are under development to market cotton varieties with two Bt genes in the near future. It is anticipated that this second Bt strain will be more active on a broader range of Lepidoterous pests. This project attempted to evaluate varieties with two stacked Bt (Bollgard II) genes against fall armyworm, soybean loopers, and other Lepidopterous species.

Cotton was planted in 2000 and 2001 in replicated plots on Prattville Experiment Field, Prattville, Gulf Coast Research and Extension Center, Fairhope, and Wiregrass Research and Extension Center, Headland, in anticipation of a natural population of fall armyworms occurring. Three varieties were planted (conventional, Bollgard, and Bollgard II). These farm locations were in central, southeast, and southwest Alabama where fall armyworms have historically occurred.

Plots were monitored weekly for fall armyworms. In 2000, at the central Alabama location, lab-reared fall armyworms were released into the test plots with only limited success. However, low natural populations did occur at two sites, while soybean loopers occurred at the third location. In 2001, neither species occurred at either location, so comparisons were made on bollworm and tobacco budworm effectiveness.

Bollgard II plots incurred much less boll bract etching from fall armyworm larvae (FAW) in the 2000 season at two test locations than did the Bollgard or conventional plots (Table 1). Bollgard and conventional plots showed similar levels of damage at Prattville but Bollgard had less FAW damage than the conventional plots at Headland. Bollgard II plots at Fairhope had no soybean looper larvae or defoliation while both the Bollgard and conventional plots had up to 30 larvae per six row feet and 10% foliage loss. Based on these results, Bollgard II appears to have broader Lepidopterous pest activity than does Bollgard.

During the 2001 season all caterpillar pressure was light. No damage or larvae were found in the Bollgard II plots at any of the three locations. Under this low level of pressure, Bollgard plots only had low levels of bollworm/budworm damage on one date at each of two locations (Table 2). Therefore, pressure was likely not adequate to demonstrate the improved effectiveness of Bollgard II over Bollgard against bollworms or budworms.

TABLE 1. BOLLGARD II EVALUATIONS 2000 SEASON

	——Variety——		
	DP50	DP50B	DP50II
Date	% of bolls with fall armyworm etching		
	Prattville		
August 7	2.0	0.0	0.0
August 21	20.0	9.0	0.0
August 29	28.0	23.0	2.0
	Headland		
August 15	0.0	0.0	0.0
August 23	0.0	0.0	0.0
September 4	26.0	5.0	0.0
Date	Numbers of soybean loopers/6 row feet		
	Fairhope		
August 22	12.0	12.8	0.0
August 27	24.8	32.3	0.0
Date	——% defoliation——		
	Fairhope		
September 5	10.0	10.0	0.0

TABLE 2. BOLLGARD EVALUATIONS 2001 SEASON

	——Variety——		
	DP5415	NuCotn 33B	Bollgard II
Date	——% damaged fruit——		
	Prattville		
July 16	38.0	1.2	0.0
August 1	8.0	0.0	0.0
August 8	28.0	0.0	0.0
August 14	13.0	0.0	0.0
	Fairhope		
July 3	1.3	0.0	0.0
July 10	2.6	0.0	0.0
July 17	10.6	0.0	0.0
August 7	2.6	0.0	0.0
	Headland		
July 10	16.0	0.0	0.0
July 16	36.0	2.6	0.0
July 23	2.6	0.0	0.0
July 30	2.6	0.0	0.0
August 13	2.6	0.0	0.0

[1] Damaged caused by either the bollworm or tobacco budworm.

NEMATICIDES

MANAGEMENT OF THE RENIFORM NEMATODE WITH ANHYDROUS AMMONIA

K. S. McLean, W. S. Gazaway, A. J. Palmateer, N. W. Greer, and J. R. Akridge

The efficacy of anhydrous ammonia for the management of the reniform nematode (*Rotylenchulus reniformis*) was evaluated in Huxford, Alabama. The test was conduced in a field naturally infested with the reniform nematode and monocultured in cotton. The soil was a silty loam. Anhydrous ammonia was applied either in the fall or six weeks before planting by injecting the chemicals 12 inches deep with shanks. Temik 15G and Di-Syston were applied at planting in the seed furrow with chemical granular applicators attached to the planter. PGPR consisted of *Bacillus subtilis* strain (GBO3) plus *B. amyloliquifaciens* strain (IN937a), which was applied as a directed spray in the seed furrow at 10 gallons per acre applied through 8002E flat fan nozzles.

Plots consisted of four rows, 25 feet long with a 36-inch row spacing. All plots were arranged in a randomized complete block design with six replications. Blocks were separated by a 20-foot alley. Each row was planted with 125 Suregrow 125 BR cotton seed on May 2. All plots were maintained with standard production practices recommended by the Alabama Cooperative Extension System commonly used in the area. Plots were not irrigated.

Population densities of reniform nematode were determined throughout the season at monthly intervals. Ten soil cores, 1 inch in diameter and 8 inches deep were collected from the two center rows of each plot in a systematic sampling pattern. Nematodes were extracted using gravity sieving and sucrose centrifugation technique. Plots were harvested on October 17.

The season was warm and moist and was ideal for producing a good cotton growth and reniform reproduction. Thirty days after planting reniform nematode populations were significantly lower in the Temik 15G treatment compared to all other treatments (see table). No significant differences in reniform populations were observed in any of the treatments at 84 days after planting. By defoliation at 115 days after planting, the anhydrous ammonia at 200 and 120 units and the Temik 15G treatments produced significantly lower reniform populations than the ammoniun nitrate treatment. Cotton seed yield varied 501 pounds per acre for the anhydrous ammonia 200 units and the ammonium nitrate treatments respectively. The anhydrous ammonia treatments at 200 and 90 units produced a significantly greater yield than the ammonium nitrate and the PGPR treatment. The anhydrous ammonia treatments increased yield over the ammonium nitrate treatments by 204 pounds per acre.

EFFECT OF ANHYDROUS AMMONIA ON RENIFORM POPULATION ACROSS THE SEASON AND COTTON SEED YIELD

Treatment [1]	Rate formulated product	Reniform/150 cc of soil May 24	June 21	Aug. 15	Sept.25	Seed cotton *lb/ac*
Anhydrous ammonia	200 units/ac - fall app.	3043 b	4944 ab	5266 a	4458 b	3093 a
Anhydrous ammonia	120 units/ac - preplant	3365 b	4742 ab	6463 a	4120 b	2650 bc
Anhydrous ammonia	90 units/ac - preplant	5197 a	5579 a	7223 a	5631ab	2887 ab
Ammonium nitrate	90 units/ac - at plant	4326 ab	6043 a	7146 a	6875 a	2592 c
Temik 15G+Ammonium nitrate	7 lb/ac + 90 units/ac - at plant	4390 ab	3305 b	8588 a	4172 b	2831 abc
PGPR +Ammonium nitrate	1 pt/ac+ 90 units/ac - at plant	4236 ab	4867 ab	7081 a	5995 ab	2592 c
LSD (P=0.05)		1563	1726	3361	2332	274

[1] Di-Syston (7 lb/ac - at planting) added in all treatments except the Temik treatment.
PGPR consisted of *Bacillus subtilis* strain (GBO3) + *B. amyloliquifaciens* strain (IN937a).

EVALUATION OF THE SOIL FUMIGANT VAPAM FOR RENIFORM NEMATODE MANAGEMENT IN COTTON

K. S. McLean, A. J. Palmateer, N. W. Greer, G. W. Lawrence, and J. R. Akridge

The efficacy of Vapam for the management of the reniform nematode (*Rotylenchulus reniformis*) was evaluated near Huxford, Alabama. The test was conduced in a field naturally infested with the reniform nematode and monocultured in cotton. The soil was a silty loam. Vapam ammonia was applied two weeks before planting by injecting the chemicals 12 inches deep with shanks. Temik 15G treatments were applied at planting on May 25 in the seed furrow with chemical granular applicators attached to the planter. Di-Syston was applied similarly to the control.

Plots consisted of four rows, 25 feet long with a 36-inch row spacing. All plots were arranged in a randomized complete block design with six replications. Blocks were separated by a 20-foot alley. Each row was planted with 125 Suregrow 125 BR cotton seed. All plots were maintained with standard production practices recommended by the Alabama Cooperative Extension System. Plots were not irrigated. Population densities of reniform nematode were determined through out the season at monthly intervals.

Ten soil cores, 1 inch in diameter and 8 inches deep were collected from the two center rows of each plot in a systematic sampling pattern. Nematodes were extracted using gravity sieving and sucrose centrifugation technique. Plots were harvested on November 12.

The season was dry in the spring; thus, planting was delayed. Pre-plant populations of reniform nematodes averaged 3614 reniform per 150 cubic cm of soil. Thirty days after planting, reniform nematode populations were significantly lower in all the nematicide treatments as compared to the control (see table). The Vapam treatments reduced reniform populations 91% compared to the control. By 90 days after planting only the Vapam at the 8-gallons-per-acre rate significantly reduced the reniform populations compared to the control. No significant differences in reniform populations were observed between any treatment at 125 days after planting.

Cotton seed yield varied 280 pounds per acre for the Temik 15 G 3.5 pounds per acre and the untreated control treatments respectively. The Vapam treatments increased yield over the control by an average of 153 pounds per acre; however, no treatment increased yields significantly over the control.

EFFECT OF VAPAM ON RENIFORM NEMATODE POPULATIONS AND SEED COTTON YIELD

Treatment [1]	Rate formulated product	Timings	Reniform/150 cc of soil May 2 [2]	June 21	Aug. 15	Sept. 25	Seed cotton lb/ac
Control	—	—	3403 a	7278 a	11163 a	4532 a	2372a
Vapam HL	5 GPA	14 DBP	3433 a	678 c	6927 ab	5523 a	2596 a
Vapam HL	8 GPA	14 DBP	2772 a	519 c	5317 b	6257 a	2455 a
Temik 15 G	3.5 lb/ac	at plant	4064 a	2480 b	9030 ab	4296 a	2652 a
Temik 15 G	5.0 lb/ac	at plant	4399 a	1592 bc	9219 ab	4764 a	2473 a
LSD (P=0.05)			1747	1250	4305	2149	302

[1] Di-Syston (7 lb/ac - at planting) added in all treatments except the Temik treatments. [2] May 2 = 23 days before planting.
Means compared using Fisher's protected least significant difference test (P=0.05).

TELONE FALL FUMIGATION VERSUS SPRING FUMIGATION FOR RENIFORM NEMATODE MANAGEMENT IN COTTON

William S. Gazaway, J.R. Akridge, and Kathy McLean

Telone II and Temik 15G are the two commonly used nematicides for controlling reniform nematodes in cotton. Telone II, a fumigant, is injected approximately 18 inches deep in raised soil beds in the spring at least one week prior to cotton planting to avoid injury to emerging cotton seedlings. Telone is a very effective nematicide when applied to a soil that is well-pulverized, free of clods, and relatively warm and dry. However, if applied to cold, wet soils—conditions that often occur early in the spring in Alabama—the fumigant will not control nematodes effectively and may injure or even kill cotton seedlings. It appears that cotton producers could obtain better results from fumigation in the fall when the soil is warmer and drier. The purpose of this test is to compare the effectiveness of fall fumigation versus spring fumigation for controlling reniform nematodes in cotton.

Plots consisted of four 36-inch rows thirty feet long and were arranged in a complete randomized block with five replications. Nematode soil samples and yield data were taken from the center two rows. Treatments are listed in Table 1. Nematode samples were taken three times: (1) in the fall on November 4, 2000, (2) in the spring on May 5, 2001, and (3) on June 2001. Telone was injected 18 inches deep using a subsoil shank to designated plots on December 4, 2000 and April 11, 2001. Other plots not receiving Telone were also subsoiled. Cotton, DPL 458 B/RR variety, was planted on May 2, 2001. All plots received cultural, weed, and insect control practices according to Auburn University recommendations.

All Telone II fumigated treatments significantly outproduced Temik 15G (7 pounds per acre) and the Di-Syston 15G treatments (Table 2). No significant yield differences between the fall application rates of Telone (3 gallons per acre and 5 gallons per acre, respectively) and the spring application of Telone 3-gallons-per-acre rate. This could be due to the ideal soil temperature and moisture conditions at the time of the Telone spring fumigation in April. The failure of Temik 15G to produce a yield response is puzzling, since soil moisture and temperature in early May was ideal for the activation of Temik.

TABLE 1. TREATMENTS APPLIED IN THE FALL/SPRING TELONE AND TEMIK TEST

Treatment	Rate/acre	Time of application
1 Telone II	3 gal	injected in the fall
2 Telone II	5 gal	injected in the fall
3 Telone II	3 gal	injected in the spring
4 Temik 15G	7 lb	in seed furrow at planting
5 Di-Syston 15G	7 lb	in seed furrow at planting

TABLE 2. COTTON YIELD RESPONSE TO TELONE II AND TO TEMIK 15G

Treatment	Rate/acre	Application	Seed cotton/acre
1 Telone II	3 gal	fall	2948 a
2 Telone II	5 gal	fall	3035 a
3 Telone II	3 gal	spring	3010 a
4 Temik 15G	7 lb	at planting	2423 b
5 Di-Syston 15G	7 lb	at planting	2317 b
LSD	(P=.01)		395

IMPACT OF FALL FUMIGATION WITH TELONE AND POST PLANT TEMIK APPLICATIONS ON COTTON PRODUCTION

William S. Gazaway, Kathy McLean, and Don Moore

Reniform nematodes continue to be a major impediment to successful cotton production in Alabama. Losses in cotton fields heavily infested with reniform nematodes (*Rotylenchulus reniformis*) can range from 20% to as high as 75% depending on growing conditions. In past years, nematicides, Telone II and Temik 15 G, have been used to moderate these losses and allow growers to successfully produce a profit in these fields.

Currently cotton producers who use Telone II inject it approximately 18 inches deep in well-pulverized, raised soil beds seven days prior to planting. Soil conditions at this time (particularly in the early spring) are often too wet and too cold for the fumigant to be effective. Under these conditions, not only does Telone not control nematodes but it can remain in the soil and harm developing cotton seedlings. For this reason, Telone applied the previous fall when soil conditions are drier and warmer might be more effective.

Temik 15G applied at 5 to 7 pounds per acre in the seed furrow is the most frequently used nematicide to control reniform nematodes. Past trials have shown that this nematicide can be quite effective against reniform nematodes when applied at planting. Moreover, trials in north Alabama have shown a substantial yield increase with an application of Temik 15G (7 pounds per acre) or Vydate (2 pints per acre) at pinhead square. A trial was set up, therefore, to determine if similar results could be obtained with post applications of Temik in central Alabama.

The Avant cotton field near Prattville, Alabama, was selected because it had suffered substantial production losses due to reniform nematodes. The field, a sandy loam (66% sand, 29% silt, and 5% clay) was disced thoroughly in January 2001 and bedded up. Treatments were arranged in a complete randomized block design with six replicates (Table 1). Plots consisted of four 36 inch rows, 25 feet long. Data were taken from the center two rows. Telone II

TABLE 1. SUMMARY OF TREATMENTS FOR AVANT TEST

Treatment	Rate/acre	Time of application
Telone II	3 gal	fall fumigation. Injected 18 inches deep.
Telone II	5 gal	fall fumigation
Telone II	3 gal	spring fumigation
Temik 15G	7 lb	in seed furrow at planting
Temik 15 G + Temik 15G	7 lb + 7 lb	in seed furrow at planting, followed by side dress application at pin head square.
Temik 15G	5 lb	in seed furrow at planting
Adage	—	seed treatment for early season insect control

was injected 18 inches beneath the top of the raised bed surface at 3 gallons per acre and at 5 gallons per acre to designated plots. All plots not receiving Telone were sub-soiled at the same 18 inch depth. The fall Telone fumigation which normally would be applied in November or December, 2000 was not made until January 29, 2001 due to wet soil conditions. Soil temperature at the time of fall fumigation was 54°F. On March 28, 2001, Telone II at 3 gallons per acre was injected into the designated spring fumigation plots. Soil temperature was 51°F at time of fumigation. Again all other plots received the same subsoil treatment as the spring fumigated plots. On May 21, 2001, all plots were planted with Sure Grow 125 BR seed treated with the insecticide Adage. Temik 15 G was applied in the seed furrow at 5 pounds per acre or 7 pounds per acre to designated plots. Temik 15G was later applied as a side dress treatment on July 6, 2001 to designated plots.

Nematode samples were taken the previous fall (on November 30, 2000), on April 10, 2001, on August 01, 2001, and at harvest (on October 1, 2001).

Plots that received Telone II applied in the fall at 5 gallons per acre produced significantly higher yields than plots receiving no nematicide (i.e. Adage treated) or plots treated with Temik 15G at 7 pounds per acre (Table 2). Plots receiving Temik 15G at planting (7 pounds per acre) and a side dress treatment (7 pounds per acre) at pin head square produced the second highest yields in the test but were not significantly greater than other Telone plots or Temik (5 pounds per acre) plots. Plots treated with Temik 15G (5 pounds per acre) at planting and the untreated plots produced slightly better yields than Temik (7 pounds per acre).

TABLE 2. COTTON YIELD RESPONSE TO TELONE AND TO TEMIK APPLICATIONS

Treatment	Rate/acre	Application	Seed cotton/acre
Telone II	5 gal	fall fumigation	2948 a
Temik 15G + Temik 15G	7 lb + 7 lb	at planting pinhead square	2791 ab
Telone II	3 gal	spring fumigation	2682 ab
Telone II	3 gal	fall fumigation	2638 ab
Temik 15G	5 lb	at planting	2561 ab
Adage		treated seed	2400 b
Temik 15	7 lb	at planting	2279 b
LSD (P=0.05)			505

IMPACT OF VARIOUS CROP ROTATIONS AND WINTER COVER CROPS ON THE RENIFORM NEMATODE IN COTTON

W.S. Gazaway, J.R. Akridge, and K.S. McLean

Previous research in Alabama revealed that certain non-host crops reduced reniform nematode populations to manageable levels within one cropping year. Cotton alternated with summer non-host crops on alternate years produced significantly more cotton than continuous cotton with or without a nematicide. However, reniform populations returned to potentially damaging levels after one growing season back in cotton. Some cotton producers also believe that certain winter cover crops have a beneficial effect on cotton production in reniform infested fields. The purpose of this test is to reaffirm non-host crops' ability to reduce reniform populations and to determine if certain winter cover crops or fallow will reduce reniform populations to safe levels.

The test was conducted on the Ward Brothers' farm near Huxford, Alabama, in a loam field (49% sand, 34% silt, and 17% clay). This field has had a high infestation of reniform nematodes for more than 12 years and, as a result, experienced substantial cotton yield losses over that period. The experimental design was a split plot, randomized design with five replications. Plots consisted of four 36-inch rows, 25 feet long. Main plots were the winter cover crops that include common vetch (Cahaba White), rye (Wren's Abruzzi), and fallow. Subplots were summer crops that include cotton (DPL 458 B/RR), corn (DeKalb 683), soybean (AgriPro 5588-RR), and peanut (Southern Runner). (In 2000, soybean 'AgriPro 5588-RR' cultivar replaced 'Centennial' because 'Centennial' seeds were no longer available.) The crop rotation scheme consisted of a 1-year rotation of a non-host summer crop with cotton. That is, peanut, corn, and soybean were planted during even years and cotton was planted in odd years. Two treatments (i.e., continuous cotton) were planted to cotton every year. One continuous cotton treatment received a nematicide/ insecticide (Temik 15G) and the other continuous cotton treatment (no nematicide) received only an insecticide, Di-Syston 15G.

This rotation study was begun with winter cover crops and a fallow treatment following cotton in the fall of 1997. Non-host crops and cotton for the continuous cotton plots were planted to designated plots in the spring of 1998. Cotton was planted to all plots in the spring of 1999, followed by non-host crops again in 2000. Cotton was planted to all plots again in the spring of 2001.

Cotton (DPL-458 B/RR) was planted to all plots May 2001. Di-Syston 15G was applied at 7 pounds per acre in the seed furrow at planting for early season insect control to all treatments except the continuous cotton plus nematicide treatment. Temik 15G was applied at 7 pounds per acre in the seed furrow at planting to the continuous cotton plus nematicide treatment plots. Soil samples were pulled for nematode analyses from the two inner rows of each plot on May 2, 2001 and October 21, 2001. Cotton was harvested from the two inner rows of each plot on October 21, 2001.

All other cultural practices, weed control, and insect control were implemented according to Auburn University recommendations.

All treatments including continuous cotton produced relatively good yields due to ideal growing conditions throughout the 2001 growing season (Table 1). The cotton following peanut rotation produced the highest cotton yield (Tables 1 and 3). The corn/cotton rotation and the soybean/cotton rotation produced the next highest yields although they were not significantly greater than continuous cotton with or without a nematicide (Table 3). Although the peanut/cotton rotation increased yields significantly, no such increases occurred with either the corn/cotton rotation or the soybean/cotton rotation in 2001. Although there appears to be no significant difference between winter cover crops and fallow (Table 2), the fallow/peanut rotation produced significantly higher cotton yields than the rest (Table 1). Cotton yields following the winter cover rye in 2001 were significantly improved over cotton yields following rye in 1999. This improvement may be attributed to leaving rye stubble standing in the field rather than incorporating it in the soil prior to planting the summer crop as it had been done in years previous to 2000. Since then, no nitrogen deficiency symptoms have been observed in cotton or in the other summer non-host crops.

TABLE 1. CROP ROTATIONS RANKED IN ASCENDING ORDER ACCORDING TO COTTON YIELD, HUXFORD, ALABAMA, 2001

Rotation scheme	Seed cotton yield *lb/ac*
Fallow/peanut/cotton	3704 a
Vetch/peanut/cotton	3107 ab
Rye/peanut/cotton	2964 b
Rye/corn/cotton	2929 b
Fallow/corn/cotton	2857 b
Vetch/soybean/cotton	2771 b
Fallow/cotton/cotton	2765 b
Vetch/corn/cotton	2741 b
Fallow/soybean/cotton	2719 b
Rye/soybean/cotton	2696 b
Vetch/cotton/cotton	2617 b
Rye/cotton+Temik/cotton+Temik	2601 b
Fallow/cotton + Temik/cotton + Temik	2531 b
Rye/cotton/cotton	2520 b
Vetch/cotton + Temik/cotton + Temik	2470 b
LSD (P=0.05)	676

TABLE 2. EFFECT OF WINTER COVER CROPS AND WINTER FALLOW ON 1999 AND 2001 COTTON PRODUCTION

Winter cover crop	—Seed cotton *(lb/ac)*— 1999	2001
Fallow	2615 b	2916 a
Vetch	2849 a	2741 a
Rye	2085 c	2742 a
LSD (P=0.05)	233	406

Reniform nematode population response reflected a similar pattern as the yield response between summer crop rotations and continuous cotton (Table 4). Reniform populations declined significantly following one year of corn, soybean, or peanut while populations remained high in both nematicide-treated and untreated continuous cotton plots (see Nov. 9, 00 column, Table 4). After one crop of cotton, reniform nematode populations had rebounded to damaging levels by the end of the growing season in all treatments (see Oct. 17, 01 column, Table 4). Winter cover crops did not appear affect reniform populations (Table 5).

One year corn/cotton, soybean/cotton, and peanut/cotton rotations were more effective than the nematicide Temik in reducing reniform nematodes to manageable levels. The rapid buildup of reniform nematodes after one season of cotton in 1999 and 2001 confirms that rotation, like a nematicide treatment, is good for only one growing season.

TABLE 3. IMPACT OF CROP ROTATION WITH NON-HOST SUMMER CROPS ON COTTON PRODUCTION IN 1999 AND 2001

1998 and 2000 summer crops	—Seed cotton *(lb/ac)*— 1999	2001
Corn	2808 a	2842 b
Peanut	2739 a	3259 a
Soybean [1]	2720 a	2729 b
Cotton	2175 b	2634 b
Cotton + Temik	2139 b	2534 b
LSD (P=0.05)	219	283

[1] Soybean cultivar changed from Centennial in 1998 to AgroPro-5588-RR in 2000.

TABLE 4. IMPACT OF ONE YEAR OF COTTON (2001) ON RENIFORM POPULATIONS FOLLOWING NON-HOST SUMMER CROPS THE PREVIOUS YEAR (2000)

Growing seasons 2000/2001	——Reniform per 100 CC soil—— Nov. 9,00	May 2,01	Oct. 17,01
Cotton/cotton	2394	663	4050
Cotton/cotton + Temik	1336	520	3130
Corn/cotton	529	74	2470
Soybean/cotton	596	159	2787
Peanut/cotton	489	247	2856
LSD (P=0.05)	449	236	855

TABLE 5. IMPACT OF WINTER COVER CROPS ON RENIFORM POPULATIONS DURING AND AFTER COTTON PRODUCTION

Winter cover crop	—Reniform per 100 CC soil— Nov. 9,00	May 2,01	Oct. 17,01
Fallow	1076	328	3413
Vetch	990	236	2741
Rye	1140	433	3107
LSD (P=0.05)	778	408	750

FUNGICIDES

EVALUATION OF FULL SEASON COTTON VARIETIES FOR RESPONSE TO BOLL ROT DISEASE IN ALABAMA

A. J. Palmateer, K. S. McLean, K. Glass, and M. D. Pegues

A cotton variety trial was planted on May 1 at the Gulf Coast Research and Extension Center in Fairhope, Alabama, and included 27 early season and 25 full season cotton varieties. The soil type was a sandy loam. Plots consisted of two rows, 25 feet long with a 40-inch wide row spacing and were arranged in a randomized complete block design with four replications. Blocks were separated by a 20-foot alley. The nematicide Temik 15G (5 pounds per acre) was applied in-furrow at planting. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Cotton boll rot was evaluated by recording the number of healthy bolls and diseased bolls from a thousandth of an acre section within each plot. Ratings of boll rot were conducted on September 25 at 148 days after planting. Percent diseased bolls (number of diseased bolls divided by total number counted) was calculated for each variety. Plots were harvested on November on 14.

Cotton boll rot disease incidence was high for early-planted cotton in 2001 due to wet conditions. Disease indexes for the early season cotton varieties ranged from a high of 32.5 % diseased bolls to a low of 18.1% diseased bolls for Germain's GC-377 and Deltapine DP451B/RR, respectively (Table 1). Deltapine DP451B/RR, Sure-Grow 215B, and PhytoGen PSC 355 had the lowest disease indexes of the early variety cotton; however, 12 varieties produced significantly less boll rot than Germain's GC-377. Disease indexes for the full season cotton varieties ranged from a high of 28.5 % disease bolls to a low of 11.4 % diseased bolls for Sure-Grow 821 and Deltapine DP655BRR, respectively (Table 2). Deltapine DP655BRR, Deltapine DP 5690,4600 RR, and Deltapine NuCotton 35B had the lowest boll rot disease indexes; however, 18 varieties produced significantly less boll rot than Sure-Grow 821. In 2001, the early and full season varieties overall averaged 24.87% and 23.91% boll rot disease indexes; thus, there are no generalizations that can be made between early and full season varieties.

TABLE 1. VARIETY RESPONSE TO COTTON BOLL ROT AND YIELD OF SELECTED REGULAR EARLY SEASON COTTON VARIETIES AT THE GULF COAST RESEARCH AND EXTENSION CENTER

Variety[1]	Bolls *no/plot*	Diseased bolls *no/plot*	Disease index[2] *%*	Yield seed cotton *lb/ac*
Deltapine NuCotton 33B	82 abc	31 a-d	27 a-d	1006 abc
Deltapine DP 20B	81 abc	31 a-d	27 a-d	802 c-e
Deltapine DP 422B/RR	93 a	32 a-d	26 a-e	912 a-e
Deltapine DP 451B/RR	88 ab	19 e	18 e	889 a-f
Stoneville BXN 47	83 abc	29 a-e	26 a-e	1046 a
Sure-Grow 747	94 a	29 a-e	23 b-e	841 a-f
Sure-Grow 105	83 abc	34 ab	29 ab	854 a-f
Paymater PM1560BG	81 abc	30 a-d	27 a-e	876 a-f
Deltapine DP 428B	85 ab	24 b-e	22 b-e	958 a-d
Deltapine DP 425RR	96 a	32 a-d	25 a-e	959 a-d
Deltapine DP 436RR	93 a	37 a	28 abc	844 a-f
PhytoGen PSC 355	81 abc	22 de	21 cde	980 a-d
Stoneville ST 4691B	90 a	28 a-e	24 b-e	1028 a
Stoneville ST 4892BR	87 ab	30 a-e	26 a-d	815 b-f
Sure-Grow 125BR	87 ab	24 b-e	21 b-e	700 f
Sure-Grow 501BR	88 ab	29 a-e	25 a-e	955 a-d
Paymaster PM 1218BG/RR	84 ab	23 cde	22 b-e	961 a-d
1500 RR	65 c	27 a-e	29 abc	908 a-f
Fiber Max FM 966	84 abc	27 a-e	23 b-e	994 a-d
Sure-Grow 521R	81 abc	24 b-e	22 b-e	916 a-e
Sure-Grow 215B	83 abc	22 de	20 de	1026 ab
Deltapine DP 491	80 abc	26 b-e	24 b-e	975 a-d
Germain's GC-271	81 abc	29 a-e	27 a-d	873 a-f
Germain's GC-377	70 bc	33 abc	32 a	914 a-e
PM 1199 RR	89 ab	34 abc	28 a-d	736 ef
AMX 4207	84 abc	30 a-e	26 a-d	787 def
Stoneville ST 4793R	83 abc	25 b-e	24 b-e	921 a-e
LSD (P=0.05)	19	11	8	211

[1] Planted May 1, 2001. [2] Disease index = (no. of disease bolls/no. of healthy bolls + disease bolls) X 100.

TABLE 2. VARIETY RESPONSE TO COTTON BOLL ROT AND YIELD OF SELECTED REGULAR FULL SEASON COTTON VARIETIES AT THE GULF COAST RESEARCH AND EXTENSION CENTER

Variety [1]	Bolls *no/plot*	Diseased bolls *no/plot*	Disease index [2] *%*	Yieldseed cotton *lb/ac*
Deltapine Acala 90	98 abc	18 a-d	15 bc	767 ef
Deltapine DP 5690	92 abc	16 cd	13 bc	741 f
Deltapine DP 5415	91 abc	18 a-d	17 bc	933 a-e
Deltapine NuCotton 33B	102 ab	28 abc	21 abc	964 abc
Deltapine NuCotton 35B	94 abc	16 cd	15 bc	1078 a
Deltapine DP 5415 RR	92 abc	19 a-d	17 bc	779 def
Deltapine DP 5690RR	103 ab	25 a-d	19 abc	861 b-f
Deltapine DP 448B	109 a	32 a	23 ab	867 b-f
PytoGen PSC 161	91 abc	19 a-d	18 bc	957 a-d
Fiber Max FM 989RR	80 bc	24 a-d	24 ab	860 b-f
Fiber Max FM 832	73 c	16 cd	18 bc	768 ef
Sure-Grow 821	74 c	29 abc	28 a	905 a-f
Sure-Grow 747	106 ab	26 a-d	21 abc	939 a-e
Paymaster PM 1560BG/RR	87 abc	24 a-d	22 ab	908 a-f
Deltapine DP 458BRR	104 ab	21 a-d	16 bc	974 b-f
Deltapine DP655BRR	96 abc	12 d	11 c	799 c-f
PhytoGen HS 12	89 abc	31 ab	23 ab	969 abc
Stoneville ST 4892BR	93 abc	22 a-d	19 abc	1036 ab
DP Delta Pearl	98 abc	22 a-d	19 abc	1068 a
4600 RR	107 a	19 a-d	14 bc	1030 ab
Deltapine DP 565	93 abc	26 abc	23 ab	1029 ab
Deltapine DP 491	86 abc	19 a-d	18 bc	997 ab
PytoGen Phy 72 Acala	87 abc	25 a-d	22 ab	778 def
Stoneville ST 580	92 abc	22 a-s	18 abc	875 b-f
Stoneville STX 9905	92 abc	18 bcd	17 bc	1006 ab
LSD (P=0.05)	27	14	10	184.72

[1] Planted May 1, 2001. [2] Disease index = (no. of disease bolls/no. of healthy bolls + disease bolls) X 100.

EVALUATION OF SELECTED FUNGICIDES FOR CONTROL OF COTTON BOLL ROT DISEASE ON DPL458BR

A. J. Palmateer, K. S. McLean, and M. D. Pegues

A cotton fungicide test was planted on June 7 at the Gulf Coast Research and Extension Center in Fairhope, Alabama. The test site was a sandy loam soil. All fungicides were applied as a foliar spray using TX-12 cone nozzles, mounted on ground slides spraying upward with two nozzles per row calibrated to deliver 26 gallons per acre at 75 pounds per square inch. Plots consisted of two rows, 40 feet long, with a 38-inch wide row spacing and were arranged in a randomized complete block design with five replications. A10-foot alley was cut prior to defoliation to facilitate harvest. The nematicide Temik 15G (5 pounds per acre) was applied in-furrow at planting. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Plots were sprayed at full bloom and two weeks later. The number of healthy and rotted bolls were recorded on October 10. Plots were harvested on November 26.

The incidence of boll rot was moderate due to the late planting. Seed cotton yields varied by 737 pounds per acre for the Folicur 4 ounces active ingredient per acre at full bloom plus 14 days and Messenger 2.25 grams active ingredient per acre at full bloom plus 14 days applications (see table). One application at full bloom for Terraclor 4F, Rovral 4F, and Messenger showed numerically higher yields in comparison to each treatment applied again 14 days later whereas applications at full bloom plus 14 days later increased cotton yield for Quadris 2SC, Benlate 50WP, and Folicur treatments, respectively. No treatments produced a significantly greater yield than the control.

EFFECT OF SELECTED FUNGICIDES ON COTTON BOLL ROT DISEASE INCIDENCE AND SEED COTTON YIELD

Treatment	Rate *ai/ac*	Spray schedule	Healthy bolls Oct. 24, 01	Diseased bolls[1] Oct. 24,01	Disease index [2] %	Yield seed cotton *(lb/ac)*
Quadris 2SC	6 oz	Full bloom	78 ab	6 a	7 a	5239 a
Quadris 2SC	6 oz	Full bloom + 14 days	91 a	4 a	4 a	5285 a
Benlate 50WP	0.5 lb	Full bloom	81 ab	7 a	8 a	5012 a
Benlate 50WP	0.5 lb	Full bloom + 14 days	76 ab	8 a	10 a	5367 a
Folicur	4 oz	Full bloom	82 ab	8 a	9 a	4890 a
Folicur	4 oz	Full bloom + 14 days	87 ab	7 a	7 a	5465 a
Terraclor 4F	16 oz	Full bloom	75 ab	7 a	9 a	5340 a
Terraclor 4F	16 oz	Full bloom + 14 days	76 ab	6 a	8 a	5070 a
Rovral 4F	4 oz	Full bloom	76 ab	9 a	11 a	5221 a
Rovral 4F	4 oz	Full bloom + 14 days	81 ab	6 a	7 a	4914 a
Messenger	2.25 gm	Full bloom	84 ab	10 a	10 a	5082 a
Messenger	2.25 gm	Full bloom + 14 days	85 ab	5 a	5 a	4728 a
Control	—		70 b	8 a	11 a	4989 a
LSD (P=0.05)			18	6	7	962

[1] Number of diseased bolls per 50 ft of row.
[2] Disease index = (no. of disease bolls/no. of healthy bolls + disease bolls) X 100.
Means compared using Fisher's protected least significant difference test (P=0.05).

EVALUATION OF SELECTED IN-FURROW FUNGICIDES FOR CONTROL OF SEEDLING DISEASE OF COTTON IN NORTH ALABAMA

K. S. McLean, A. J. Palmateer, N. W. Greer, and B. E. Norris

This cotton fungicide test was planted on April 11 at the Tennessee Valley Research and Extension Center, Belle Mina, Alabama. The field had a history of cotton seedling disease and the soil type was a Decatur silty loam. Fungicides were applied as a seed treatment or as an in-furrow spray or granular applications at planting. All in-furrow fungicide sprays were applied with flat tip 8002E nozzles calibrated to deliver 6 gallons per acre at 18 pounds per square inch. In-furrow granular applications were applied with chemical granular applicators attached to the planter.

Plots consisted of two rows, 25 feet long with a 40-inch wide row spacing and were arranged in a randomized complete block design with five replications. Two rows of each plot were infested with millet seed inoculated with *Pythium spp.* and *Rhizoctonia solani* and the remaining two row were left in a natural state. Blocks were separated by a 20-foot alley. The nematicide Temik 15G (5 pounds per acre) was applied in-furrow at planting. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts and skip index ratings were recorded at two, four, and six weeks after planting to determine the percent seedling loss and stand density due to cotton seedling disease. Plots were harvested on September 19.

Significant differences in seedling stand were observed in the inoculated plots at two, four, and six weeks after planting (Table 1). At two weeks after planting, Ridomil Gold PC, Terraclor Super X 18.8G, Quadris SC, and Ridomil Gold PC plus Quadris SC produced significantly greater stands than the untreated control. Ridomil Gold PC, Terraclor Super X 18.8G, Quadris SC, Ridomil Gold PC plus Quadris SC, Terrazole 4E plus Quadris SC, and Rovral 4E increased stand over the control at four and six weeks after planting. A significantly lower skip index, indicating a more evenly spaced seedling stand, was observed two weeks after planting only in the Ridomil Gold PC treatment. However, by four and six weeks after planting Ridomil Gold PC, Terraclor Super X 18.8G, Quadris SC, Ridomil Gold PC plus Quadris SC, Terrazole 4E plus Quadris SC, and Rovral 4E all produced a significantly lower skip index than the control. Seed cotton yields varied more than 988 pounds per acre for the Quadris SC and the Ridomil Gold EC treatments. Ridomil Gold PC, Terraclor Super X 18.8G, Terraclor Super X EC, Quadris SC, and Ridomil Gold PC plus Quadris SC, Terrazole 4E plus Quadris SC, and Rovral 4E all produced significantly greater yields than the control. The average yield of seed cotton from all fungicide-treated plots was 424 pounds per acre greater than the untreated control.

Significant differences in seedling stand were not observed in the naturally infested plots at two and four weeks after planting (Table 2). However, at six weeks after planting, Ridomil Gold PC, Terraclor Super X 18.8G, Quadris SC, and Quadris SC plus Ridomil Gold PC produced significantly greater stands than the untreated control. A significantly lower skip index, indicating a more evenly spaced seedling stand, was observed six weeks after planting in six of the nine fungicide treatments when compared to the control. Seed cotton yields varied 365.9 pounds per acre for the Terrazole 4E plus Rovral 4E and the Terraclor Super X EC treatments respectively. The average yield of seed cotton from the fungicide-treated plots was not greater than the yield of the untreated control.

TABLE 1. EFFECT OF SELECTED FUNGICIDES ON COTTON STAND, SKIP INDEX, AND YIELD UNDER HIGH DISEASE PRESSURE

Treatment	Rate[1]	Timings	Stand[2]			Skip index[3]			Seed cotton
			April 26	May 14	June 11	April 26	May 14	June 11	*lb/ ac*
Untreated control	—	—	35 de	25 c	29 d	11 b	13 a	14 a	2203 c
Terrazole 4E + Quadris	7.0 + 5.0 oz/ac	In furrow	50 bcd	47 b	50 c	12 ab	6 bc	4 bc	2844 a
Terrazole 4E + Rovral 4E	7.0 + 4.0 oz/ac	In furrow	35 de	31 c	29 d	10 b	13 a	13 a	2180 c
TSX 18.8 G	5.5 lbs	In furrow	62 ab	72 a	71 ab	8 bc	2 c	4 bc	2770 ab
TSX EC	48 oz/ac	In furrow	27 e	31 c	24 d	15 a	13 a	13 a	2491 b
Rovral 4E	6.0 oz/ac	In furrow	46 cd	47 b	48 c	10 b	7 b	7 b	2540 b
Ridomil Gold PC	7 lb/ac	In furrow	68 a	74 a	79 a	4 c	3 c	3 c	2752.ab
Ridomil Gold EC	1.0 fl oz/ac	In furrow	28 e	25 c	20 d	12 ab	13 a	15 a	2044 c
Quadris SC	6.0 oz/ac	In furrow	60 abc	57 b	60 bc	8 bc	8 b	6 bc	3032 a
Quadris SC+ Ridomil Gold	6.0 +1.0 oz/ac	In furrow	52 bc	57 b	56 bc	8 bc	5 bc	6 bc	2993 a
LSD (P=0.05)			15	12	17	5	4	4	286

[1] Rate of formulated product.
[2] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[3] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

TABLE 2. EFFECT OF SELECTED FUNGICIDES ON COTTON STAND, SKIP INDEX, AND YIELD UNDER LOW DISEASE PRESSURE

Treatment	Rate[1]	Timings	Stand[2]			Skip index[3]			Seed cotton
			April 26	May 14	June 11	April 26	May 14	June 11	*lb/ ac*
Untreated control	—	—	73 a	76 a	50 c	5 abc	3 ab	6 a	3573 abc
Terrazole 4E + Quadris	7.0 + 5.0 oz/ac	In furrow	61 a	75 a	64 bc	8 a	3 ab	2 b	3361 bcd
Terrazole 4E + Rovral 4E	7.0 + 4.0 oz/ac	In furrow	58 a	84 a	52 c	4 abc	2 ab	2 b	3670 a
TSX 18.8 G	5.5 lbs	In furrow	67 a	79 a	77 ab	6 abc	2 b	2 b	3325 cd
TSX EC	48 oz/ac	In furrow	56 a	71 a	51 c	8 a	5 a	4 ab	3304 d
Rovral 4E	6.0 oz/ac	In furrow	63 a	73 a	62 bc	8 ab	3 ab	3 ab	3366 bcd
Ridomil Gold PC	7 lb/ac	In furrow	67 a	79 a	84 a	4 bc	1 b	2 b	3429 abcd
Ridomil Gold EC	1.0 fl oz/ac	In furrow	74 a	88 a	54 c	4 c	1 b	1 b	3589 ab
Quadris SC	6.0 oz/ac	In furrow	71 a	79 a	72 ab	5 abc	3 ab	3 ab	3432 abcd
Quadris SC + Ridomil Gold	6.0 + 1.0 oz/ac	In furrow	73 a	75 a	71 ab	6 abc	4 ab	2 b	3474 abcd
LSD (P=0.05)			18	18	22	4	4	3	257

[1] Rate of formulated product.
[2] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[3] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

EVALUATION OF SELECTED IN-FURROW FUNGICIDES FOR CONTROL OF SEEDLING DISEASE OF COTTON IN CENTRAL ALABAMA

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This cotton fungicide test was planted on April 13 at the Prattville Experiment Field in Prattville, Alabama. The field had a history of cotton seedling disease and the soil type was a Decatur silty loam. Fungicides were applied as a seed treatment or as an in-furrow or spray or granular application at planting. All in-furrow fungicide sprays were applied with flat tip 8002E nozzles calibrated to deliver 6 gallons per acre at 18 pounds per square inch. In-furrow granular applications were applied with chemical granular applicators attached to the planter.

Plots consisted of two rows, 30 feet long with a 36-inch wide row spacing and were arranged in a randomized complete block design with five replications. Two rows of each plot were infested with millet seed inoculated with *Pythium spp.* and *Rhizoctonia solani* and the remaining two rows were left in the natural state. Blocks were separated by a 20-foot alley. The nematicide Temik 15G (5 pounds per acre) was applied in-furrow at planting. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts and skip index ratings were recorded at two, four, and six weeks after planting to determine the percent seedling loss and stand density due to cotton seedling disease. Plots were harvested on September 19.

Significant differences in seedling stand were observed in the inoculated plots at two, four, and six weeks after planting (Table 1). At two weeks after planting, the seedling emergence of Delta Coat AD at 11.75 ounces per cwt and Rovral 4E was 39% and 13% of the total seed planted, respectively, compared to 27% in the control. This trend continued with the percent stand decreasing at four and six weeks after planting. A significantly lower skip index, indicating a more evenly spaced seedling stand, was not observed as compared to the control. Seed cotton yields varied over 399 pounds per acre for the Terraclor Super X 18.8G and the Messenger treatments respectively. The average yield of seed cotton from the fungicide-treated plots was not greater than the yield of the untreated control.

Significant differences in seedling stand were not observed in the naturally infested plots at two, four, and six weeks after planting. However, when the stand was averaged over all treatments, only 48% of the seed emerged and survived by six weeks after planting. A significantly lower skip index indicating a more evenly spaced seedling stand was observed at six weeks after planting with the Ridomil Gold PC treatment as compared to the control. Seed cotton yields varied over 347 pounds per acre for the Quadris SC and the Terraclor Super X 18.8G treatments respectively. The average yield of seed cotton from the fungicide-treated plots was not greated than the yield of the untreated control.

TABLE 1. EFFECT OF SELECTED FUNGICIDES ON COTTON STAND, SKIP INDEX, AND YIELD UNDER HIGH DISEASE PRESSURE

Treatment	Rate[1]	Timings	Stand[2] April 26	Stand[2] May 14	Stand[2] June 11	Skip index[3] April 26	Skip index[3] May 14	Skip index[3] June 11	Seed cotton *lb/ ac*
Untreated control	—	—	35 a-d	34 a-d	30 a-d	15 abc	14 bcd	13 abc	1932
Terrazole 4E + Quadris	7.0 + 5.0 oz/ac	In furrow	33 a-d	29 bcd	27 bcd	14 abc	16 a-d	15 ab	1843
Terrazole 4E + Rovral 4E	7.0 + 4.0 oz/ac	In furrow	34 a-d	33 a-d	31 a-d	17 abc	16 a-d	14 abc	2013
TSX 18.8 G	5.5 lbs	In furrow	23 cd	22 cd	26 bcd	19 ab	18 ab	15 ab	2121
TSX EC	48 oz/ac	In furrow	38 abc	39 a-d	34 abc	14 bc	12 d	11 bc	1940
Rovral 4E	6.0 oz/ac	In furrow	17 d	21 d	17 d	19 a	18 ab	18 a	1726
Ridomil Gold	7 lb/ac	In furrow	32 a-d	36 a-d	33 a-d	17 abc	13 bcd	11 bc	2065
Ridomil Gold	1.0 fl oz/ac	In furrow	37 abc	33 a-d	32 a-d	16 abc	12 cd	11 ab	1798
Quadris	6.0 oz/ac	In furrow	26 bcd	25 bcd	29 cd	18 ab	19 a	15 ab	1932
Quadris + Ridomil Gold	6.0 + 1.0 oz/ac	In furrow	28 bcd	28 bcd	24 bcd	18 ab	16 a-d	14 ab	1927
Delta Coat AD	11.75 fl oz/cwt	Seed trt	50 a	50 a	46 a	14 abc	12 d	8 c	2036
Delta Coat AD	9.0 fl oz/cwt	Seed trt	41 abc	42 abc	38 abc	17 abc	13 bcd	12 abc	2101
Messenger	2.25 oz/ac	In furrow	46 ab	44 ab	42 ab	12 c	12 cd	11 bc	1948
Messenger	1.125 oz/ac	In furrow	25 cd	22 d	21 cd	18 ab	17 abc	16 ab	1722
LSD (P=0.05)			19	20	18	5	5	6	403

[1] Rate of formulated product.
[2] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[3] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

Table 2. Effect of Selected Fungicides on Cotton Stand, Skip Index, and Yield under Low Disease Pressure

Treatment	Rate[1]	Timings	Stand [2]			Skip index [3]			Seed cotton
			April 26	May 14	June 11	April 26	May 14	June 11	*lb/ ac*
Untreated control	—	—	56 a	61 a	55 a	9 abc	9 ab	9 ab	3053
Terrazole 4E + Quadris	7.0 + 5.0 oz/ac	In furrow	63 a	65 a	55 a	11 abc	10 ab	8 abc	3073
Terrazole 4E + Rovral 4E	7.0 + 4.0 oz/ac	In furrow	67 a	57 a	55 a	12 a	10 a	8 abc	3037
TSX 18.8 G	5.5 lbs	In furrow	64 a	67 a	49 a	12 ab	9 ab	9 a	2867
TSX EC	48 oz/ac	In furrow	76 a	73 a	69 a	7 abc	6 ab	5 abc	2908
Rovral 4E	6.0 oz/ac	In furrow	56 a	63 a	58 a	9 abc	8 ab	8 abc	3089
Ridomil Gold	7 lb/ac	In furrow	63 a	55 a	54 a	8 abc	8 ab	7 abc	2960
Ridomil Gold	1.0 fl oz/ac	In furrow	76 a	69 a	66 a	6 c	5 b	4 c	3194
Quadris	6.0 oz/ac	In furrow	59 a	66 a	62 a	9 abc	6 b	6 abc	3214
Quadris + Ridomil Gold	6.0 + 1.0 oz/ac	In furrow	80 a	74 a	63 a	10 abc	7 ab	7 abc	3146
Delta Coat AD	11.75 fl oz/cwt	Seed trt	68 a	64 a	59 a	9 abc	6 ab	5 abc	2871
Delta Coat AD	9.0 fl oz/cwt	Seed trt	71 a	68 a	63 a	10 abc	5 b	6 abc	3190
Messenger	2.25 oz/ac	In furrow	69 a	71 a	63 a	7 bc	6 ab	5 bc	3012
Messenger	1.125 oz/ac	In furrow	60 a	53 a	51 a	9 abc	9 ab	7 abc	3008
LSD (P=0.05)			27	26	23	5	5	4	367.0

[1] Rate of formulated product.
[2] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[3] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

Evaluation of Selected Seed Treatment Fungicides for Control of Seedling Disease of Cotton in North Alabama

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This cotton fungicide test was planted on April 20 at the Tennessee Valley Research and Extension Center in Belle Mina, Alabama. The field had a history of cotton seedling disease and the soil type was a Decatur silty loam. All seed treatments were applied to the seed by the manufacturer. Plots consisted of two rows, 25 feet long with a 40-inch wide row spacing and were arranged in a randomized complete block design with five replications. Two rows of each plot were infested with millet seed inoculated with *Pythium spp.* and *Rhizoctonia solani* and the remaining two rows were left naturally infested. Blocks were separated by a 20-foot alley. The nematicide Temik 15G (5 pounds per acre) was applied in-furrow at planting. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts and skip index ratings were recorded at two, four, and six weeks after planting to determine the percent seedling loss and stand density due to cotton seedling disease. Plots were harvested on October 9.

Significant differences in seedling stand were observed in the inoculated plots at two and four weeks after planting (Table 1). At two and four weeks after planting, Maxim 4 FS plus Azoxystrobin plus Apron XL 3 LS and Azoxystobin plus Apron XL 3 LS plus Maxim 4 FS plus Systhane 40 WSP produced significantly greater stands than all other seed treatments. All seed treatments except Apron XL 3 LS plus Maxim 4 FS produced a significantly greater stand than the control. A significantly lower skip index, indicating a more evenly spaced seedling stand, was observed at four weeks after planting in all the seed treatments as compared to the control. Seed cotton yields varied over 1,657 pounds per acre for the Azoxystobin plus Apron XL 3 LS plus Maxim 4 FS plus Systhane 40 WSP and the untreated control treatments. All seed treatments significantly increased seed cotton yields over the untreated control. The average yield from the fungicide-treated plots was 1,090 pounds per acre greater than the yield of the untreated control.

Significant differences in seedling stand were observed in the naturally infested plots at two and four weeks after planting (Table 2). At two and four weeks after planting, the untreated control and Apron XL 3 LS plus Maxim 4 FS plus Systhane 40 WSP produced greater stands than ten of the other seed treatments. Skip indexes were very low in this test; thus, the seedling stand was uniform. Seed cotton yields varied over 753 pounds per acre for the untreated control and the Maxim 4 FS plus Azoxystobin plus Apron XL 3 LS treatments. The average yield from the fungicide-treated plots was not greater than the yield of the untreated control.

TABLE 1. EFFECT OF SELECTED SEED TREATMENTS ON COTTON STAND, SKIP INDEX, AND SEED COTTON YIELD UNDER HIGH DISEASE PRESSURE

Treatment	Rate/100kg seed	Application	–Stand 25 ft row [1] –		—Skip index [2] —		Seed cotton
			14 DAP	28 DAP	14 DAP	28 DAP	*lb/ac*
Untreated control	—		34 e	17 f	10 ab	15 a	1719 h
Apron XL 3 LS + Maxim 4 FS + Systhane 40WSP	7.5 + 2.5 + 21	Seed trt	68 bc	56 de	3 def	5 cde	2924 a-e
Apron XL 3 LS + Maxim 4 FS	7.5 + 2.5	Seed trt	45 de	30 f	8 bc	12 b	2085 f-h
Azoxystrobin + Apron XL 3 LS	8.0 + 7.5	Seed trt	55 cd	57 de	4 de	4 c-f	2726 cde
Azoxystrobin + Apron XL 3 LS	10.0 + 7.5	Seed trt	62 bcd	66 cd	3 def	5 cd	2739 cde
Azoxystrobin + Apron XL 3 LS	15.0 + 7.5	Seed trt	68 bc	61 cde	3 def	4 c-f	2906 a-e
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 1.25	Seed trt	53 cd	48 e	5 de	6 c	2987 a-d
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 2.5	Seed trt	58 bcd	56 de	3 def	3 c-g	2456 e-g
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	10.0 + 7.5 + 1.25	Seed trt	63 bcd	57 de	2 def	4 c-g	2699 cde
Azoxystrobin + Maxim 4 FS + Apron XL 3 FS	10.0 + 2.5 + 7.5	Seed trt	61 bcd	61 cde	5 def	4 c-g	3023 abc
Maxim 4 FS + Azoxystrobin + Apron XL 3 LS	1.25 + 15.0 + 7.5	Seed trt	90 a	90 ab	2 ef	1 g	3272 ab
Apron XL 3 LS + Maxim 4 FS	7.5 + 1.25	Seed trt	65 bc	55 de	4 de	6 c	2522 def
Azoxystobin + Apron XL 3 LS Maxim 4 FS + Systhane 40 WSP	8.0 + 75 + 2.5 + 21.0	Seed trt	92 a	104 a	1 f	2 fg	3376 a
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS + Systhane 40 WSP	10.0 + 7.5 + 2.5 + 21.0	Seed trt	76 ab	87 b	2 def	3 d-g	2807 b-e
Azoxystrobin + Baytan 30 + Allegiance-Fl	4.0 + 10.0 + 15.0	Seed trt	68 bc	77 bc	4 def	2 efg	2807 b-e
LSD (P=0.05)			19	17	2	1	480

[1] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[2] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

TABLE 2. EFFECT OF SELECTED SEED TREATMENTS ON COTTON STAND, SKIP INDEX, AND SEED COTTON YIELD UNDER LOW DISEASE PRESSURE

Treatment	Rate/100kg seed	Application	–Stand 25 ft row [1] – 14 DAP	28 DAP	—Skip index [2] — 14 DAP	28 DAP	Seed cotton *lb/ac*
Untreated control	—		125 a	133 a	0 c	1 b	3727 a
Apron XL 3 LS + Maxim 4 FS + Systhane 40WSP	7.5 + 2.5 + 21	Seed trt	126 a	131 ab	0 c	0 b	3408 a-d
Apron XL 3 LS + Maxim 4 FS	7.5 + 2.5	Seed trt	98 b-e	111 a-e	1 bc	1b	3186 cde
Azoxystrobin + Apron XL 3 LS	8.0 + 7.5	Seed trt	94 cde	100 efg	4 a	1 b	3261 b-e
Azoxystrobin + Apron XL 3 LS	10.0 + 7.5	Seed trt	98 b-e	104 d-g	1 bc	1 b	3233 b-e
Azoxystrobin + Apron XL 3 LS	15.0 + 7.5	Seed trt	78 e	82 g	2 bc	1 b	3052 de
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 1.25	Seed trt	84 e	91 efg	2 bc	3 a	3199 cde
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 2.5	Seed trt	85 de	87 fg	1 bc	1 b	3214 b-e
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	10.0 + 7.5 + 1.25	Seed trt	92 cde	101 d-g	1 bc	1 b	3316 a-e
Azoxystrobin + Maxim 4 FS + Apron XL 3 FS	10.0 + 2.5 + 7.5	Seed trt	95 cde	106 c-f	1 bc	1 b	3029 de
Maxim 4 FS + Azoxystrobin + Apron XL 3 LS	1.25 + 15.0 + 7.5	Seed trt	91 cde	101 d-g	2 ab	1 b	2974 e
Apron XL 3 LS + Maxim 4 FS	7.5 + 1.25	Seed trt	111 abc	128 abc	0 c	1 b	3063 de
Azoxystobin + Apron XL 3 LS Maxim 4 FS + Systhane 40 WSP	8.0 + 75 + 2.5 + 21.0	Seed trt	110 a-d	128 abc	1 bc	1 b	3491 abc
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS + Systhane 40 WSP	10.0 + 7.5 + 2.5 + 21.0	Seed trt	110a-d	124 a-d	0 c	0 b	3248 b-e
Azoxystrobin + Baytan 30 + Allegiance-Fl	4.0 + 10.0 + 15.0	Seed trt	91 cde	110 b-f	2 bc	1 b	3050 de
LSD = (P=0.05)			25	24	2	1	418

[1] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[2] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

EVALUATION OF SELECTED SEED TREATMENT FUNGICIDES FOR CONTROL OF SEEDLING DISEASE OF COTTON IN CENTRAL ALABAMA

K. S. McLean, A. J. Palmateer, N. W. Greer, and D. Moore

This cotton fungicide test was planted on April 20 at the Prattville Experiment Field in Prattville, Alabama. The field had a history of cotton seedling disease and the soil type was a sandy loam. All seed treatments were applied to the seed by the manufacturer. Two rows of each plot were infested with millet seed inoculated with *Pythium spp.* and *Rhizoctonia solani* and the remaining two rows were left naturally infested. Plots consisted of two rows, 25 feet long with a 40-inch wide row spacing and were arranged in a randomized complete block design with five replications. Blocks were separated by a 20-foot alley. The nematicide Temik 15G (5 pounds per acre) was applied in-furrow at planting. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts and skip index ratings were recorded at two, four, and six weeks after planting to determine the percent seedling loss and stand density due to cotton seedling disease. Plots were harvested on October 9.

Significant differences in seedling stand were observed in the inoculated plots at two and four weeks after planting (Table 1). At two and four weeks after planting, Maxim 4 FS plus Azoxystrobin plus Apron XL 3 LS and Azoxystobin plus Apron XL 3 LS plus Maxim 4 FS plus Systhane 40 WSP at the high rates produced significantly greater stands than the untreated control. Eleven seed treatments produced a significantly greater stand than the control at four weeks after planting. A significantly lower skip index, indicating a more evenly spaced seedling stand, was observed at two weeks after planting in the Azoxystrobin plus Maxim 4 FS plus Apron XL 3, and the Azoxystrobin plus Baytan 30 plus Allegiance FL seed treatments as compared to the untreated control. Seed cotton yields varied over 1253 pounds per acre for the Azoxystobin plus Apron XL 3 LS plus Maxim 4 FS plus Systhane 40 WSP and the untreated control treatments. Twelve of the seed treatments significantly increased seed cotton yields over the untreated control. The average yield of seed cotton from the fungicide-treated plots was 793 pounds per acre greater than the yield of the untreated control.

TABLE 1. EFFECT OF SELECTED SEED TREATMENTS ON COTTON STAND, SKIP INDEX, AND SEED COTTON YIELD UNDER HIGH DISEASE PRESSURE

Treatment	Rate/100kg seed	Application	–Stand 25 ft row [1]– May 11	May 24	—Skip index [2] — May 11	May 24	Seed cotton *lb/ac*
Untreated control	—		8 b-e	6 d	22 a-d	19 abc	1389 h
Apron XL 3 LS + Maxim 4 FS + Systhane 40WSP	7.5 + 2.5 + 21	Seed trt	12 a-d	18 ab	19 d-g	16 bc	1926 ef
Apron XL 3 LS + Maxim 4 FS	7.5 + 2.5	Seed trt	6 cde	8 cd	22 abc	20 ab	1648 gh
Azoxystrobin + Apron XL 3 LS	8.0 + 7.5	Seed trt	9 cde	11 bcd	21 a-e	19 abc	1975 efg
Azoxystrobin + Apron XL 3 LS	10.0 + 7.5	Seed trt	5 de	13 a-d	23 ab	16 bc	2134 c-f
Azoxystrobin + Apron XL 3 LS	15.0 + 7.5	Seed trt	11 a-d	15 abc	20 b-g	17 bc	2231 a-f
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 1.25	Seed trt	10 bcd	11 bcd	19 c-g	20 ab	2091 def
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 2.5	Seed trt	11 a-d	18 ab	21 b-f	18 bc	2338 a-e
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	10.0 + 7.5 + 1.25	Seed trt	12 abc	20 a	19 d-g	17 bc	2497 abc
Azoxystrobin + Maxim 4 FS + Apron XL 3 FS	10.0 + 2.5 + 7.5	Seed trt	11 a-d	15 abc	18 fg	16 c	2159 b-f
Maxim 4 FS + Azoxystrobin + Apron XL 3 LS	1.25 + 15.0 + 7.5	Seed trt	17 a	20 a	17 g	17bc	2338 a-e
Apron XL 3 LS + Maxim 4 FS	7.5 + 1.25	Seed trt	11 a-d	14 a-d	20 b-d	18 abc	1626 gh
Azoxystobin + Apron XL 3 LS Maxim 4 FS + Systhane 40 WSP	8.0 + 75 + 2.5 + 21.0	Seed trt	8 b-e	20 a-d	22 a-d	18 abc	2642 a
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS + Systhane 40 WSP	10.0 + 7.5 + 2.5 + 21.0	Seed trt	17 a	17 ab	18 efg	17 bc	2430 a-d
Azoxystrobin + Baytan 30 + Allegiance-Fl	4.0 + 10.0 + 15.0	Seed trt	13 ab	16 abc	18 efg	17 bc	2531 ab
LSD (P=0.05)			7	8	3	4	394

[1] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[2] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

Significant differences in seedling stand were not observed in the naturally infested plots at two and four weeks after planting (Table 2). At four weeks after planting, only 21% of the seed survived due to dry conditions. A significantly lower skip index, indicating a more evenly spaced seedling stand, was observed at four weeks after planting in the Azoxystrobin plus Maxim 4 FS plus Apron XL 3, the Maxim 4 FS plus Azoxystrobin plus Apron XL 3 LS, the Apron XL 3 LS plus Maxim 4 FS and the Azoxystobin plus Apron XL 3 LS plus Maxim 4 FS plus Systhane 40 WSP low rate seed treatments compared to the untreated control. Seed cotton yields varied over 1056 pounds per acre for the Azoxystobin plus Baytan 30 plus Allegiance FL and the Azoxystobin plus Apron XL 3 LS seed treatments. The average yield of seed cotton from the fungicide-treated plots was not greater than the yield of the untreated control.

TABLE 2. EFFECT OF SELECTED SEED TREATMENTS ON COTTON STAND, SKIP INDEX, AND SEED COTTON YIELD UNDER LOW DISEASE PRESSURE

Treatment	Rate/100kg seed	Application	–Stand 25 ft row [1] –		—Skip index [2] —		Seed cotton
			May 11	May 24	May 11	May 24	*lb/ac*
Untreated control	—	—	25 a	24 a	16 abc	16 a	3470a
Apron XL 3 LS + Maxim 4 FS + Systhane 40WSP	7.5 + 2.5 + 21	Seed trt	26 a	25 a	14 bc	15 ab	3393a
Apron XL 3 LS + Maxim 4 FS	7.5 + 2.5	Seed trt	26 a	27 a	13 bc	13 abc	3369a
Azoxystrobin + Apron XL 3 LS	8.0 + 7.5	Seed trt	21 a	22 a	17 abc	14 abc	3340a
Azoxystrobin + Apron XL 3 LS	10.0 + 7.5	Seed trt	18 a	21 a	20 a	15 ab	2425 c
Azoxystrobin + Apron XL 3 LS	15.0 + 7.5	Seed trt	25 a	26 a	15 bc	16 ab	3199 a
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 1.25	Seed trt	30 a	26 a	15 bc	13 abc	3127 ab
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	8.0 + 7.5 + 2.5	Seed trt	21 a	25 a	16 bc	15 abc	2957 abc
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS	10.0 + 7.5 + 1.25	Seed trt	20 a	24 a	17 ab	14 abc	2502 bc
Azoxystrobin + Maxim 4 FS + Apron XL 3 FS	10.0 + 2.5 + 7.5	Seed trt	21 a	24 a	15 bc	11 c	2986 abc
Maxim 4 FS + Azoxystrobin + Apron XL 3 LS	1.25 + 15.0 + 7.5	Seed trt	30 a	31 a	14 bc	14 bc	3199 a
Apron XL 3 LS + Maxim 4 FS	7.5 + 1.25	Seed trt	30 a	28 a	15 bc	11 bc	3107 ab
Azoxystobin + Apron XL 3 LS Maxim 4 FS + Systhane 40 WSP	8.0 + 75 + 2.5 + 21.0	Seed trt	29 a	29 a	13 c	11 bc	3078 abc
Azoxystrobin + Apron XL 3 LS + Maxim 4 FS + Systhane 40 WSP	10.0 + 7.5 + 2.5 + 21.0	Seed trt	27 a	21 a	17 ab	13 abc	3132 ab
Azoxystrobin + Baytan 30 + Allegiance-Fl	4.0 + 10.0 + 15.0	Seed trt	32 a	31 a	13 c	12 abc	3480 a
LSD (P=0.05)			14	11	5	4	667

[1] Number of live seedling per 25 ft of row; all rows received 125 Suregrow 125 BR seed.
[2] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

EVALUATION OF SELECTED FUNGICIDES FOR CONTROL OF SEEDLING DISEASE IN ULTRA NARROW ROW COTTON

K. S. McLean, D. P. Delaney, C. D. Monks, A. J. Palmateer, N. W. Greer, and L. Carter,

A cotton fungicide test was planted on April 12 at the E. V. Smith Research Center in Shorter, Alabama. Fungicides were applied either as seed treatments, in-furrow granules, or as a broadcast spray. Fungicides applied as a broadcast spray were applied immediately before planting utilizing a backpack CO_2 charged six-foot boom with flat fan tip 8002E nozzles calibrated to deliver 10 gallons per acre at 30 pounds per square inch. In-furrow granular treatments were applied with the seed at planting. DP 458 B/RR was planted in all plots at a rate of 180,000 seed per acre with a cone type drill. Plots consisted of 18 rows, 25 feet long with a 7-inch wide row spacing and were arranged in a randomized complete block design with six replications. Blocks were separated by a 20-foot alley. All plots were maintained throughout the season with standard herbicide, insecticide, and fertility production practices as recommended by the Alabama Cooperative Extension System. Stand counts, skip index, and vigor ratings were recorded at two, four, and six weeks after planting to determine the percent seedling loss, stand density, and seedling vigor due to cotton seedling disease. The number of open and closed bolls were counted on August 9 to indicate relative plant maturity. The center 7 feet of each plot was harvested on September 6 with a finger stripper.

Cotton seedling disease incidence was moderate in 2001 due to dry conditions. Significant differences in seedling stand were observed. At two and six weeks after planting, all fungicide treatment stands were equivalent to the control except Terraclor Super X 18.8G. No differences in the skip index were observed. Seed cotton yields varied 427 pounds per acre for the Quadris 2SC and the Terraclor Super X EC at 48 ounces per acre treatments, respectively, with no significant differences between any treatments. The average yield of seed cotton from the fungicide-treated plots was not greater than the yield of the untreated control.

EFFECT OF SELECTED FUNGICIDES ON COTTON STAND, SKIP INDEX, AND SEED COTTON YIELD PER ACRE

Treatment	Rate	Stand per 25 foot of row [1]			Skip index [2]	Seed cotton *lb/ac*
		April 24	May 11	May 23	May 23	Sept. 6
Untreated control	—	47 ab	46 ab	43 a	7.8	5007
TSX 18.8 G	5.5 lb/ac	33 c	37 b	30 b	12.0	4911
TSX 2EC	48 fl oz/ac	45 ab	42 ab	43 a	8.3	4733
TSX 2EC	96 fl oz/ac	40 bc	41 ab	42 a	10.7	5085
Rovral 4CF	5.2 fl oz/ac	47 ab	46 ab	40 a	9.0	5042
Ridomil Gold PC	7 lb/ac	39 bc	43 ab	36 ab	10.1	4775
Ridomil Gold PC	3.0 fl oz/ac	49 a	42 ab	36 ab	10.3	4768
Quadris 2.08 SC	6.0 fl oz/ac	45 ab	50 a	38 ab	8.7	5160
Delta Coat AD	11.75 fl oz/cwt	44 ab	44 ab	37 ab	9.6	4735
LSD (P=0.05)		9	10	10	4.7	475

[1] Number of live seedling per 25 ft of row.
[2] Skip index ratings on 25 ft of row. Rating scale: 1 = 1 ft gap; 2 = 2 ft gap; 3 = 3ft gap;... 25 = no plants.
Means compared using Fisher's protected least significant difference test (P=0.05).

MOLECULAR STUDIES

DEVELOPMENT OF NOVEL TRANSFORMATION SYSTEMS IN COTTON

Allan Zipf, Hamidou Sakhanokho, Govind Sharma, and Khairy Soliman

The current project concerning novel transformation systems in cotton ultimately aims to provide Alabama farmers with new cotton lines that have improved fiber qualities. This project has the long-term goal of providing a farmer-driven source for transgenic plants alongside the offerings of corporations, such as Monsanto, Dow, and Pioneer.

The objectives of this project were to (1) develop reliable tissue culture systems for producing diploid plants, and (2) discover new regenerable germplasms for use in transformation for both cotton improvement and for study of gene function.

Current achievements include developing reliable somatic embryogenesis culture system for producing diploid plants, and evaluating somaclonal variation from tissue culture procedure.

Developing reliable somatic embryogenesis culture system for producing diploid plants. The importance of both carbohydrate and nitrogen source in the development of highly embryogenic callus among diploid cottons has been elucidated. A new generation of *Gossypium arboreum* somatic embryos has been produced and several methods for improving somatic embryo maturation, somatic embryo germination, and seedling acclimation are currently being evaluated. Though plants have been obtained, the recovery rate is still abysmal and needs to be improved before successful transformation can be initiated.

Evaluating somaclonal variation from tissue culture procedure. DNA was successfully extracted from several regenerated tetraploid plants for further, in-depth evaluation of somaclonal variation, if any, from the process. Purity was checked by both UV spectrophotometer and by agarose gel electrophoresis. An AFLP kit was purchased and the DNA will be evaluated after researchers receive appropriate training on a recently purchased ABI 3100 capillary electrophoresis system. Other polymorphic PCR-based markers, such as SSR, will also be used to provide further information. A set of cotton SSR marker primers has been purchased from Research Genetics (Invitrogen) and a series has also been obtained from a collaborator, Dr. Sukumar Saha, USDA/ARS/CSRL, MS.

ISOLATION OF GENES RELATED TO COTTON PERFORMANCE AND QUALITY

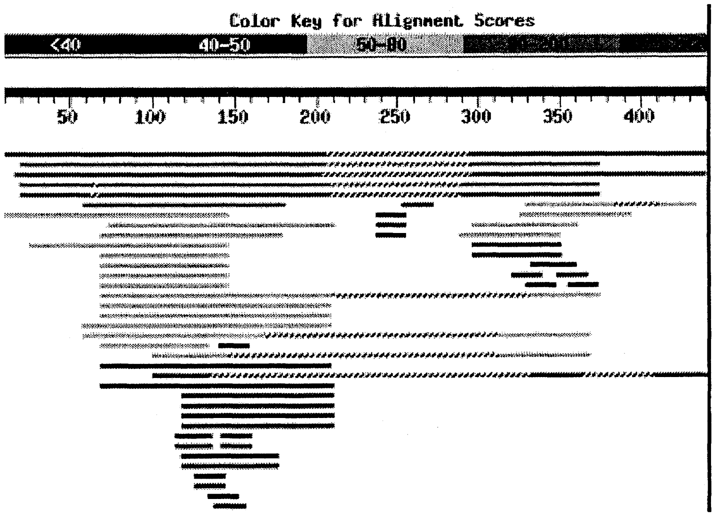
Khairy Soliman, Allan Zipf, Govind Sharma, Zhengdao Wu, Aaron Jeffries, and James Bolton

An important objective of cotton research at Alabama A&M University is to reveal genes that may have roles in either cotton growth or fiber quality. A number of projects trying to find genes associated with various aspects of cotton culture are being conducted through a diverse set of active collaborators. Three of these projects will be discussed in this article.

Identification of members of the cellulose synthase (GhCesA) gene family in cultivated cottons. Because cotton equals fiber equals cellulose, it is extremely important to understand the dynamics of cotton fiber development, starting with the number and kinds of genes involved and including fiber initiation to fiber elongation to fiber maturation.

In an ongoing pilot project with Dr. Debby Delmer, UC-Davis, researchers are studying the evolutionary diversity of cellulose synthase (*CesA*) in *Gossypium* (see Figure 1). Primers were designed from regions conserved in both *Gossypium* and *Arabidopsis* that successfully amplify fragments from both diploid and tetraploid members of the genus. Preliminary results indicate that the regions spanned are highly conserved, with little rearrangement.

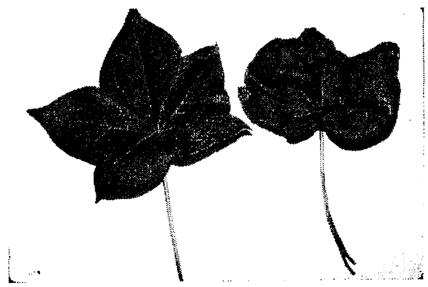
Figure 1. Graphical alignment results of a BLAST search of the sequence for *CesA* PCR 1A + 2A fragment clone 1.



Indications are that at least three members of the *CesA* gene family exist in tetraploid cottons.

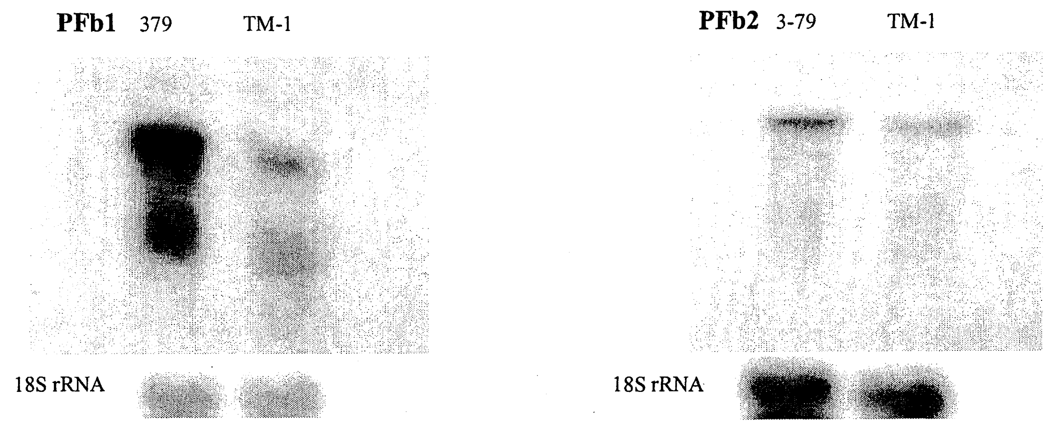
Identification of genes related to cotton fiber development using unique mutants. In a separate USDA Capacity Building project, with a USDA collaborator, Dr. Sukumar Saha, fiber cells are being studied to characterize the *Li-1* mutant fiber development. Short fiber and distorted stems and leaves characterize this mutant that is inherited as a Mendelian dominant (see Figure 2). This mutation represents a change in a very important fiber gene and researchers hope to find a marker linked to the mutation, if not the mutated gene itself, by developing a linkage map based on inheritance in an F_2 population.

Figure 2. Morphology of the *Li-1* mutant. Leaves taken from Upland (left) and *Li-1* mutant (right). Note distorted morphology of the mutant leaf.



Identification of fiber-related genes by differential screening. Another Capacity Building project aims to identify cotton genes associated with fiber quality. Messenger RNAs were isolated from the fiber layers of high yielding Upland cotton, TM-1, and high fiber quality Pima cotton, 3-79, respectively. A cDNA library was constructed from the high fiber-quality line, 3-79, and screened differentially with the cDNA probes obtained from mRNAs of TM-1 and 3-79, respectively. Thirteen cDNA clones were selected for sequencing and subjected to northern hybridization analysis. Five of the thirteen cDNAs showed high expression in the twenty day-post-anthesis (DPA) fiber tissue of 3-79 cotton. Northern blotting suggests that these genes are not unique to Pima cotton but definitely are expressed in higher amounts. Sequence analysis indicated the presence of a cotton lipid transfer protein, a mitogen-activated protein kinase and a novel gene with no homologous sequences in the Genbank database. The remaining two separate cDNAs showed high identity in nucleotide sequence to 6 DPA *G. arboreum* and 7 to 10 DPA *G. hirsutum* fiber cDNAs, respectively, but of unknown functions. The cDNA clones differentially expressed in the 3-79 cotton fiber were presumed to be associated with cotton fiber quality, but their specific contribution has not been determined (see Figure 3). These sequences represent one of the few reports to study fiber-associated gene expression in Pima cotton (*G. barbadense)*. The relationship of these highly expressed genes to fiber quality remains for the next round of studies.

Figure 3. Differential expression of clones PFb1and PFb2 in 3-79 cotton fiber.



DEVELOPING *IN VITRO* COTTON CULTURE SYSTEMS FOR RENIFORM NEMATODE STUDIES

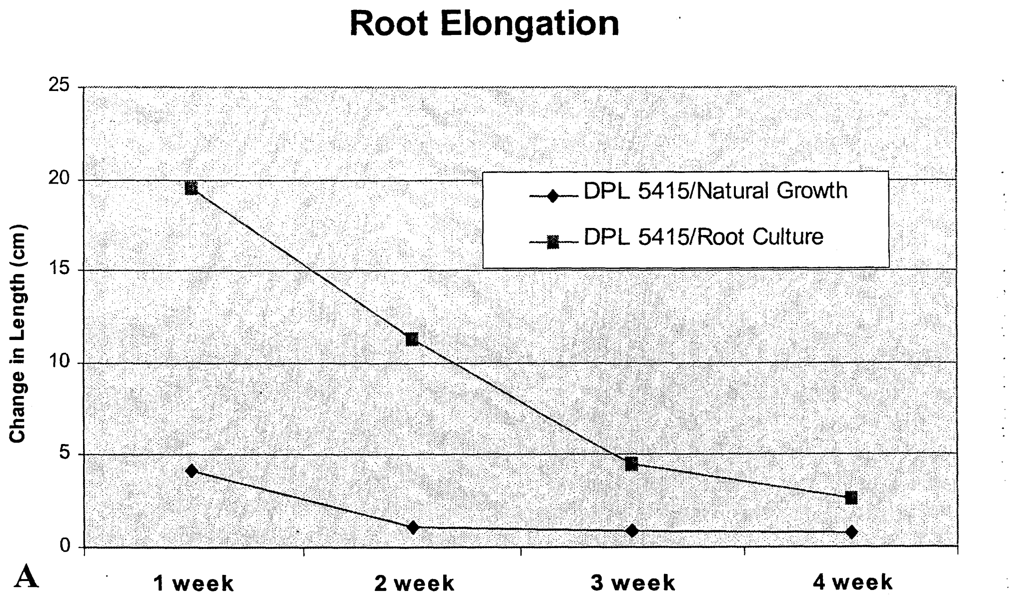
Dewang Deng, Allan Zipf, Govind Sharma, and Yonathan Tilahun

Reniform nematodes, *Rotylenchulus reniformis*, are becoming an increasingly serious threat to cotton producers with their continued spread into uninfected cotton production areas. However, studies on the infection by and resistance to reniform nematodes are difficult to perform in the field or even in the greenhouse. As an alternative, *in vitro* root cultures could be used as a model to study plant tolerance and susceptibility to the nematode. Cotton excised root cultures have not been studied successfully in earlier investigations, hence the critical need for the present study.

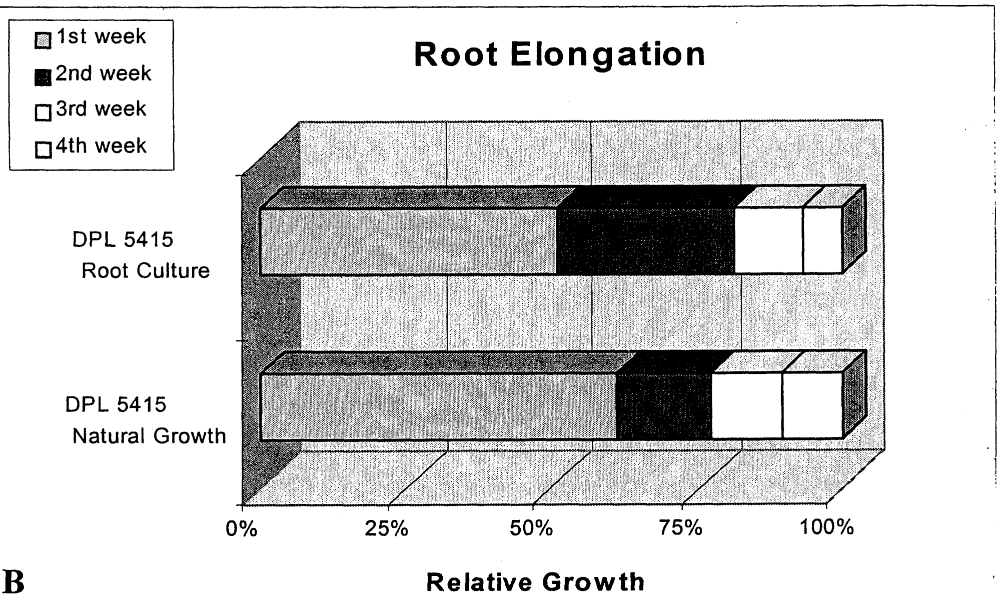
The objectives of this study were to (1) develop long-term (at least 30 day) cotton root cultures, (2) sterilize viable reniform nematodes, and (3) establish continuous reniform infections in the root cultures.

For the first time, continuous culture in liquid medium of excised roots of *Gossypium hirsutum* has been achieved, with healthy roots being maintained for at least four weeks. Cultures were incubated in Cotton Root Culture Medium [CRCM] (1/2 MS basal liquid medium plus 50 mg myo-inositol, 0.5 mg nicotinic acid, 0.5 mg pyridoxine-HCl, 0.5 mg thiamine-HCl, and 15 g/L glucose) under a minimal rocking condition in the dark at room temperature. The elongation of roots was genotype-specific and was more effective in liquid than on agar medium. However, the pattern of elongation was similar: there was an initial surge of root elongation and then a dramatic slowdown after the second week, continuing without death up to 10 weeks or more (see figure). This sigmoid pattern of elongation was also seen in uncut, soil-grown plants. It is hoped this method has potential use for the research of nematode infections.

Timecourse of root elongation for different culture treatment.
A. Change in weekly root length for different treatments. B. Relative change in weekly root elongation for different treatments. ANOVA analysis showed there was significance (P<0.01) between the two treatments.



A



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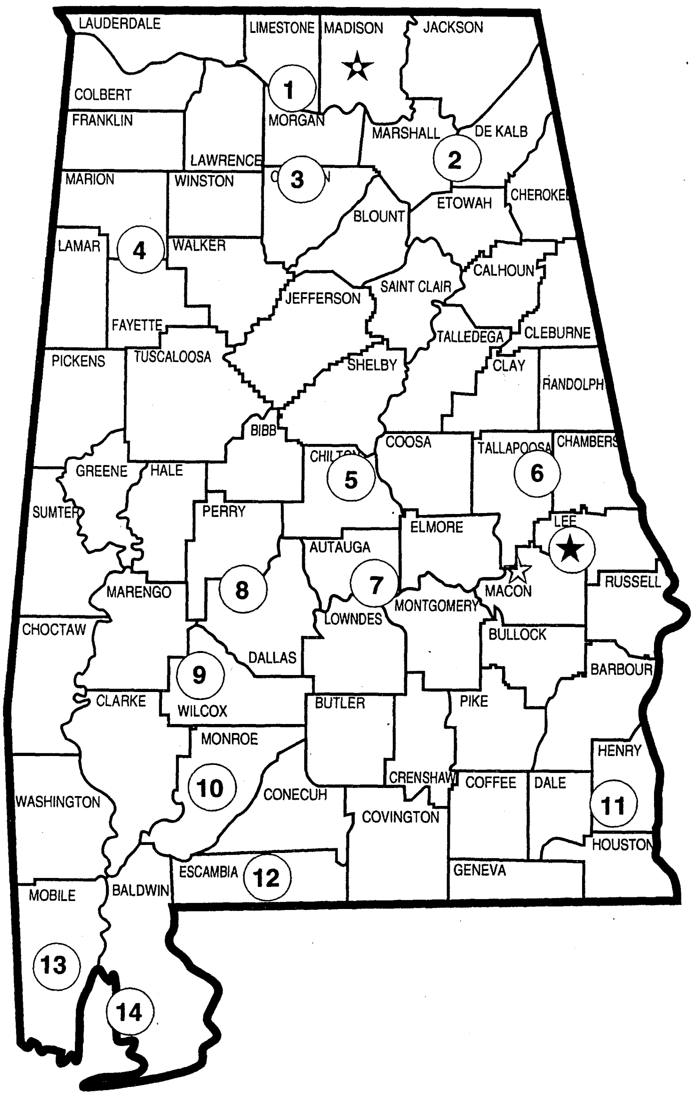

- Main Agricultural Experiment Station, Auburn.
- Alabama A&M University
- E. V. Smith Research Center, Shorter.

1. Tennessee Valley Research and Extension Center, Belle Mina
2. Sand Mountain Research and Extension Center, Crossville
3. North Alabama Horticulture Station, Cullman
4. Upper Coastal Plains Station, Winfield
5. Chilton Area Horticulture Station, Clanton
6. Piedmont Research Station, Camp Hill
7. Prattville Experiment Field, Prattville
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