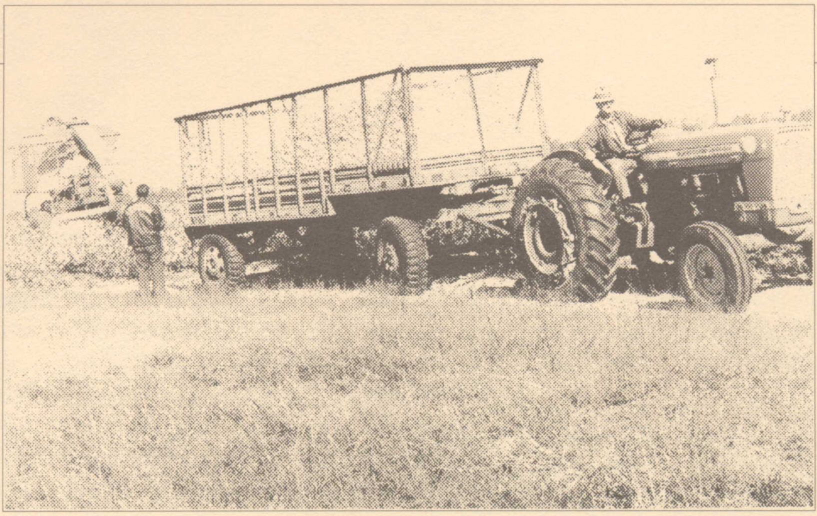

Research Update 1992

Cotton

Surface Applications of Potassium Best for Cotton

When growing cotton on a soil with "low" subsoil potassium (K), what rate of K fertilizer should be used and how should it be applied? These questions were addressed through an Alabama Agricultural Experiment Station field study at the Tennessee Valley Substation, Belle Mina.

Often in Alabama, cotton with K deficiency has been found to have adequate surface soil K, but subsoil K levels are "low." A recent survey of cotton fields across Alabama found that 29 percent of the subsoils tested "low" or "very low" in K, while only 19 percent of the subsoils tested "high."

The research site rated "medium" in surface K, but "low" in subsoil K, according to Soil Testing Laboratory results. Potassium fertilizer, at rates shown in the table, was either broadcast in the spring or split-applied with fall and spring applications. The fall application was turned under with a moldboard plow.

Cotton was grown in the test area in 1989 and 1991 and exhibited severe K deficiency symptoms during both years. Surface application of K rates in the spring produced yields similar to cotton treated with K split-applied in the spring and fall. Using higher rates of K fertilizer than normally recommended (60 pounds K_20) for a soil rated "medium" in K did result in some yield response. However, cotton yield response to K fertilizer indicates little benefit from the deep turning under of K fertilizer rates in the fall.

This research would indicate that, for cotton grown on soils testing "low" in subsoil K, increasing K_2O applications 30 to 60 pounds per acre above surface soil recommendations may be necessary. Applying this rate of K fertilizer to the soil surface before planting seems the best method to correct a K deficiency in research plots. However, these rates may have to be applied for several years before subsoil K levels are increased.

Effects of Rates and Timing of Potassium Fertilizer on Cotton Yields, Tennessee Valley Substation, Belle Mina

Annual K_20 rates, yield/acre		Seed cotton, yield/acre		
Fall	Spring	1989	1991	Avg.
0	0	1,777	1,538	1,658
0	60	2,649	1,807	2,228
0	120	2,814	1,794	2,304
0	180	2,942	1,924	2,433
60	60	2,860	1,872	2,366
90	90	2,840	1,800	2,320
120	0	2,740	1,598	2,169

C.H. Burmester and G.L. Mullins

Microbial Insecticides Compare Favorably to Conventional Insect Control in Cotton

Research in the United States and in other countries, such as Australia, has shown that various microbial products, primarily based on the bacterium *Bacillus thuringiensis* (B.t.), can result in yields similar to that of conventional insecticides, such as Karate®, against cotton bollworm and tobacco budworm. Additionally, B.t. products should reduce the rate of increase of insecticide resistance to conventional insecticides because of their novel mode of action and their low toxicity towards beneficial insects.

Alabama Agricultural Experiment Station field studies were initiated in 1991 to see if similar results could be obtained in Alabama and to determine which microbial products were the most similar to that of conventional insecticides.

Cotton (Deltapine 90) was planted May 23, 1991, at the Wiregrass Substa-

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ALABAMA AGRICULTURAL EXPERIMENT STATION AUBURN UNIVERSITY
LOWELL T. FROBISH, DIRECTOR AUBURN UNIVERSITY, ALABAMA

Reducing Cotton Production Inputs

Significant tillage and chemical inputs are currently used to produce cotton in Alabama's Tennessee Valley region. Reducing these inputs without affecting yield would provide substantial savings to growers.

An Alabama Agricultural Experiment Station study was initiated in 1991 at the Tennessee Valley Substation, Belle Mina, to investigate the potential for reducing cotton production costs. The test area was divided into no-till and conventional till strips. Prowl 4E® at 1 pint per acre was incorporated on all conventional tillage plots, and Prowl at 2 pints per acre plus Roundup® at 2 pints per acre was sprayed on no-till plots prior to planting. Soil fungicide treatments consisted of in-furrow (TSX®) or hopper box (Apron®). Soil insecticide treatments consisted of Temik 15G® at 3 or 5 pounds per acre. Preemergence herbicide treatments consisted of Cotoran 4L® broadcast at 2 or 4 pints per acre.

All possible combinations of chemical inputs were used in each tillage system. Conventional tillage plots were cultivated and direct sprayed with Cotoran plus MSMA. Control treatments (no fungicide, Temik, or Cotoran applied) were included for each tillage system.

Reduced Cotton Production Inputs Trials, 1991, Tennessee Valley Substation, Belle Mina

Tillage type	Stand count no./6 ft. row	Seed cotton yield
		Lb./A
No-till		
In-furrow	24	1,573
Hopper box	23	1,546
Temik, 3 lb.	24	1,488
Temik, 5 lb.	23	1,632
Cotoran, 2 pt.	23	1,568
Cotoran, 4 pt.	24	1,551
Average	24	1,560
Conventional		
In-furrow	25	1,647
Hopper box	25	1,638
Temik, 3 lb	24	1,577
Temik, 5 lb.	27	1,708
Cotoran, 2 pt.	26	1,611
Cotoran, 4 pt.	24	1,673
Average	25	1,642
No-till control	27	1,514
Conventional control	26	760

Cotton stand counts were equal for both tillage systems and were not affected by soil fungicide treatments, see table. Seed cotton yield was slightly higher for conventional than no-till systems when averaged over chemical inputs. Temik at the higher labeled rate provided numerically higher yields in both tillage systems. Annual morningglory control was equal for both the low and high Cotoran rates in both tillage systems, averaging 94 percent overall. Prickly sida control was lower in conventional (81 percent) than in no-till (92 percent) for the low Cotoran rate.

Yields were not affected by Cotoran rate in either tillage system. Seed cotton yield was higher for the no-till control than for the conventional tillage control, primarily due to weed germination suppression in the non-tilled soil. First-year results indicate some production inputs might be reduced without adversely affecting yield.

M.G. Patterson, B.E. Norris, and B.L. Freeman

Microbial Insecticides, continued

tion, Headland. Each treatment plot was eight rows wide by 75 feet long and was replicated four times. In addition to an untreated control, the following insecticides were tested: pyrethroid (Karate); ovicide (Larvin® and Ovasyn); B.t. (Dipel®, Javelin®, EXP 60516A, Bactec I®, and Bactec III®); Thuringiensin (Di-Beta); virus (Elcar®); gut poison (potassium carbonate); and a feeding stimulant (strawberry gelatin). Foliar treatments, including Prime Oil® as a spreader/sticker, were applied seven times (July 3, 9, 22, and 30 and Aug. 6, 9, and 16) followed by one blanket coverage spray of Karate on Aug. 22 to preserve damage levels obtained from the microbial treatments.

Treatments were initiated when at least five bollworm/budworm eggs were found per 25 terminals. Yields were taken by mech-anically harvesting the middle two rows per plot on November 6.

There were significant differences among cotton yields, with Karate-treated plots yielding notably more than the untreated control or the EXP 60516A, Di-Beta, and Bactec III plus gelatin treatments. Therefore, all treatments with a cotton yield greater than 30 pounds per plot were not significantly different from Karate, see table. Also, the addition of an ovicide always resulted in at least a slight increase in control.

The summer of 1991 was a relatively light year for bollworm/budworm infestations in south Alabama. Continued research in upcoming summers will be needed to determine if microbial products can be as effective as conventional controls when bollworm/budworm pressure is greater.

W.J. Moar and R.H. Smith

Microbial Control of Bollworm/Budworm on Cotton in Headland, Alabama, 1991

Treatments[1]	Yield[2,3]
Karate, 0.04 lb. a.i.	37.05
Javelin + Larvin + Elcar, .125 lb.	35.53
Dipel ES + Larvin	35.15
EXP60516A + Larvin	34.35
Larvin, 0.25 lbs. a.i.	33.20
Dipel ES + Ovasyn, .125 lb. a.i.	32.30
Di-Beta + Dipel ES	31.90
Javelin, .25 lb., + Larvin	31.60
Dipel ES, 1.5 pt.	31.55
Bactec III, .75 lb., + Larvin + potassium carbonate, 150 g	31.10
Bactec I, .75 lb.	30.90
Untreated control	28.25
Di-Beta, 10 g a.i.	27.55
Bactec III, .75 lb., + strawberry gelatin	25.00

[1] Treatment rates per acre.
[2] Mean of four replicates (25 plants sampled/replicate) season long (six sampling dates).
[3] Yield in pounds seed cotton/plot.

Cotton Responds to Foliar Feeding of Potassium Nitrate

The occurrence of late season potassium (K) deficiency in cotton is becoming more and more common in the Southeast. Visual symptoms of K deficiency develop late in the season due to the high demand for K during boll development. Preliminary work in Arkansas has indicated possible yield and quality increases by foliar applications of potassium nitrate (KNO_3) to cotton.

In 1991, an Alabama Agricultural Experiment Station field test at the Tennessee Valley Substation, Belle Mina, and an on-farm test at Sam Spruell's farm in Lawrence County were established to evaluate foliar feeding of KNO_3 in Alabama. The soil at the Tennessee Valley Substation was rated "high" in K, while the farm site tested "low" in K. At both sites KNO_3 (10 pounds KNO_3 per 10 gallons of water per acre) was applied at 10- to 14-day intervals beginning 2 weeks after first white bloom. The Substation cotton received four applications of KNO_3, while the on-farm cotton received three applications.

Severe late season K deficiency symptoms were noted in the on-farm field, while only slight K deficiency symptoms were noted in the Substation field. The on-farm cotton completely defoliated when the cotton was only 30 percent open due to the K deficiency.

Cotton at the Substation site was irrigated and yields were excellent, see table. A positive yield response to both soil and foliar applied K was observed at this site, even though the soil had a "high" soil test rating for K. The on-farm site also produced good yields, but no yield response to either the soil or foliar applied K was observed.

Response of Cotton to Soil and Foliar Applied Potassium

Potassium treatments/acre		Seed-cotton yield/acre	
Soil	Foliar	TVS	On-farm
Lb.	*Lb.*	*Lb.*	*Lb.*
0	None	2,648	3,002
0	KNO_3	3,034	2,733
30	None	2,896	—
30	KNO_3	3,011	—
60	None	3,034	—
60	KNO_3	3,126	2,761

Initial first-year results appear to be conflicting. However, these results suggest that cotton yields can be increased by foliar applications of KNO_3 under conditions of slight K deficiency and high yields. In contrast, when cotton K deficiency was severe, foliar K was not sufficient to correct the deficiency.

G.L. Mullins and C.H. Burmester

Effects of Planting Date, Row Spacing, Variety, and Plant Growth Regulator on Cotton

Results of Alabama Agricultural Experiment Station research from 1988 through 1990 at the Gulf Coast Substation, Fairhope, indicated an April planting date for Deltapine (DPL) 90 cotton on a solid-36-inch row produced greater yields than May or June dates in 2 of 3 years. New research was initiated at Fairhope in 1991 to study the interaction between row spacing, planting date, cotton variety, and PIX® plant growth regulator.

Cotton was planted April 15 and May 15. DPL 20, a short season variety, was compared to DPL 90, a long season variety, on both planting dates. A solid 36-inch pattern was compared to a skip pattern where pairs of rows 36 inches apart were separated by 60-inch skips. Lastly, PIX was either applied or not applied. All possible combinations of planting date, row spacing, variety, and PIX treatments were represented.

Seed cotton yields were approximately 900 pounds per acre greater for the May planting date when averaged over row spacing and variety, see table. Within planting dates, the solid 36-inch pattern produced slightly higher yields than the skip pattern. Except for DPL 20 planted on May 15, neither variety demonstrated a clear yield advantage over the other.

PIX did not significantly affect yield in any case; however, cotton height was reduced 8 to 12 inches in PIX treated plots. More bolls per plant were counted for the April planting date (average 26) compared to the May planting (average 21). Rotten bolls per plant were numerically higher for the April planting (average 6) than the May planting (average 4). No differences in the number of rotten bolls were found among row patterns within each planting date.

Planting Date, Row Spacing, Variety, and Growth Regulator Effects on Cotton, Fairhope, 1991

Planting date	Row spacing	Variety	Seed cotton yield
	In.		*Lb.*
April 15	Solid-36	DPL 90	3,100
	Solid-36	DPL 20	3,279
	Skip-36	DPL 90	2,968
	Skip-36	DPL 20	2,858
		Average	3,052
May 15	Solid-36	DPL 90	3,836
	Solid-36	DPL 20	4,341
	Skip-36	DPL 90	3,799
	Skip-36	DPL 20	3,802
		Average	3,944

M.G. Patterson, M.D. Pegues, and K.L. Edmisten

Chlorophyll Meter Has Potential for Determining Cotton N Status

Cotton producers, consultants, and researchers have long sought for a quick, reliable method to determine cotton nitrogen (N) needs. Improper N application can affect production and the environment.

Petiole nitrate tests are used in sev-

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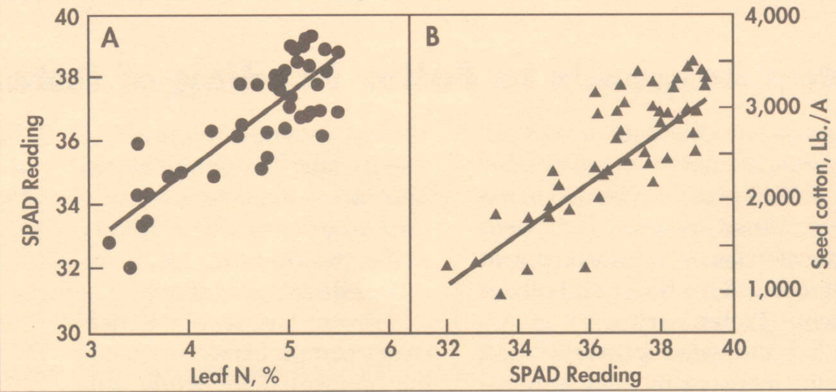
Chlorophyll Meter, continued

eral southern states to monitor cotton N status, but research has not confirmed the reliability of these tests in Alabama. Leaf-blade total N analysis has been useful in predicting cotton N requirements, and is less affected by climate and seasonal changes than petiole nitrate.

Because leaf N status is directly related to leaf chlorophyll content, a newly developed hand-held chlorophyll meter could offer a substitute for leaf-blade total N analysis. Chlorophyll meter readings are measured in soil plant analysis development (SPAD) units and are instantaneous. If chlorophyll meters could predict cotton N needs, farmers could realize substantial savings of money, labor, and time associated with leaf-tissue collection and analysis.

Research was conducted in 1991 to determine the feasibility of using chlorophyll meter readings for determining cotton N status. The experiment was conducted at the E.V. Smith Research Center, Shorter. Several N rates were used to establish a range of cotton (Deltapine 50) yield, tissue N concentration, and chlorophyll concentration. Chlorophyll meter readings were taken at first square, first bloom, and mid-bloom on the uppermost fully developed leaves. For comparison, leaf-blade and petiole samples were collected and analyzed for total N and nitrate, respectively.

Abundant, well distributed rainfall during the 1991 growing season promoted high seed cotton yields and response to N fertilizer. Seed cotton yields ranged from about 1,000 pounds per acre with no N fertilizer to 3,500 pounds per acre with 160 pounds N per acre.



Relationship between (A) chlorophyll meter readings (SPAD) and cotton leaf-blade N at first square, and (B) between seed cotton yield and chlorophyll meter readings at first square.

Chlorophyll meter readings on leaves at first square were highly related to leaf-blade total N, see figure A. Relationships between leaf-blade total N and chlorophyll meter readings at first square also were highly related to cotton yield, figure B. Similar relationships were found at first bloom and mid-bloom.

These relationships suggest that cotton N requirements could be predicted with the chlorophyll meter. In addition, the chlorophyll meter predicted seed cotton yields as well as or better than leaf-blade N and petiole nitrate analyses at all three stages of growth. Especially promising is the connection between chlorophyll meter readings at first square and seed cotton yield, because supplemental N fertilizer could easily be applied at that stage of growth.

Further calibration of the meter is needed before this technology can be useful to producers.

C.W. Wood, D.W. Reeves, and K.L. Edmisten

EDITOR'S NOTE

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March 1992 4 M

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