Research Update 1993

COTTON

New Cotton Herbicides Show Promise

Cotton weed control across the country will change significantly when either of two new herbicides, bromoxynil and DPX-PE350, which are now being tested in Alabama Agricultural Experiment Station (AAES) trials, are registered by the Environmental Protection Agency.

Bromoxynil, a contact herbicide sold as Buctril for use in small grains, was tested for over-the-top broadleaf control in transgenic cotton during 1991 and 1992. This transgenic cotton has been genetically modified to tolerate bromoxynil, which kills ordinary cotton. DPX-PE350, being developed under the trade name Staple, also provides postemergence over-the-top control of broadleaf weeds in cotton and can be used on all cotton varieties. Full registration of both products for cotton is expected by the 1995 growing season.

Bromoxynil was tested on transgenic cotton plants that were grown following USDA guidelines at the Tennessee Valley Substation, Belle Mina. Treatments were evaluated for crop injury and weed control ability. DPX-PE350 was evaluated from 1990

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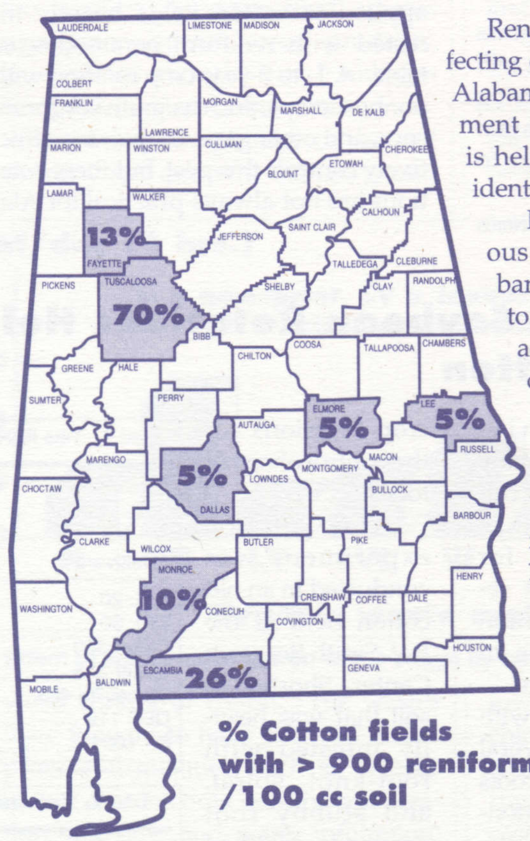
Reniform Nematodes - A New Threat to Cotton Production in Alabama



Counties with damaging levels of reniform nematode.

Reniform nematode, a serious pest affecting cotton, has become widespread in Alabama. Alabama Agriculural Experiment Station research (AAES) research is helping determine populations and identify controls for this pest.

Reniform nematodes pose a serious threat to cotton production in Alabama because they spread from field to field on farm equipment, readily adapt to all soil types, and frequently cause substantial damage to cotton without being detected. Reniform nematodes were reported in 1959 in an east Alabama cotton field but a recent AAES survey identified reniform nematodes in almost 15 percent of the cotton fields sampled statewide.

The highest and most damaging reniform nematode populations were found in cotton fields in central and south Alabama, as shown in the figure. Seventy percent of the cotton fields surveyed in Tuscaloosa County contained reniform populations greater than 900 per 100 cc of soil, which is the level considered capable of reducing cotton yields.

Yield loss studies conducted in Escambia County in 1989 showed cotton yields in fields containing high reniform nematode populations could be reduced by 75

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Alabama Agricultural Experiment Station Auburn University
Lowell T. Frobish, Director Auburn University, Alabama

New Cotton Herbicides, continued

through 1992 at the Tennessee Valley Substation and the Prattville Experiment Field, Prattville.

Good to excellent annual morningglory and prickly sida control was obtained with postemergence treatments of both products. Buctril exhibited excellent postemergence activity, but no significant soil-residual activity. Staple demonstrated soil-residual activity and foliar activity.

Little or no crop injury was observed with postemergence treatments of either product. Both herbicides also provided postemergence control of velvetleaf, common cocklebur, and other broadleaf weeds that affect cotton.

Neither product has annual grass activity, therefore a grass herbicide will be needed in a herbicide program using these new products. One weakness that both herbicides share is their failure to control sicklepod postemergence.

M.G. Patterson, D.P. Moore, and B.E. Norris

Reniform Nematodes, continued

percent. Subsequent studies conducted in this same field and in a second field in 1990, 1991, and 1992 showed that the greatest yield losses from reniform occurred when cotton was subjected to unfavorable growing conditions.

Yield Response to Nematicides in Two Cotton Fields, 1990-1991

Treatment	Application method	Lint	Profit[1] per acre
Rate/acre		Lb./ac	
Telone II[2], 3 gal.	Injected	149	$50
Temik 15G[3], 10 lb.	Band	163	$70

[1] Temik 15G @ $2.80/lb.; Telone II @ $9.00/gal.; cotton @ $0.60/ lb.
[2] Telone injected 2 weeks prior to planting.
[3] Temik incorporated on a 6-inch band over the row at planting.

Studies have shown that nematicides are the most economical and effective means for controlling existing reniform nematode populations in cotton. Higher rates of aldicarb (Temik 15G®) and 1.3-dicloropropene (Telone II®) produced profitable yields when applied to cotton fields heavily infested with reniform nematodes,see table. A 1- to 2-year crop rotation with nonhost crops, such as grain sorghum, corn, and other grass crops, also effectively controls this pest, but these rotations are not always practical for Alabama cotton producers. Peanut, a nonhost, can be used as an effective rotation crop by cotton producers who also grow peanuts.

No commercial cotton varieties have exhibited resistance to reniform nematodes, but some cotton varieties may have tolerance to the nematode. In a variety test conducted this year in a heavily infested reniform field, two cotton varieties, LARN and LA 887, produced good yields, despite maintaining high reniform populations.

W.S. Gazaway and D.E. Rush

Bahiagrass and Soybean Rotations Help Manage Nematodes in Cotton

Damage from nematodes is an important yield limiting factor for many cotton fields in Alabama and other cotton growing states. Finding a practical, efficient management system for nematodes can be difficult, but research suggests that rotating cotton with various other plants may be an effective way to control these pests.

Cotton soils are often infested with a variety of nematode species, several of which cause damage to the roots directly and in association with cotton-wilt pathogens.

Management of nematodes has typically focused on development of resistant varieties and the use of nematicides. While these methods have been moderately effective, various shortcomings with these controls suggest there is a need for additional management systems. For the past 5 years, researchers working in the Alabama Agricultural Experiment Station have been evaluating the use of several crop rotations for the control of nematodes.

One rotation experiment was conducted in an old cotton field at the E.V. Smith Research Center, Shorter, in soil that was heavily infested with root-knot, spiral, and stubby root nematodes and had a serious wilt problem. Treatments included seven cultivars planted with and without the use of a nematicide (aldicarb).

Results clearly showed the benefits of rotation. Yields of cotton grown following 2 years of

Table 1. Yield Response of Seven Cotton Cultivars to a Bahiagrass-Cotton Rotation

	Seed cotton yield, lb./acre			
	Continuous cotton		Bahiagrass - cotton	
Cultivars	Nontreated	Nematicide	Nontreated	Nematicide
DPL 20	872	1,897	1,809	2,071
DPL 50	937	1,939	2,136	2,245
Coker 320	850	1,548	1,613	2,071
Coker 315	676	1,351	1,635	1,940
Stoneville 453	523	1,591	1,722	2,049
DES 119	806	1,657	1,984	2,180
S - 1001	1,134	1,918	1,831	2,332

Table 2. Yield Response of Seven Cotton Cultivars to a Soybean-Cotton Rotation

	Seed cotton yield, lb./acre			
	Continuous cotton		Soybean - cotton	
Cultivars	Nontreated	Nematicide	Nontreated	Nematicide
DPL 20	1,134	2,507	1,766	2,245
DPL 50	1,286	2,747	1,875	2,149
Coker 320	1,417	2,638	2,158	2,659
Coker 315	1,199	2,747	1,875	2,616
Stoneville 453	676	2,245	1,722	2,463
DES 119	1,439	2,616	1,940	2,354
S - 1001	1,417	2,703	2,245	2,594

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Effects of Budworm/Bollworm Management Systems in Early- and Late-Planted Cotton

Because of the potential for the tobacco budworm to develop resistance to pyrethroid insecticides in Alabama, as it has in other areas already, several strategies have been proposed for managing budworms and bollworms in cotton. Most of these strategies are aimed at reducing the number of pyrethroid applications applied for worm control. However, the effects of alternative management tactics on profitability or on outbreaks of secondary pests such as aphids, whiteflies, loopers, and beet armyworms, are generally unknown.

In 1991 an Alabama Agricultural Experiment Station study was initiated at the Wiregrass Substation, Headland, to compare the number of insecticide applications required to control tobacco budworms and bollworms in four management systems. Management systems were: (1) pyrethroids applied against all three generations of budworms/bollworms; (2) pyrethroids applied against the second generation of worms, and carbamates and organophosphates applied against first and third generations; (3) ovicidal rates of thiodicarb applied when first generation egg numbers exceeded 50 eggs per 100 cotton terminals; and (4) only carbamates and organophosphates used for all insect control. Secondary pest population densities and cotton yields also were determined for each system.

Because planting dates for cotton in the Wiregrass region are variable, usually timed around peanut planting schedules, DES 119 cotton was planted on two planting dates (April 18 and May 23) for each management system. Production practices, other than insect management, were standard for the area.

Both planting date and pest management system affected the number of insecticide applications that were required, (the table). Fewer insecticide applications were needed to protect the crop planted in May than for the April planting. On both planting dates, the fewest applications were required in the ovicide-based system because of the high treatment threshold used. The most were required when no pyrethroids were used.

The high treatment threshold used for the first budworm/bollworm generation in the ovicide-based system resulted in greater worm numbers and damage when worm populations peaked in June. Second generation (July) worm populations and damage were greatest in the no-pyrethroid system for both planting dates. Third generation budworm/bollworm infestations were low in all treatments in 1991 and are not presented. Secondary pest numbers were not affected by management systems and were low during

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EFFECTS OF BUDWORM/BOLLWORM MANAGEMENT SYSTEMS ON PERCENT WORM INFESTATIONS AND DAMAGE, NUMBER OF INSECTICIDE APPLICATIONS, AND YIELDS OF COTTON PLANTED ON TWO DATES

	1st generation		2nd generation		Insecticide applications	Seed cotton/acre
	Worms	Damage	Worms	Damage		
						Lb.
April 18 planting						
Pyrethroids all generations	4.0	10.5	4.0	9.0	11	3,487
Pyrethroids 2nd generation only	5.5	19.0	11.0	14.5	12	3,459
Ovicides 1st generation	21.0	30.0	6.5	12.0	11	3,672
No pyrethroids	9.0	20.5	15.0	22.5	14	2,994
All systems	9.9	20.0	9.1	14.5	—	3,403
May 23 planting						
Pyrethroids all generations	3.5	13.0	11.0	19.5	10	3,814
Pyrethroids 2nd generation only	7.0	20.0	9.0	19.5	11	3,717
Ovicides 1st generation	17.0	31.5	11.5	17.0	10	3,975
No pyrethroids	11.5	25.0	17.0	19.0	12	3,918
All systems	9.8	22.4	12.1	18.8	—	3,856

Bahiagrass and Soybean Rotations, continued

bahiagrass were significantly greater than those obtained with the cultivars following 2 years of Deltapine 50 cotton, (Table 1). Yield response was greatest for the nematicide-treated plots in the continuous cotton treatments. Nematicide application was of questionable economic value for most cultivars in the bahiagrass rotation.

In another experiment at the Center, rotations with soybeans were conducted to assess the value of root-knot nematode-resistant soybeans (Kirby) in rotation with cotton. This experiment was conducted in a field infested with the same nematodes found in the previously mentioned study and treatments included both nematicide treated and nontreated plots.

After 2 years of planting Kirby soybean, yields of the seven cotton cultivars were significantly greater than yields of the cultivars following 2 years of Deltapine cotton, (Table 2). Again, yield response to the nematicide treatment was most pronounced in plots with continuous cotton. However, in contrast with the bahiagrass rotation, yield responses to aldicarb in the soybean rotation were highly significant. This suggests that a rotation using Kirby soybeans with cotton is not as effective as the bahiagrass rotation in managing the nematode-wilt problem present in many Alabama fields.

Other rotation systems with forage and row crops are being studied and look promising for the management of nematode problems.

R. Rodriguez-Kabana, D.G. Robertson, and J.S. Bannon

Cover Systems and Starter Fertilizers Evaluated on No-Till Cotton

Northern Alabama, an area of intense cotton production, has many soil types that are considered highly erodible and therefore must have approved soil conservation plans to meet requirements of the 1985 farm bill. One method farmers can use to meet soil erosion tolerances is to use no-tillage or minimum-tillage cotton systems.

Previous grower and researcher experience indicated these systems might reduce cotton growth and yield, especially when cotton was no-tilled into old cotton stubble, compared to conventionally tilled cotton. A field study was conducted in 1991 and 1992 to verify growth and yield limiting factors with no-till cotton production in northern Alabama.

The study, which was conducted at the Tennessee Valley Substation, Belle Mina, compared cotton growth and yields between the two most commonly used no-till cover systems and conventionally tilled cotton. Comparisons between starter fertilizer materials and placement of those materials also were evaluated in each tillage system. The two no-till cover systems evaluated were old cotton stubble or fall seeded wheat, killed 2 weeks prior to planting. Starter fertilizer treatments consisted of liquid fertilizers supplying N and P_2O_5 rates of 0-0, 15-0, and 15-50 pounds per acre applied either in a band 4 inches over the row or 2 x 2 placed.

Cotton yields at the test site were only about one bale per acre due to a drought in 1991. However, abundant rainfall produced cotton yields of about two bales per acre in 1992.

Effects of Starter Fertilizer Placement on Growth: Yield of Cotton

Starter fertilizer treatment			Height[1]		Seed cotton yield	
lb./A	Placement	Tillage	1991	1992	1991	1992
			In.	*In.*	*Lb./a*	*Lb./a*
0-0	—	Conv.	24	31	1,440	3,310
15-0	Band	Conv.	25	32	1,550	3,380
15-0	2x2	Conv.	26	32	1,450	3,550
15-50	Band	Conv.	27	31	1,410	3,720
15-50	2x2	Conv.	24	32	1,560	3,320
0-0	—	Stubble	21	30	1,350	3,130
15-0	Band	Stubble	21	28	1,460	3,310
15-0	2x2	Stubble	21	30	1,650	3,270
15-50	Band	Stubble	21	30	1,530	3,310
15-50	2x2	Stubble	22	31	1,650	3,390
0-0	—	Wheat	23	31	1,450	3,180
15-0	Band	Wheat	24	31	1,670	2,840
15-0	2x2	Wheat	26	34	1,670	3,190
15-50	Band	Wheat	27	35	1,620	3,400
15-50	2x2	Wheat	26	35	1,770	3,420

[1]Heights were taken at early bloom each year.

Both years cotton no-tilled into old stubble produced shorter, more compact plants than cotton conventionally tilled or no-tilled into wheat. Starter fertilizers had little effect on conventional cotton yield either year, while starter fertilizers increased cotton yield in the no-till covers in 1991 but not in 1992. Response to starter placement treatments also varied greatly between tillage treatments and years.

Although growth differences between the no-till cover systems and conventionally tilled cotton were noted, cotton yields were similar in each tillage system for both years. Starter fertilizer response was erratic, but these results support previous findings starter fertilizer is more likely to elicit a response from no-till cotton than conventionally tilled cotton. Soil moisture and soil compaction measurements were taken in all tillage treatments in 1992. This should supply additional information on why no-till cotton growth may differ from conventionally tilled cotton.

C.H. Burmester and M.G. Patterson

Effects of Budworm/Bollworm Management Systems, continued

most of the season. However, in early August, whitefly numbers were almost 10 times greater in the cotton planted in April (28.7 per terminal) than in the May planting (2.7 per terminal). In contrast, looper populations were slightly greater in the cotton planted in May (46.2 per row foot) than the April planting (29.4 per row foot).

Planting dates had more effect on cotton yields than did management systems. Seed cotton yields averaged about 450 pounds greater in the late planting than in the early planting. Despite the early season damage levels, the highest yields were obtained in the high-threshold, ovicide-based system, regardless of planting date. When no pyrethroids were used, yields were reduced in cotton planted in April, but not in the cotton planted in May.

Because of year-to-year variability in pest numbers and weather conditions, results of this experiment might not be consistent every year. However, this study demonstrated that in some years in the Wiregrass region of Alabama it is possible to sustain relatively heavy early-season damage and still produce good cotton yields, even in cotton planted as late as the end of May. Late planting does not necessarily lead to the need for more insecticide applications.

The increased number of applications required, and the lower yields exhibited by cotton that was never treated with pyrethroids demonstrate the value of this class of insecticides. A management system based on high budworm/bollworm thresholds in June and on the use of an ovicide when thresholds are exceeded resulted in good yields. If a similar system is adopted by most growers, development of pyrethroid resistance by the tobacco budworm may be delayed in Alabama.

M.J. Gaylor

Broiler Litter on Cotton

Three years of research at the Tennessee Valley Substation and two years at E. V. Smith Research Center has demonstrated that broiler litter can be used effectively as a source of nitrogen (N) for cotton. However, total nitrogen in the litter is not a reliable index of nitrogen availability compared to ammonium nitrate fertilizer.

In some years, total N in broiler litter was just as effective as the total N in ammonium nitrate in increasing cotton lint yields. In other years, more N as broiler litter was needed. However, rates as high as 4 tons per acre or 240 pounds N per acre as broiler litter had no negative effects on cotton yields. In some cases, the higher broiler litter rate enhanced yields over conventional fertilizers.

Growers interested in using animal manures as a fertilizer source are concerned that excessive N applications may result is excessive vegetative growth and decreased yields due to late maturity and boll rot. This problem was observed only at the Tennessee Valley in 1992. However, Pix™ (mepiquot chloride) applications were effective in controlling excessive growth and enhancing yields in 1992. Pix resulted in average yields of 1,780 compared to 1,560 pounds lint per acre where no Pix was applied.

Residual soil nitrate levels were not greater to a depth of 3 feet when broiler litter was used compared to 120 pounds N per acre as ammonium nitrate. However, yields indicated that previous broiler litter applications can result in significant carryover of residual organic N in the soil.

C.C. Mitchell, C.H. Burmester, and C.W. Wood

Effects of Soil-Applied Organic Wastes on Cotton

Disposal of organic wastes, such as old newspapers and lawn waste, is becoming a big problem for municipalities. Finding uses for these wastes in agricultural production systems could benefit the environment and agriculture. Research underway through the Alabama Agricultural Experiment Station indicates that certain wastes may have potential value for cotton production.

A field study was initiated in 1992 at the E.V. Smith Research Center, Shorter, to evaluate the effects of surface-applied, noncomposted organic wastes (newsprint, wood products, yard waste, and gin trash); nitrogen sources to adjust carbon:nitrogen ratios; and time of application on the seed cotton yield, growth, maturity, and weed control of cotton. The wastes were thought to have potential to improve soil qualities, such as organic matter content, bulk density, soil aeration, porosity, and water infiltration, which could result in better control of soil erosion and enhance soil productivity.

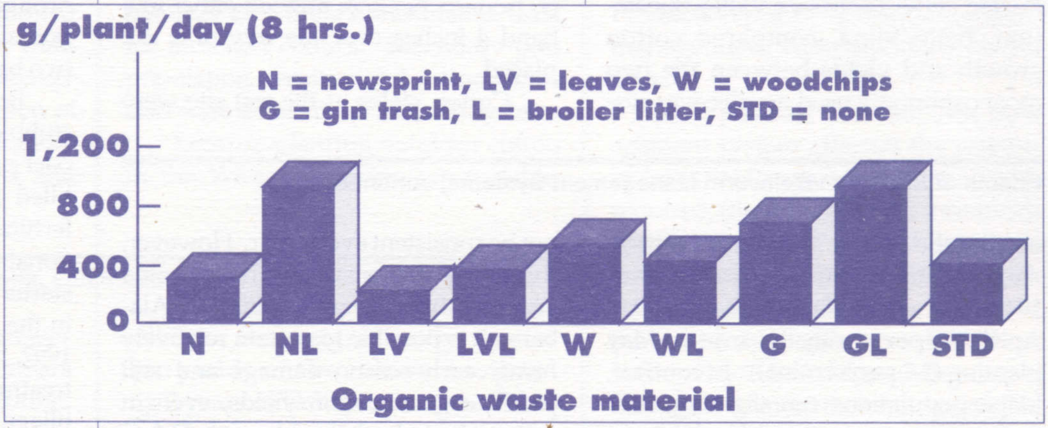
Results of the study have shown that the first year of surface-applied noncomposted organic waste reduced seed cotton yields, (the table). Newsprint had the greatest influence on seed cotton yield, but this impact was greatly reduced when broiler litter, another abundant waste product, was added to the soil. This treatment also provided some herbicidal effect on large crabgrass seedlings in cotton.

The addition of noncomposted newsprint and leaves, plus ammonium nitrate as a nitrogen source produced cotton plants that had smaller leaf areas, used less water, and produced smaller seed cotton yields than the standard control. Adding wood chips or gin trash and using ammonium nitrate resulted in cotton plants that were no different than the standard with respect to leaf area, water use, and seed cotton yield.

Adding broiler litter to the above treatments increased cotton leaf area, water use, and seed cotton yield. Beneficial effects from the broiler litter were greatest with newsprint, followed by leaves, gin trash, and wood chips. However, higher water use by cotton plants does not necessarily translate into higher yields, as was the case here. Water use efficiency appeared best with broiler litter and leaves, followed by broiler litter and wood chips, broiler litter and gin trash, and lowest with broiler litter and newsprint.

These results suggest that some of these wastes used in combination with broiler litter may benefit cotton production.

J.H. Edwards, R.H. Walker, and C.C. Mitchell



Effect of waste materials on water usage by cotton plants.

Weeds in Broiler Litter

When broiler litter is applied to cotton fields, weed problems sometimes increase. Some cotton producers fear that broiler litter is actually introducing problem weeds into the field. Though logic suggests that the increased weed growth is coming from the fertilizing effect of the litter and not from new weed seeds in the litter itself, little research has been conducted on this widespread concern.

An Alabama Agricultural Experiment Station greenhouse incubation study addressed this issue by evaluating 18 broiler litter samples collected from houses throughout Alabama in 1992. The objectives were to see if any weed seed were introduced when litter was added to a sterilized soil and to determine the effect of litter on growth of weeds that were planted in the soil.

As expected, absolutely no weeds came up during a 2-month incubation period in the soil treated with any of the broiler litter samples. The different litter samples did, however, affect the germination and growth of morningglory, sicklepod, spiny amaranth, and crabgrass seeds that were inoculated in the soil.

These results suggest that cotton producers should not be concerned about introducing noxious weeds into their cotton fields when broiler litter is used as an alternative fertilizer source.

C.C. Mitchell and R.H. Walker

EDITOR'S NOTE

Mention of company or trade names does not indicate endorsement by the Alabama Agricultural Experiment Station or Auburn University of one brand over another. Any mention of nonlabel uses or applications in excess of labeled rates of pesticides or other chemicals does not constitute a recommendation. Such use in research is simply part of the scientific investigation necessary to fully evaluate materials and treatments.

Information contained herein is available to all persons without regard to race, color, sex, or national origin.

February 1993 4 M

Effect of Soil Test Potassium on Cotton Response to Foliar Potassium Applications

Foliar applications of potassium (K) as KNO_3 on cotton are becoming a common practice in parts of the southeastern cotton belt. However, predicting the probability of a yield response to this practice has not been possible.

In 1992, long-term soil fertility experiments at five Alabama locations were used to measure cotton yield response to foliar-applied KNO_3 on treatments where soil-test K concentrations varied from low to high. For this Alabama Agricultural Experiment Station study, foliar KNO_3, at a rate of 10 pounds per acre (1.3 pounds N and 4.4 pounds K_2O per acre), was applied four times at weekly intervals beginning the week after first bloom. The other half of each plot received foliar-applied urea at the same nitrogen rate.

Cotton at all locations responded to increasing levels of soil-test K, indicating that K deficiencies existed at all locations. In fact, severe K deficiencies were observed at several locations. However, foliar KNO_3 increased cotton yields at only two of the five locations— the Prattville Experiment Field and the Monroeville Experiment Field, both on Lucedale soils. The yield increase was about the same whether soil test K was low or high.

These results indicate that response to foliar-applied K appears to be soil related but not related to soil-test K. Other soil and physiological factors may influence the predictability of cotton yield response to foliar-applied K. While these data do not provide a definitive answer about the effectiveness of this technique, growers across the cotton belt have reported increased yields in about 40 percent of the fields where foliar-applied K is used.

C.C. Mitchell, G.L. Mullins, and C.H. Burmester

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