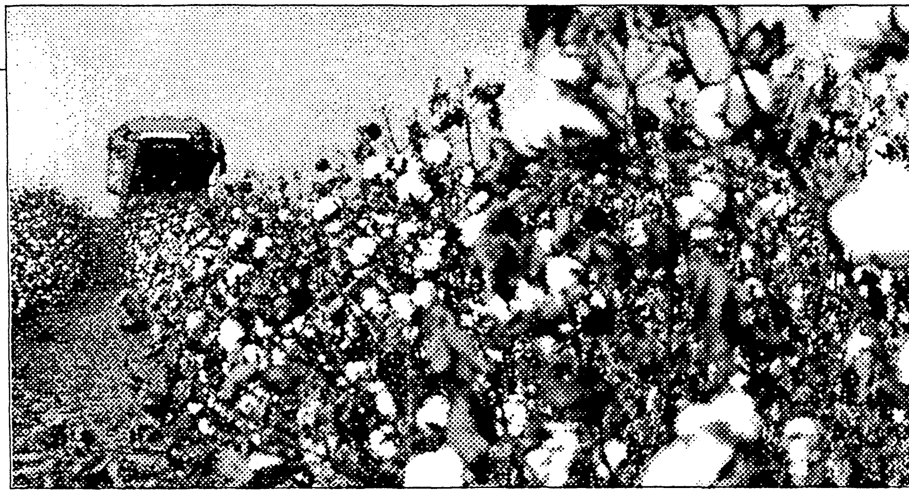

RESEARCH UPDATE 1991

COTTON

Herbicide Resistance Demonstrated by Cocklebur in Cotton

Reports of common cocklebur in cotton fields developing resistance to the arsenical herbicides MSMA and DSMA have become increasingly common in the Southeast during the past few years. These reports were investigated through AAES research in a greenhouse study during 1990.

Cocklebur seed from cotton fields located near Orrville and Polk in west Alabama were planted in 1-quart cups of potting soil. Cocklebur plants were treated separately at 2-leaf and 6-leaf growth stages with MSMA at rates of 0.5 to 4.0 pound active ingredient (a.i.) per acre in a spray volume of 15 gallons per acre.

Cocklebur obtained from Orrville and treated at the 2-leaf stage could not be controlled with MSMA at 0.5 to 1.0 pound a.i. per acre, as shown in the table. Only 59 percent control was obtained with the 2-pound rate.

Cocklebur from Polk treated at the 6-leaf stage also could not be controlled with MSMA rates of 0.5 to 1.0 pound a.i. per acre and only 48 percent control was obtained with 2 pounds a.i. per acre.

Regrowth occurred on the lower stem nodes after top growth was burned down with MSMA rates of 2 and 4 pounds a.i. per acre. This regrowth would allow cocklebur to escape early herbicide treatment and compete with cotton if no further treatments were applied.

Common Cocklebur Control from Over-the-top Herbicide Treatments

Herbicide, a.i./acre	Orrville		Polk	
	2-leaf	6-leaf	2-leaf	6-leaf
	Pct.	*Pct.*	*Pct.*	*Pct.*
Control................	0	0	0	0
MSMA, 0.5 lb.......	10	60	61	4
MSMA, 1.0 lb.......	14	65	77	4
MSMA, 2.0 lb.......	59	72	80	48
MSMA, 4.0 lb.......	80	75	79	68

This indicates that common cocklebur is developing resistance to MSMA. Because DSMA has a comparable chemical makeup, similar control response and resistance development would be expected for this chemical. These findings suggest that alternative control methods for MSMA- and DSMA-resistant cocklebur must be studied.

M.G. Patterson and T.V. Hicks

April 15 Planting Best at Fairhope

Cotton is again being grown in Alabama's coastal counties with acreage increasing in Baldwin and Mobile counties during the past 3 years. Because information concerning the optimum planting dates for cotton in this area is limited, an AAES field study was initiated in 1988 to learn more about ideal planting dates.

The study was conducted at the Gulf Coast Substation, Fairhope, to evaluate the yield potential of cotton planted April 15, May 15, and June 15. Cotton was grown both with and without Pix® plant growth regulator. Yields were obtained each year for all planting dates except the May 15 date in 1988 when dry weather prevented the establishment of a workable stand.

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

April 15 Planting, continued

The highest yields were obtained each year from the April 15 planting date, as shown in the table. Yields from cotton planted in April were significantly higher than yields from other planting dates in 1988 and 1989. Yields were approximately equal for April and May planting dates in 1990. Pix provided a yield increase for the June planting in 1988, but gave no benefits at other planting dates or in other years.

M.G. Patterson, M.D. Pegues, N.R. McDaniel, and E.L. Carden

Cotton Date of Planting-Pix Study, Gulf Coast Substation, Fairhope

Planting date, Pix treatment	Seed cotton yield		
	1988	1989	1990
	Lb.	*Lb.*	*Lb.*
April 15			
No Pix	1,906	3,527	2,384
Pix	1,730	3,216	2,517
May 15			
No Pix	—	2,408	2,202
Pix	—	2,439	2,302
June 15			
No Pix	998	2,122	2,009
Pix	1,256	2,070	1,852

No-till Cotton Matches Yield of Conventional Cotton

Conservation tillage planting systems for cotton have been studied since the early 1980's in Alabama, but on-farm use of conservation tillage has been only on a limited scale. However, new conservation compliance regulations and a renewed interest in reducing labor, machinery, and fuel costs associated with con-

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Cotton Shows Little Response to Deep Placement of Potassium Fertilizer

Research in Mississippi has shown that deep placement of a narrow band of potassium fertilizer under the cotton row can produce increases in lint yields. AAES field studies were initiated in 1989-90 to see if similar results could be obtained in Alabama.

The studies were conducted at the E.V. Smith Research Center, Shorter, and the Tennessee Valley Substation, Belle Mina, in 1989, and at the Prattville Experiment Field, Prattville, in 1990.

Several treatments were compared at each research site. Deep placement treatments at the sites were achieved using a dry fertilizer applicator that applies fertilizer at depths of 6 to 15 inches behind a subsoil shank. Potassium was applied deep at rates ranging from 0 to 90 pounds K_2O per acre. Other treatments received K applied as surface broadcast applications at rates ranging from 0 to 90 pounds K_2O per acre with and without subsoiling. Two additional deep placement treatments received 1,500 pounds limestone per acre and 1,500 pounds limestone plus 90 pounds K_2O per acre. A final treatment of 120 pounds K_2O per acre deep placed was included at the Tennessee Valley Substation and Prattville Experiment Field.

At the E.V. Smith Research Center and the Tennessee Valley Substation, no consistent yield responses were observed for the deep placement treatments. A yield response to the deep placement of K was obtained in 1990 at the Prattville Experiment Field, as shown in the table, but a greater yield response was obtained by applying the same rates of K as a surface broadcast application.

Initial results from this series of field studies suggest that, for cotton, the deep placement of K fertilizer on the soils studied was not superior to surface broadcast applications of K fertilizer.

G.L. Mullins, C.H. Burmester, and D.W. Reeves

Cotton Yield Response to Deep Placement of K, Prattville Experiment Field, 1990

Treatment: Application rate/acre, lb. — K_2O	Limestone[1]	Subsoiled	Seed cotton, per acre
			Lb.
Surface applied[2]			
30	0	No	2,573
60	0	No	2,707
90	0	No	2,423
30	0	Yes	2,583
60	0	Yes	2,700
90	0	Yes	2,867
Deep placement[3]			
30	0	Yes	2,364
60	0	Yes	2,596
90	0	Yes	2,691
30	1,500	Yes	2,589
90	1,500	Yes	2,550
120	0	Yes	2,534
No K_2O or lime	—	No	2,439
No K_2O or lime	—	Yes	2,374

[1]Limestone application in selected treatments refers to the deep placement of lime with a dry fertilizer applicator.
[2]Potassium fertilizer broadcast on soil surface (after subsoiling) prior to secondary tillage.
[3]Dry K fertilizer placed in a vertical band from 6 to 15 inches, applied approximately 3 weeks prior to planting.

No-till Cotton, continued

ventional cotton production has increased interest in no-till or minimum tillage cotton.

Vetch, crimson clover, rye, wheat, and old crop stubble have been evaluated as cover crops for no-till cotton in AAES experiments. Use of in-row subsoiling has also been evaluated. Earlier studies found that vetch and clover covers created cotton establishment problems because the vetch and clovers were difficult to kill and the thick mulches kept the soil cool, increasing seedling diseases and insect problems.

In-row subsoiling was found to be beneficial only on sandy soils which often develop "hard pans" or "traffic pans." Subsoiling of clayey soils at planting often resulted in poor stands when wet clay that was pulled to the soil surface impeded planting.

Research during the last 3 years has concentrated on growing cotton no-till into small grains or old cover crops. A rotation experiment at the Tennessee Valley Substation, Belle Mina, in 1988 was modified to include planting cotton no-till into old cotton stubble or a wheat cover crop. The wheat cover crop and winter weeds in the old stubble were killed 2 weeks prior to planting. The no-till cotton was planted into the stubble with a conventional planter modified with a coulter directly in front of each row to reduce trash.

Good cotton stand establishment was found with both no-till systems; however, seed cotton yields during the last 3 years were increased by 200 pounds per acre by planting into wheat cover compared to old cotton stubble. The greatest differences were found in the dry years of 1988 and 1990. Conventionally planted cotton and cotton planted no-till into wheat cover have produced similar yields.

C.H Burmester

Seed Cotton Yields of No-till and Conventional Till Cotton, Tennessee Valley Substation, Belle Mina

Tillage type	Seed cotton yield/acre			
	1988	1989	1990	Av.
	Lb.	*Lb.*	*Lb.*	*Lb.*
No-till				
Into cotton stubble	1,140	2,440	1,510	1,697
Into wheat cover	1,380	2,490	1,840	1,903
Conventional	1,400	2,780	1,700	1,960

Specialized Cultivator Tested for Minimum Tillage Cotton

A series of minimum tillage cotton experiments at the Tennessee Valley Substation, Belle Mina, and the Wiregrass Substation, Headland, during a 4-year period revealed that weeds could be effectively controlled using broadcast herbicide applications. However, this increases weed control costs above conventional tillage systems where herbicides are banded over the row and the middles are cultivated. AAES experiments were initiated to evaluate the potential of reducing weed control costs by using a specialized cultivator in minimum tillage cotton.

Cotton was planted into desiccated rye cover using a strip tillage planter (Ro-Till®). A preemergence herbicide mixture (Cotoran® plus Zorial®) was either banded over the row or broadcast. Additional weed control inputs included minimum tillage cultivation and postemergence directed sprays. A conventional till-

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Broiler Litter Evaluated for Use as Cotton Fertilizer

Alabama's growing poultry industry and increased environmental concerns with excessive application of broiler litter to small acreages have created an interest in the use of broiler litter on row crops. With more than 200,000 acres of cotton in northern Alabama in close proximity to the broiler industry, cotton could provide an important outlet for litter disposal. However, little research on cotton's response to broiler litter applications has been available and possible problems associated with broiler litter applications, such as rank vegetative growth and delayed cotton maturity, have not been addressed.

Three AAES field studies were conducted in 1990 at the Tennessee Valley Substation, Belle Mina, and in farmers' fields in Cullman and Lauderdale counties to evaluate the effects of broiler litter on cotton growth and development. In these studies, broiler litter rates of 2, 3, and 4 tons per acre were compared to 0, 60, and 120 pounds fertilizer nitrogen (N) per acre. All litter applications were incorporated before planting and N fertilizers were applied half at preplant and half as sidedressing.

No detrimental effects on cotton growth and no additional weed pressures were found when litter was used. Early season height and node measurements indicated that litter-

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Effects of Broiler Litter on Cotton Yields

Treatment/acre	Seed cotton yields/acre		
	Tennessee Valley	Cullman	Lauderdale
	Lb.	*Lb.*	*Lb.*
No N	1,840	910	850
60 lb. N	2,230	1,210	1,160
120 lb. N	2,450	1,330	1,280
Litter, 2 tons	2,460	1,250	1,100
Litter, 3 tons	2,560	1,200	1,220
Litter, 4 tons	2,520	1,320	1,280

Broiler Litter, continued

treated cotton was growing slightly faster than cotton treated with commercial N fertilizer. At all sites, the 2-ton-per-acre broiler litter treatment produced seed cotton yields equal to the standard N fertilizer treatment (60 pounds N per acre). However, extremely hot, dry weather from mid-July until September equalized most treatment effects and possible problems with late season N release from the broiler litter could not be evaluated.

These results indicate that broiler litter has potential as a fertilizer for cotton.

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

Specialized Cultivator, continued

age treatment using standard weed control techniques was included for comparison.

Weed control in minimum tillage plots which received banded preemergence herbicide applications followed by cultivation alone or cultivation plus postemergence directed sprays was equal to conventional tillage weed control in 1989, as shown in the table. Cotton yields for both minimum and conventional tillage systems also were equal that year. However, poor annual grass control in minimum tillage plots where preemergence herbicides were banded and followed by cultivation alone resulted in total yield loss for this treatment in 1990. Annual grasses were not inverted by the minimum tillage cultivator and rerooted after rainfall. Minimum tillage plots which received broadcast preemergence herbicide applications either alone or followed by cultivation, or cultivation plus postemergence directed sprays produced good cotton yields and excellent weed control both years.

M.G. Patterson, B.E. Norris, H.E. Burgess, and W.B. Webster

Effectiveness of Cultivation in Minimum-tillage Cotton at Tennessee Valley Substation, Belle Mina

Treatment[1]	Weed control: Grass 1989	Grass 1990	Broadleaf 1989	Broadleaf 1990	Cotton yield/acre 1989	Cotton yield/acre 1990
	Pct.	*Pct.*	*Pct.*	*Pct.*	*Lb.*	*Lb.*
Strip-tillage						
Banded, cultivated	83	45	81	78	2,485	0
Banded, cultivated, PDS	88	68	89	83	2,845	1,788
Broadcast	94	97	94	96	2,491	1,992
Broadcast, cultivated	95	97	95	98	2,365	2,025
Broadcast, cultivated, PDS	95	98	95	98	2,807	1,948
Conventional tillage						
Banded, cultivated, PDS	75	89	79	89	2,644	2,284

[1]Herbicide banded or broadcast; cultivated = cultivation twice during the growing season; PDS = postemergence directed spray.

Research Seeking Ways to Make Cotton Nonflammable

The comfort and durability of cotton fabric make it a natural choice for use in sleepwear, but economic and safety factors have kept it out of the children's sleepwear market for more than 15 years. AAES research is working to reopen this market to cotton.

Problems arose with cotton when federal law began to require children's sleepwear to be flame resistant. Cotton's natural flammability requires the addition of expensive flame-retardant finishes to ensure nonflammability. Unfortunately, interactions between metal ions found in hard water and compounds in phosphate-free detergents can dilute the effectiveness of flame retardants on cotton.

Research has shown that this dilution effect is caused by an extremely complicated chemical reaction. Rather than unravel this process, many sleepwear manufacturers have replaced cotton with fabrics that can be managed more easily and less expensively. Studies at the Alabama Agricultural Experiment Station have continued to explore this intricate chemical process in an effort to overcome the problems associated with making cotton flame retardant.

Flame-retardant treatments cause cotton fabric to char rather than burn by encouraging the formation of water and inhibiting the rapid breakdown of ignited material. Cotton fibers are composed almost entirely of cellulose, long-chain molecules which are the basis for most plants. The Auburn research has concentrated on finding out how metal ions influence the burning (thermal breakdown) of cellulose.

In the experimental work, cotton fabric was thoroughly cleaned, and sodium, potassium, magnesium, and calcium salts of chlorine and carbonate were applied to or formed in the fabric. These samples were then burned at various rates and temperatures. When the burning was complete, the resulting products were separated and identified.

It was discovered that all the inorganic salt additives increased the

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"Old Rotation" Helps Identify Least Risky Rotations

Economic analysis of data from 92 years of the Alabama Agricultural Experiment Station's "Old Rotation" experiment is providing information about the least risky rotation alternatives for cotton production.

In the AAES economic study, data from the Old Rotation were used to analyze the effect of alternative rotations for sustainable cotton yields. In particular, the analysis looked at the effect of winter legumes following cotton as a source of green manure and nitrogen for crops involved in the rotations. Rotations included in the long-running study were: (1) continuous cotton, with and without winter legumes and nitrogen fertilizer; (2) 2-year rotations of cotton, winter legumes, and corn, with and without nitrogen fertilizer; and (3) 3-year rotations of cotton, winter legumes, corn, and small grains-soybeans double-cropped, with nitrogen fertilizer applied to the small grains.

All rotations received 80 pounds of phosphorus (P_2O_5) and 60 pounds of potassium (K_2O) per acre per year applied to the summer crop or winter legume, or split between the summer crop and winter legume.

The net return potential of each of these alternative rotations was calculated using the past 10 years' data. Comparisons were also made of the economic riskiness of the alternative rotations on 570 acres of cropland.

The greatest net returns were realized from the continuous cotton with winter legumes and the 3-year rotation of cotton-winter legumes-small grains-soybeans. In contrast, the continuous cotton without winter legumes and without nitrogen fertilizer and the 2-year rotation of cotton-winter legumes-corn (without nitrogen fertilizer) did not generate enough income to cover out-of-pocket (variable) costs.

Results of the risk analysis indicate that the most profitable farm plan included the 3-year rotation of cotton, winter legumes, corn, and small grains-soybeans (1/3 of the acreage to cotton, 1/3 to winter legumes-corn, 1/3 to rye-soybeans double-cropped). This 3-year rotation also had a high economic risk which might be reduced by including the rotation of continuous cotton with winter legumes in the farm plan. This shift, however, results in a reduction of potential net return.

Despite a slightly decreased net return, the best overall management strategy to minimize risk while achieving an expected return of $52,581 involved planting 31 percent of the cotton acreage in continuous cotton with winter legumes and the remainder to the 3-year rotation of cotton-winter legumes-corn-small grains-soybeans.

J.L. Novak, C.C. Mitchell, Jr., and J.R. Crews

Nonflammable Cotton, continued

amount of carbon dioxide, water, and carbon monoxide released by the fabric. The yields of these products increased or decreased as additional salts were added, depending on the type of salt used.

These results are the first steps in explaining the complicated chemistry involved when cotton burns. Once this process is understood, new flame retardant finishes could be developed for cotton fabrics which will reopen the children's sleepwear market to cotton and allow consumers a wider choice of fabrics.

I.R. Hardin

Reniform Nematode on Cotton in Alabama

Cotton producers across the State have reported a general decline in cotton production in many of their fields. In a few cases, yields have declined to less than 50 percent of their original production capacity. Reniform nematode has now been identified as being at least partially responsible for that decline in production.

Reniform nematodes attack cotton in all stages of development. Cotton fields infested with reniform nematode do not display the typical signs associated with other plant parasitic nematodes. Damage is general and spread throughout the entire field rather than being restricted to plants in localized areas within the field. Reniform-infested cotton plants are usually stunted but exhibit no other unusual aboveground symptoms. Affected cotton roots exhibit poor growth but form no galls or lesions like those caused by root-knot nematodes.

Cotton soil samples analyzed at the Plant Diagnostic Laboratory in Auburn and a Statewide systematic survey initiated last summer have indicated that this nematode is present in all major cotton producing areas of Alabama. It is also found in almost all soil types, which makes practically all Alabama cotton fields potential targets for infestation.

Nematicide and crop rotation studies conducted through the Alabama Agricultural Experiment Station and in other Southeastern States indicate that reniform can be controlled by either rotation, nematicides, or a combination of both. Data from nematicide trials revealed that Telone® and Temik® increased cotton yields by as much as 75 percent in heavily infested fields.

W.S. Gazaway

Cotton Varieties Tested at Gulf Coast Produce Good Yields

For years virtually no cotton was grown in extreme southwest Alabama (Baldwin and Mobile counties). In response to increased interest in planting cotton by farmers in this area, an abbreviated variety test was conducted in 1987 at the Gulf Coast Substation, Fairhope, on eight cotton varieties. The test was expanded the following year to a regular cotton variety test with 30 varieties.

Yields of Three Top Producing Varieties, Gulf Coast Substation, Fairhope

Variety	Lint yield/acre
	Lb.
Deltapine 90	1,050
DES 119	1,040
HS46	1,031

Cotton yields from the trials have been excellent, averaging about 1.5 times the State cotton yield average in Alabama. The average yield for all varieties was 752, 695, 994, and 946 pounds per acre in 1987, 1988, 1989, and 1990, respectively. Varieties with the highest 3-year average lint yields per acre were Deltapine 90, DES 119, and HS46. Yield averages for these varieties are shown in the table.

W.C. Johnson

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 non-label 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.

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