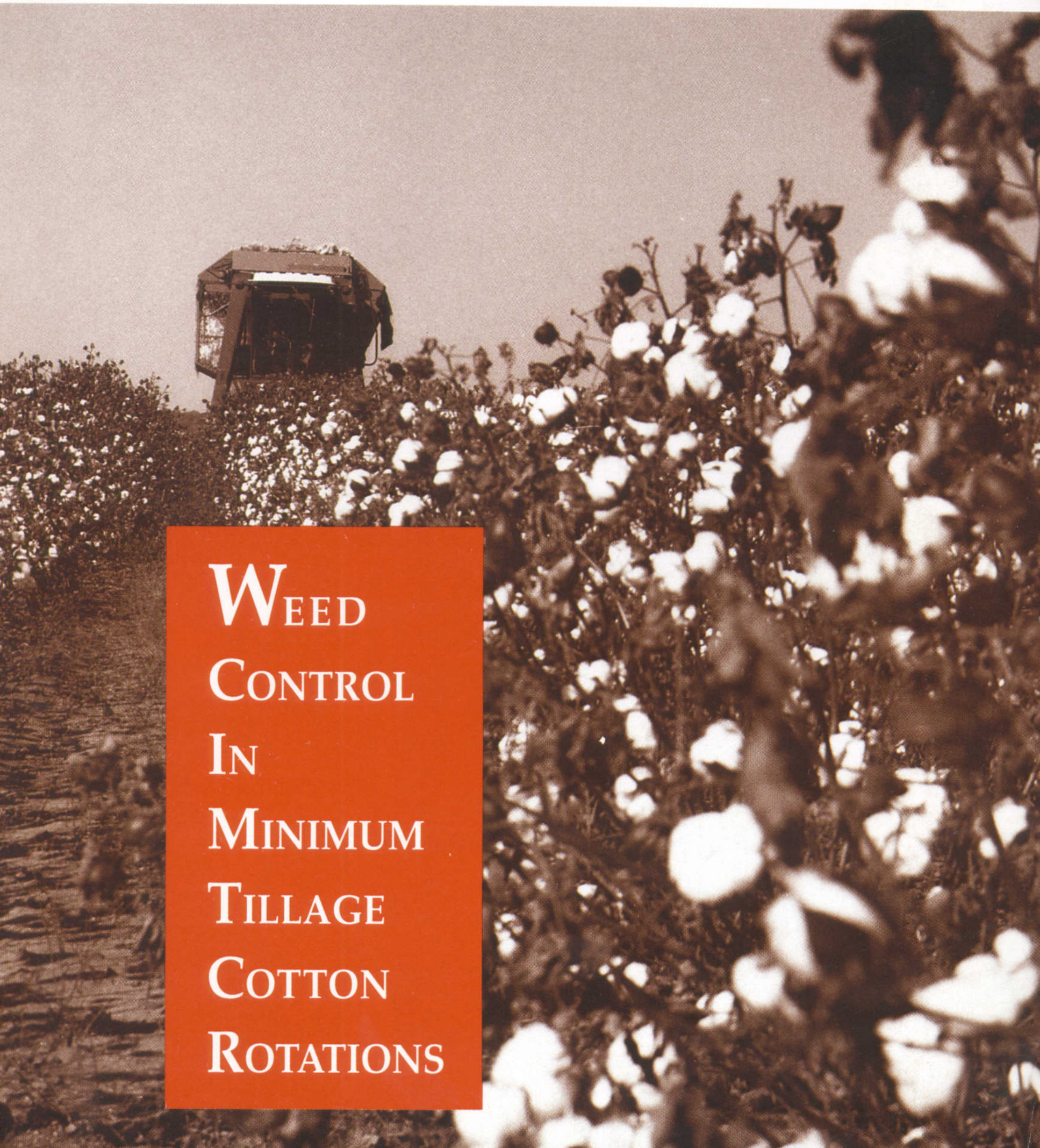
Bulletin 608
December 1990
Alabama Agricultural Experiment Station
Lowell T. Frobish, Director
Auburn University
Auburn University, Alabama



Weed Control In Minimum Tillage Cotton Rotations

CONTENTS

FIRST PRINTING 4M, DECEMBER 1990

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

Common Name	Trade Name
Trifluralin	Treflan®
Pendimenthalin	Prowl®
Metolachlor	Dual®
Atrazine	Aatrex®
Sethoxydim	Poast®
Cyanazine	Bladex®
Norflurazan	Zorial®
Fluometuron	Cotoran®
Metribuzin	Sencor®
Aciflurofen	Blazer®
Bentazon	Basagran®
MSMA	Bueno 6®

Common and trade names of herbicides.

Weed Control in Minimum Tillage Cotton Rotations

MICHAEL G. PATTERSON, WILLIAM B. WEBSTER,
HENRY IVEY, AND LARRY W. WELLS[1]

INTRODUCTION

MINIMUM TILLAGE, also known as reduced, limited, or conservation tillage, has not been universally adopted by cotton (*Gossypium hirsutum*) farmers in Alabama or other Southeastern States *(5)*. One reason for the reluctance to grow cotton in these tillage systems is the real or perceived problems associated with weed control.

Primary and secondary tillage plus herbicide applications provide the basis for weed control in conventional tillage systems, and cotton growers have confidence in this system. Primary tillage and cultivation are generally reduced or eliminated in minimum tillage systems, and weed control is dependent on preplant foliar and broadcast herbicide applications.

Several weed species cause economic losses in cotton *(7)*. Annual grasses such as large crabgrass (*Digitaria sanguinalis*), broadleaf weeds including several species of morningglory (*Ipomoea* spp.), and perennial weeds like johnsongrass (*Sorghum halepense*) and nutsedge (*Cyperus* spp.) infest cotton fields. Annual grasses are controlled in conventional tillage cotton primarily by using preplant incorporated treatments of trifluralin and pendimenthalin.[2] Herbicide incorporation is usually eliminated or reduced in minimum tillage systems, thus decreasing the activity of these herbicides. Postemergence herbicides are available for grass control in cotton, but these treatments are generally more expensive than preplant incorporated treatments.

Broadleaf weed control in cotton is accomplished with preemergence herbicide applications and postemergence directed sprays in both conventional and minimum tillage systems. These treatments are generally applied to a band centered on the cotton row in conventional

---

[1]Respectively, Assistant Professor of Agronomy and Soils, Superintendent of the Tennessee Valley Substation, Belle Mina; Superintendent and Associate Superintendent of the Wiregrass Substation, Headland.

[2]Common and some trade names of all the chemicals mentioned in this study can be found on page 2.

tillage systems. Since cultivation is often eliminated in minimum tillage, all preemergence and directed treatments are normally broadcast from row to row. This increases herbicide expense accordingly. However, some of this increase in herbicide expense is offset by a reduction in primary tillage.

The benefits of crop rotation are well documented for conventional tillage cropping *(2,3,4,6)*. Currently, rotating crops also implies the rotation of herbicides *(8)*. Certain weeds which may be impossible to control in one crop can be easily controlled in another. Although much information is available for conventional tillage rotations, little is known about the long-term effects of weed control and crop yields in minimum tillage cotton rotations.

The objectives of the studies reported herein were to evaluate weed control and crop yields from minimum (strip) tillage cotton grown in rotation as well as continuously cropped, and compare these data to the results from the same rotations under conventional tillage.

MATERIALS AND METHODS

Field experiments were conducted for 4 years (1985-88) at the Tennessee Valley Substation, Belle Mina, and the Wiregrass Substation, Headland. Cotton was grown continuously or in rotation, using strip tillage and conventional tillage. Rotational sequences are listed in table 1.

TABLE 1. ROTATIONAL SEQUENCES FOR EXPERIMENTS AT BELLE MINA AND HEADLAND[1]

Location	Crop			
	1985	1986	1987	1988
Belle Mina	cotton	corn	soybeans	cotton
	corn	soybeans	cotton	corn
	soybeans	cotton	corn	soybeans
	cotton	cotton	cotton	cotton
Headland	cotton	peanuts	sorghum	cotton
	peanuts	sorghum	cotton	peanuts
	sorghum	cotton	peanuts	sorghum
	cotton	cotton	cotton	cotton
	peanuts	peanuts	peanuts	peanuts

[1]All crop rotations were grown in strip and conventional tillage.

Crops were grown on 30-foot-long plots which were 12 rows (40 or 36 inches) wide for cotton and peanuts and 16 rows (30 inches) wide for corn, soybeans, and grain sorghum. Four replications of each treatment were used in a randomized complete block design. Crops were planted during the period from April 15 to May 25 each year. Land preparation for conventionally tilled plots included moldboard plowing, disking twice, and leveling with a field cultivator. Preplant incorporated herbicides were incorporated with the field cultivator for cotton and soybeans and with the second disking for peanuts.

Strip tillage plots were planted to wheat in the fall preceding each growing season. Paraquat at 0.5 pound a.i. (active ingredient) per acre was used to kill the wheat cover crop in March prior to planting. Plots were prepared 2 weeks before planting using a Ro-Till[3] machine which provided a tilled strip approximately 18 inches wide over the row. Crops were planted in these strips after rainfall had settled the tilled soil using Max-emerge[4] planters. Pendimethalin was used as a preemergence herbicide in strip-tillage cotton, soybean, and peanut plots and applied just before the Ro-Till operation. Pendimethalin was used as the preplant incorporated herbicide in conventional tillage cotton, soybeans, and peanuts. The herbicide programs used for each crop are listed in table 2.

Crop varieties were selected based on yields from Alabama Agricultural Experiment Station variety trials. At the Tennessee Valley Substation, Deltapine 50 cotton, Essex soybeans, and Pioneer brand 3320 corn were planted. At the Wiregrass Substation, Deltapine 90 cotton, Florunner peanuts, and Funk's 522 DR sorghum were planted.

Predominant weed species at the Tennessee Valley Substation were annual grasses [large crabgrass and fall panicum (*Panicum dichotomiflorum*)], annual morningglories [pitted (*I. lacunosa*) and entireleaf (*I. hederacea*)], and prickly sida (*Sida spinosa*). Predominant species at the Wiregrass Substation were annual grasses [Texas panicum (*Panicum texanum*) and large crabgrass], sicklepod (*Cassia obtusifolia*), annual morningglories [pitted and smallflower (*Jacauemontia tamnifolia*)], and Florida beggarweed (*Desmodium tortuosum*).

All production inputs, including soil fertilization, liming, and disease and insect control, were maintained for optimum crop production. An N-P starter fertilizer solution (20-20-0) was used with strip tillage cotton plots at the Wiregrass Substation, which appeared to provide good growoff of seedling plants.

Weed control ratings were obtained in August each year after all herbicide treatments had been applied. Crop yields were obtained at harvest and are reported on a per acre basis.

[3]Bush-Hog Corp., Selma, Alabama.
[4]John Deere Tractor Co., East Moline, Illinois.

TABLE 2. HERBICIDE PROGRAMS USED FOR CROPS GROWN CONTINUOUSLY OR IN ROTATION AT BELLE MINA AND HEADLAND[1]

Crop	Tillage	Herbicide	Rate, lb. a.i./acre	Application method
Cotton	conventional	Pendimethalin	0.5	preplant incorporated
		Fluometuron	2.0	preemergence, band
		Cyanazine	0.5	postemergence, directed
		MSMA	2.0	postemergence, directed
Cotton	strip	Paraquat	0.5	preplant foliar
		Pendimethalin	1.0	preemergence
		Fluometuron	2.0	preemergence
		Cyanazine	0.5	postemergence, directed
		MSMA	2.0	postemergence, directed
Soybeans	conventional	Pendimethalin	0.5	preplant incorporated
		Metribuzin	0.38	preemergence, band
		Aciflurofen	0.38	postemergence
Soybeans	strip	Paraquat	0.5	preplant foliar
		Pendimethalin	1.0	preemergence
		Metribuzin	0.38	postemergence
		Aciflurofen	0.38	postemergence
Peanuts	conventional	Pendimethalin	1.0	prelant incorporated
		Metolachlor	2.0	preemergence
		Paraquat	0.125	postemergence
		Bentazon	0.5	postemergence
Peanuts[2]	strip	Paraquat	0.5	preplant foliar
		Pendimethalin	1.0	preemergence
		Metolachlor	2.0	preemergence
		Paraquat	0.125	postemergence
Corn	conventional	Metolachlor	2.0	preemergence
		Atrazine	2.0	preemergence
Corn	strip	Paraquat	0.5	preplant foliar
		Metolachlor	2.0	preemergence
		Atrazine	2.0	preemergence
Sorghum	conventional	Metolachlor	2.0	preemergence
		Atrazine	2.0	postemergence
Sorghum	strip	Paraquat	0.5	preplant foliar
		Metolachlor	2.0	preemergence
		Atrazine	2.0	postemergence
		Paraquat	0.25	postemergence, directed

[1]All conventional tillage plots were cultivated twice during the growing season.

[2]Postemergence applications of sethoxydim (0.28 lb. a.i./acre) were used to supplement annual grass control in continuous peanut plots during 1987 and 1988.

RESULTS AND DISCUSSION

General Comments

Good cotton stands were obtained in strip tillage plots at both locations. The Ro-Till machine used on the clay loam soil at the Tennessee Valley Substation was equipped with modified subsoil shanks set for a depth of 6 to 8 inches. Standard shanks which run to a depth of 12 to 14 inches resulted in excessive amounts of subsoil clay being pulled to the surface. Standard subsoil shanks were used on the sandy loam soil at the Wiregrass Substation and worked well.

Good corn stands were obtained with the strip tillage system at the Tennessee Valley Substation. Soybean stands in strip-tilled plots were lower than soybean stands in conventional till plots at that location. This may have been attributable to seedbed preparation associated with the Ro-Till machine. Conventional tillage provided a better seedbed, which resulted in more uniform placement of soybean seed. Good stands of cotton and peanuts were obtained with strip tillage planting at the Wiregrass Substation in all years. A poor grain sorghum stand in 1985 resulted in large skips and therefore unacceptable weed control and crop failure in both tillage systems.

Experiments at the Tennessee Valley Substation

Weed Control

Annual grass control in both strip and conventional tillage cotton grown continuously over the 4-year study was greater than 90 percent, table 3. The combination of preemergence herbicides and postemergence directed sprays was effective in both tillage systems. Good pre-

TABLE 3. WEED CONTROL IN CONTINUOUS COTTON GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT BELLE MINA[1]

Weed species[2]	Tillage	Year 1985	Year 1986	Year 1987	Year 1988	Av.
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	95	90	93	99	94
	conv.	95	90	99	99	96
Morningglory	strip	95	88	99	99	95
	conv.	93	90	99	99	95
Prickly sida	strip	95	90	98	99	95
	conv.	88	90	99	99	94

[1]Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, fall panicum; morningglory = pitted and entireleaf.

emergence herbicide activation each year and timely directed sprays provided weed control until the crop canopy closed. Pitted morningglory and prickly sida control in continuous cotton was excellent overall in both tillage systems. Annual grass, morningglory, and prickly sida control in rotational cotton was good to excellent during the 4-year period, table 4. Except for paraquat used to kill the wheat cover each spring, identical weed control programs were used in both continuous and rotational cotton grown under both tillage systems. This indicates that good weed control can be obtained in strip-tillage cotton with herbicides currently used in conventional systems. However, because herbicides were broadcast in strip-tillage plots, the cost of chemicals used in this system was approximately 200 percent greater than in conventional-tillage cotton.

TABLE 4. WEED CONTROL IN ROTATIONAL COTTON GROWN WITH MINIMUM AND CONVENTIONAL TILLAGE AT BELLE MINA[1]

Weed species[2]	Tillage	Year				Av.
		1985	1986	1987	1988	
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	95	90	93	99	94
	conv.	95	90	99	99	96
Morningglory	strip	95	83	99	99	94
	conv.	95	90	99	99	96
Prickly sida	strip	90	90	98	99	94
	conv.	84	90	99	99	93

[1]Rotation sequence: cotton - corn - soybeans - cotton. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, fall panicum; morningglory = pitted and entireleaf.

Weed control in rotational corn was good under both tillage systems, table 5. Metolachlor and atrazine were used for weed control in both tillage systems. No herbicide carryover from atrazine to rotational soybeans was observed. Herbicide cost for corn in strip tillage was only slightly higher than conventional tillage since atrazine is normally broadcast in both systems. Banding metolachlor in conventional tillage can reduce the cost; however, the cultivations used in conventional tillage add some additional weed control costs to this system.

Weed control in rotational soybeans was good to excellent in conventional-tillage plots during all 4 years, table 6. Annual grass control in 1986, morningglory control in 1985 and 1986, and prickly sida control in 1985 were poor in strip-tillage plots. This can be explained in part by the poor soybean stand obtained using strip tillage in these years.

Drought conditions in 1988 prevented many weed seed from germinating, resulting in excellent weed control. No herbicide carryover to rotational cotton was observed during any year.

TABLE 5. WEED CONTROL IN ROTATIONAL CORN GROWN WITH MINIMUM AND CONVENTIONAL TILLAGE AT BELLE MINA[1]

Weed species[2]	Tillage	Year 1985	1986	1987	1988	Av.
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	95	90	92	99	94
	conv.	93	90	99	99	95
Morningglory	strip	81	90	96	99	91
	conv.	78	90	99	99	91
Prickly sida	strip	79	90	98	99	91
	conv.	80	90	99	99	92

[1]Rotation sequence: corn - soybeans - cotton - corn. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, fall panicum; morningglory = pitted and entireleaf.

TABLE 6. WEED CONTROL IN ROTATIONAL SOYBEANS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT BELLE MINA[1]

Weed species[2]	Tillage	Year 1985	1986	1987	1988	Av.
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	93	58	89	95	84
	conv.	89	90[3]	99	95	93
Morningglory	strip	60	68	99	95	80
	conv.	84[3]	90[3]	95	95	91
Prickly sida	strip	69	78	99	95	85
	conv.	84[3]	88	99	95	91

[1]Rotation sequence: soybeans - cotton - corn - soybeans. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, fall panicum; morningglory = pitted and entireleaf.
[3]Significant difference between tillage treatments at the 5% level.

Crop Yields

Seed cotton yields from strip and conventional-tillage continuous cotton were approximately equal over the 4-year period, table 7. However, a trend toward reduced yields with strip tillage, although not significant, was evident. Cotton yields from rotational plots followed a similar pattern, but significant decreases were observed in strip tillage plots in 1987 and 1988. Cotton maturity in strip tillage plots was approximately 2 weeks behind conventional tillage cotton in all years. This can

TABLE 7. SEED COTTON YIELDS FROM CONTINUOUS AND ROTATIONAL COTTON GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT BELLE MINA[1]

Tillage	Yield/year/acre				Av.
	1985	1986	1987	1988	
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
		Continuous			
Strip	3,019	1,804	1,416	1,265	1,876
Conventional	3,003	1,868	1,624	1,483	1,995
		Rotational			
Strip	2,910	1,804	1,277	1,177	1,792
Conventional	3,076	2,046	1,667[2]	1,652[2]	2,110

[1]Rotation sequence: cotton - corn - soybeans - cotton. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Significant difference between tillage treatments at the 5% level.

be viewed as a detriment to strip tillage at the north Alabama location where the growing season is relatively short.

Corn and soybean yields from rotational plots varied greatly over the 4-year period, table 8. Strip-tillage yields were significantly lower overall than conventional-tillage yields. Drought conditions affected corn yields in 1988 and soybean yields in 1987. During these years, strip-tillage yields were equal to or better than conventional-tillage yields. Part of the yield reduction in strip-tillage soybeans can be attributed to poor stand and the resultant poor weed control in these plots discussed earlier.

TABLE 8. CORN AND SOYBEAN YIELDS FROM ROTATIONAL PLOTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT BELLE MINA[1]

Tillage	Yield/year/acre				Av.
	1985	1986	1987	1988	
	Bu.	*Bu.*	*Bu.*	*Bu.*	*Bu.*
		Corn			
Strip	81	54	92	27[2]	63
Conventional	85	122[2]	117	7	83
		Soybeans			
Strip	28	28	18	28	25
Conventional	50[2]	45[2]	15	42[2]	38

[1]Rotation sequence: corn - soybeans - cotton - corn. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Significant difference between tillage treatments at the 5% level.

Experiments at the Wiregrass Substation

Weed Control

Annual grass control in strip tillage continuous cotton was good to excellent in 1985 and 1986, table 9. However, control in 1987 and 1988 was poorer and can be attributed in part to the presence of Texas panicum in these plots. Texas panicum is a large seeded annual grass which is difficult to control even in conventional tillage systems where good herbicide incorporation can be obtained. Pendimethalin activity is significantly reduced on Texas panicum when this herbicide is used preemergence as was done in strip tillage. Conventional tillage grass control was only slightly better overall. Annual morningglory, sicklepod, and Florida beggarweed control was good to excellent each year in both strip and conventional-tillage continuous cotton.

TABLE 9. WEED CONTROL IN CONTINUOUS COTTON GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Weed species[2]	Tillage	Year				Av.
		1985	1986	1987	1988	
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	93	83	75	73	81
	conv.	95	80	69	89[3]	83
Morningglory	strip	93	93	95	89	93
	conv.	94	93	92	87	92
Sicklepod	strip	93	94	96[3]	97	95
	conv.	91	94	80	97	91
Florida beggarweed	strip	94	95	98	99	97
	conv.	95	95	95	99	96

[1]Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, Texas panicum; morningglory = pitted and smallflower.
[3]Significant difference between tillage treatments at the 5% level.

Annual grass control in continuous strip-tillage peanuts was good initially in 1985, but declined over the next 3 years, table 10. Although supplemental postemergence applications of sethoxydim were used in 1987 and 1988, grass control was less than ideal. Except for annual morningglory (primarily smallflower) and Florida beggarweed control in 1988, overall broadleaf weed control was good and approximately equal for both tillage systems.

Weed control in rotational cotton was equal in both tillage systems over the 4-year period except for annual grass control in 1988, table 11. Annual morningglory control was good to excellent in all years. Sicklepod control equal to or greater than 90 percent was obtained each year

TABLE 10. WEED CONTROL IN CONTINUOUS PEANUTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Weed species[2]	Tillage	Year				Av.
		1985	1986	1987	1988	
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	91	76	83	69	80
	conv.	95	74	94	98[3]	90
Morningglory	strip	93	82	88	53	79
	conv.	95	84	93	87[3]	90
Sicklepod	strip	90	71	95	75	83
	conv.	89	75	91	82	84
Florida beggarweed	strip	76	78	95[3]	63	78
	conv.	86	81	83	91[3]	85

[1]Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, Texas panicum; morningglory = pitted and smallflower.
[3]Significant difference between tillage treatments at the 5% level.

TABLE 11. WEED CONTROL IN ROTATIONAL COTTON GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Weed species[2]	Tillage	Year				Av.
		1985	1986	1987	1988	
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	92	68	78	77	79
	conv.	95	71	72	93[3]	83
Morningglory	strip	89	90	96	84	90
	conv.	95	89	95	92	93
Sicklepod	strip	93	77	96	96	91
	conv.	90	83	92	97	91
Florida beggarweed	strip	95	94	99	98	97
	conv.	95	95	94	99	96

[1]Rotation sequence: cotton - peanuts - grain sorghum - cotton. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, Texas panicum; morningglory = pitted and smallflower.
[3]Significant difference between tillage treatments at the 5% level.

except 1986. Postemergence-directed sprays with cyanazine plus MSMA reduced Florida beggarweed populations for rotational peanuts following cotton. Although not used in this rotation, norflurazon could be included with fluometuron if additional broadleaf weed control was needed, without detrimental effects to the following peanut crop.

Both annual grass and broadleaf weed control was better in conventional-tillage rotational peanuts than in strip tillage, table 12. Cultivation was especially beneficial for annual grass and annual morningglory

TABLE 12. WEED CONTROL IN ROTATIONAL PEANUTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Weed species[2]	Tillage	Year				Av.
		1985	1986	1987	1988	
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	85	72	73	80	77
	conv.	95[3]	68	92[3]	97[3]	88
Morningglory	strip	92	77	76	84	82
	conv.	95	90[3]	90[3]	87	91
Sicklepod	strip	86	72	88	91	84
	conv.	93[3]	77	93	90	88
Florida beggarweed	strip	64	86	85	94	78
	conv.	71	87	94[3]	98	85

[1]Rotation sequence: - peanuts - grain sorghum - cotton - peanuts. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, Texas panicum; morningglory = pitted and smallflower.
[3]Significant difference between tillage treatments at the 5% level.

control. Except for sicklepod control in 1985 and Florida beggarweed control in 1987, control levels were equal for these species in both tillage systems. Paraquat applied over the top generally provided good contact kill of small weeds. However, paraquat is weak on crabgrass and smallflower morningglory and these species were present at harvest.

Herbicide costs for strip tillage peanuts would compare favorably with conventional tillage since broadcast applications are normally applied in conventional systems. However, poor grass control from preemergence pendimethalin applications necessitated supplemental postemergence applications of sethoxydim, which significantly increased herbicide cost.

A poor grain sorghum stand in 1985 resulted in less than ideal weed control from both tillage systems, table 13. Good stands in following years resulted in better weed control in both tillage systems. Except for annual grass control in 1987, weed control was equal in both tillage systems from 1986 to 1988. Postemergence over-the-top application of atrazine and postemergence-directed sprays of paraquat in strip tillage or cultivation in conventional systems provided season long control. A narrow row spacing (30 inches) combined with the competitive nature of grain sorghum aided weed control. Weed control costs for grain sorghum in both tillage systems are approximately equal since atrazine is normally broadcast in conventional tillage and the post-directed paraquat application compares favorably with cultivation.

TABLE 13. WEED CONTROL IN ROTATIONAL GRAIN SORGHUM GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Weed species[2]	Tillage	Year 1985	1986	1987	1988	Av.
		Pct.	*Pct.*	*Pct.*	*Pct.*	*Pct.*
Annual grass	strip	69	91	51	88	75
	conv.	79[3]	95	69[3]	94	84
Morningglory	strip	48	95	89	89	80
	conv.	81[3]	95	88	95	90
Sicklepod	strip	65	95	62	93	79
	conv.	85[3]	95	58	87	81
Florida beggarweed	strip	30	95	92	94	78
	conv.	56[3]	95	89	98	85

[1]Rotation sequence: grain sorghum - cotton - peanuts - grain sorghum. Each crop was established on separate plots in 1985 to start the rotation. Tillage plots were maintained on the same plots each year.
[2]Annual grasses = large crabgrass, Texas panicum; morningglory = pitted and smallflower.
[3]Significant difference between tillage treatments at the 5% level.

Crop Yields

Seed cotton yields from strip and conventional-tillage continuous cotton were equal overall for the 4-year period at the Wiregrass Substation, table 14. Strip tillage outyielded conventional-tillage in 1987, and the reverse was true in 1988. Strip-tillage peanut yields were lower than conventional-tillage yields with continuous cropping in 1986 and 1988, and a trend toward reduced yield was apparent in 1987. Part of this decrease can be explained as a result of poor weed control in strip tillage plots during 1988. However, disease increases also figured into continuous strip-tillage peanut yield reductions (discussed later).

TABLE 14. YIELDS FROM CONTINUOUS COTTON AND PEANUTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Tillage	Yield/year/acre 1985	1986	1987	1988	Av.
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
		Seed cotton			
Strip	3,443	3,654	2,117[2]	2,348	2,890
Conventional	3,201	4,011	1,639	2,638[2]	2,872
		Peanuts			
Strip	2,481	1,289	1,787	1,519	1,769
Conventional	2,659	1,936[2]	2,123	2,305[2]	2,256

[1]Tillage treatments were maintained on the same plots each year.
[2]Significant difference between tillage treatments at the 5% level.

Average seed cotton yields in rotation were approximately equal for both tillage systems over the 4-year period, table 15. Higher yields were obtained from conventional-tillage plots in 1986 and 1987, while strip-tillage produced more cotton in 1988.

Strip-tillage peanut yields in rotation were approximately equal to conventional-tillage yields overall during the 4-year period, table 15. Conventional tillage did outyield strip-tillage peanuts in 1987. Rotation provided greater overall peanut yields than continuous cropping in both strip (2,512 vs. 1,759 pounds per acre) and conventional (2,652 vs. 2,256 pounds per acre) tillage, respectively, tables 14 and 15. The advantages of rotation in strip tillage appears greater for peanuts than for cotton.

TABLE 15. COTTON, PEANUT, AND GRAIN SORGHUM YIELDS FROM ROTATIONAL PLOTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND[1]

Tillage	Yield/year/acre				Av.
	1985	1986	1987	1988	
		Seed cotton			
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Strip	3,618	2,438	2,020	2,614[2]	2,672
Conventional	3,467	3,237[2]	2,438[2]	2,263	2,851
		Peanuts			
	Lb.	*Lb.*	*Lb.*	*Lb.*	*Lb.*
Strip	2,580	2,348	2,205	2,916	2,512
Conventional	2,641	2,263	2,970[2]	2,765	2,652
		Grain sorghum			
		Bu.	*Bu.*	*Bu.*	*Bu.*
Strip	----	42[2]	25	116[2]	61
Conventional	----	36	21	97	51

[1]Rotation sequence: cotton - peanuts - grain sorghum - cotton. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.

[2]Significant difference between tillage treatments at the 5% level.

Grain sorghum yields were higher in strip than conventional tillage in 1986 and 1988. Yields were not obtained in 1985 due to a poor stand.

Volunteer peanuts are a problem in conventional-tillage culture, especially where peanuts are not rotated with other crops. Visual ratings of volunteer peanut control were obtained in continuous and rotational peanuts grown under both tillage systems, table 16. Good to excellent volunteer peanut control was obtained in both strip- and conventional-tillage rotational peanuts. Poor volunteer peanut control was obtained in strip-tillage continuous peanuts. Atrazine used in grain sorghum following peanuts in rotation effectively controlled volunteer peanuts in both tillage systems.

TABLE 16. VOLUNTEER PEANUT CONTROL IN CONTINUOUS AND ROTATIONAL PEANUTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE AT HEADLAND

Tillage	Year			Av.
	1986	1987	1988	
	Pct.	*Pct.*	*Pct.*	*Pct.*
		Continuous		
Strip	86	41	25	51
Conventional	90	63[2]	90[2]	81
		Rotational[1]		
Strip	87	90	96	91
Conventional	90	95	98	94

[1]Rotation sequence: peanuts - grain sorghum - cotton - peanuts. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Significant difference between tillage treatments at the 5% level.

White mold (*Sclerotium rolfsii*) is a serious disease of peanuts (*1*). Rotation of peanuts in conventional tillage provides an effective means of reducing the incidence of white mold. Little is known about the effects of rotation in minimum tillage on the incidence of white mold. Ratings obtained in this study show white mold can be significantly reduced by rotation in a strip-tillage cropping system, table 17. The increase of white mold in continuous strip-tillage peanuts is apparent. The buildup of white mold in continuous strip-tillage peanuts would prevent this cropping system from succeeding. However, rotational peanuts could be grown in strip tillage without sacrificing yield, table 15.

TABLE 17. INCIDENCE OF WHITE MOLD IN CONTINUOUS ROTATIONAL PEANUTS GROWN WITH STRIP AND CONVENTIONAL TILLAGE

Tillage	Hits/year/acre			Av.
	1986	1987	1988	
		Continuous		
Strip	2,965[2]	4,780[2]	8,168[2]	5,304
Conventional	2,178	3,509	3,872	3,186
		Rotational[1]		
Strip	1,815	3,146	2,541	2,501
Conventional	1,694	2,360	3,751[2]	2,602

[1]Rotation sequence: peanuts - grain sorghum - cotton - peanuts. Each crop was established on separate plots in 1985 to start the rotation. Tillage treatments were maintained on the same plots each year.
[2]Significant difference between tillage treatments at the 5% level.

SUMMARY AND CONCLUSIONS

Weed control in continuous or rotational cotton grown in long-term strip tillage can be successfully accomplished. However, broadcast herbicide applications required in this tillage system increase chemical costs approximately 200 percent above conventional tillage. Minimum-tillage cultivation equipment now available may reduce herbicide costs, but this equipment must be evaluated before recommendations can be made. Cotton can be grown continuously in strip tillage without sacrificing yield. Rotation with corn and soybeans at the Tennessee Valley Substation did not provide any advantage for strip-tillage cotton yields. Corn and soybean yields were lower in strip than conventional tillage at that location.

Peanut yields in strip-tillage rotation were equal to conventional-tillage yields. Supplemental postemergence grass herbicide treatments will increase weed control costs in strip tillage peanut production. Continuous strip-tillage peanut yields were adversely affected by the buildup of white mold.

LITERATURE CITED

(1) AMERICAN PHYTOPATHOLOGICAL SOCIETY. 1984. Compendium of Peanut Diseases. Porter, D.M., D.H. Smith, and R. Rodriguez-Kabana (ed).

(2) COPE, J.T., JR., AND D.L. THURLOW. 1980. Corn-Wheat-Soybean Rotations and Their Response to Nitrogen, Phosphorus, Potassium. Ala. Agr. Exp. Sta. Highlights of Agr. Res. 27(3):16.

(3) HAUSER, E.W., C.C. DOWLER, M.C. JELLUM, AND S.R. CECIL. 1974. Effects of Herbicide-Crop Rotation on Nutsedge, Annual Grasses, and Crops. Weed Sci. 22:172-176.

(4) LEIGHTY, C.E. 1938. Crop Rotation. Pages 406-430. In USDA Yearbook of Agr. Soils and Men.

(5) MCWHORTER, G.C. AND T. N. JORDAN. 1985. Limited Tillage Cotton Production. Pages 61-76. *In* A. Weise (ed). Weed Control in Limited Tillage Systems. Monograph No. 2. Weed Sci. Soc. Amer. Champaign, Ill.

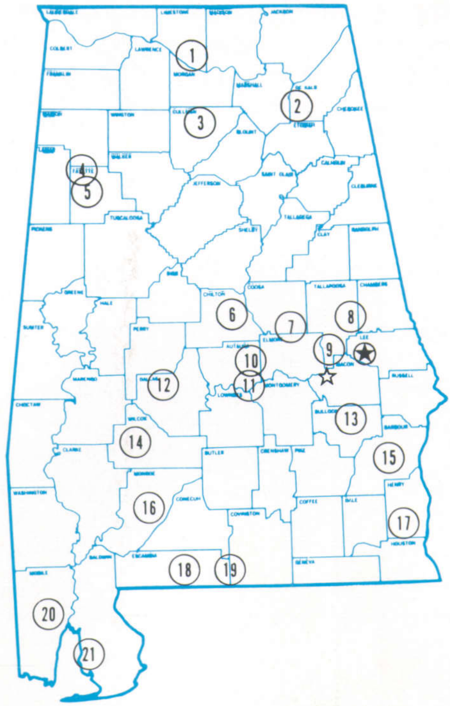
(6) NATIONAL RES. COUNCIL. 1989. Research and Science. Pages 135-194. *In* Alternative Agriculture. Nat. Res. Council. Nat. Acad. Press, Washington, D.C.

(7) PATTERSON, MIKE (chairman). 1988. Report of the Cotton Weed Loss Committee. Pages 392-395. *In* Proc. Cotton Prod. Res. Conf. National Cotton Council of Amer. Memphis, Tenn.

(8) WALKER, ROBERT H. AND GALE A. BUCHANAN. 1982. Crop Manipulation in Integrated Weed Management Systems. Weed Sci. Suppl. Vol. 30, pp. 17-34.

Alabama's Agricultural Experiment Station System
AUBURN UNIVERSITY

With an agricultural research unit in every major soil area, Auburn University serves the needs of field crop, livestock, forestry, and horticultural producers in each region in Alabama. Every citizen of the State has a stake in this research program, since any advantage from new and more economical ways of producing and handling farm products directly benefits the consuming public.



Research Unit Identification

⊛ Main Agricultural Experiment Station, Auburn.
☆ E. V. Smith Research Center, Shorter.

1. Tennessee Valley Substation, Belle Mina.
2. Sand Mountain Substation, Crossville.
3. North Alabama Horticulture Substation, Cullman.
4. Upper Coastal Plain Substation, Winfield.
5. Forestry Unit, Fayette County.
6. Chilton Area Horticulture Substation, Clanton.
7. Forestry Unit, Coosa County.
8. Piedmont Substation, Camp Hill.
9. Plant Breeding Unit, Tallassee.
10. Forestry Unit, Autauga County.
11. Prattville Experiment Field, Prattville.
12. Black Belt Substation, Marion Junction.
13. The Turnipseed-Ikenberry Place, Union Springs.
14. Lower Coastal Plain Substation, Camden.
15. Forestry Unit, Barbour County.
16. Monroeville Experiment Field, Monroeville.
17. Wiregrass Substation, Headland.
18. Brewton Experiment Field, Brewton.
19. Solon Dixon Forestry Education Center, Covington and Escambia counties.
20. Ornamental Horticulture Substation, Spring Hill.
21. Gulf Coast Substation, Fairhope.