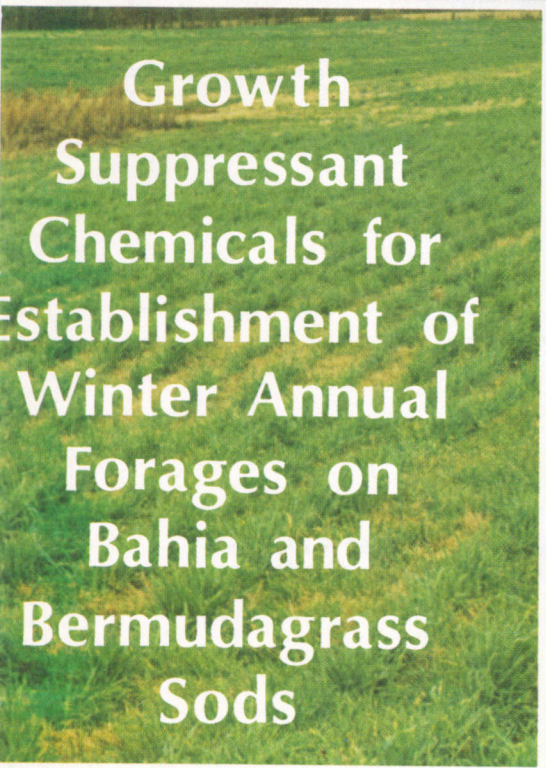
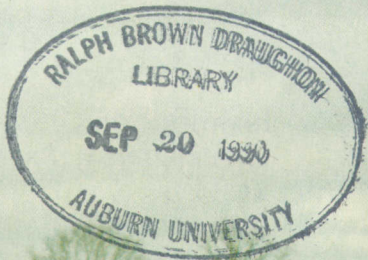




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**Growth  
Suppressant  
Chemicals for  
Establishment of  
Winter Annual  
Forages on  
Bahia and  
Bermudagrass  
Sods**



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without regard to race, color, sex, or national origin.*

# Growth Suppressant Chemicals For Establishment Of Winter Annual Forages On Bahia And Bermudagrass Sods

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## INTRODUCTION

**W**ARM SEASON PERENNIAL GRASSES, such as Pensacola bahia (*Paspalum notatum*) and Coastal bermuda (*Cynodon dactylon*), are dormant or unproductive in southern Alabama for 5 to 6 months of the year (1,6). Overseeding winter annual clovers, ryegrass, and rye on bermudagrass sods can extend the grazing season by 1 to 3 months, improve forage quality, and increase cattle weight gains (3,4).

Farmers seeding winter annuals in warm season perennial grass sods encounter several problems such as limited and undependable autumn rainfall, insects, and competition from the grass sod prior to frost. Close clipping or grazing to remove old grass residue in autumn is necessary to obtain good establishment and early production (5,7). Disking the sod will reduce grass competition for new seedlings but may leave the pasture in a rough condition. Chemical growth suppressants have been successfully used to reduce tall fescue (*Festuca arundinacea*) competition for overseeded legumes (2). Application of these chemicals to sods such as bahiagrass should reduce competition and permit earlier planting of winter annuals during September when rainfall is more dependable.

This publication summarizes results over a 3-year period at the Lower Coastal Plain Substation and a 2-year period at the Wiregrass Substation with growth suppressants for establishment of winter annual forages on warm season perennial grass sods.

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## EXPERIMENTAL PROCEDURE

Established sods of Pensacola bahia and Coastal bermudagrass were closely clipped and residue removed before planting in mid-September. Planting each year was done on a new area of sod. Three different machines were used for planting rye (*Secale cereale*) in the experiments over the 3-year period: Zip seeder, John Deere Grassland Drill, and a Tye Pasture Pleaser. Wrens Abruzzi rye was seeded at 50 pounds per acre, Gulf ryegrass (*Lolium multiflorum*) was broadcast at 15 pounds per acre, and Yuchi arrowleaf clover (*Trifolium vesiculosum*) at 5 pounds per acre. Nitrogen applications were 75 pounds per acre at planting and in February, June, and July.

Roundup® at ¼, ½, and 1 pound a.i. and Paraquat®<sup>1</sup> at ½ pound a.i. per sprayed acre were applied in 5-inch bands 10 inches apart to the sod. Diazinon®<sup>2</sup> insecticide was applied to control striped field crickets (*Nemobius fasciatus*). Plots were 6 feet x 25 feet with four or five replications. Forage was harvested when available from November to September or October with a flail harvester. Botanical composition of forage was estimated at each harvest on all plots.

## RESULTS

Paraquat gave rapid top kill of bahia and bermudagrass. After several weeks, however, new growth of bahiagrass began and continued until frost, competing with new seedlings for soil water. Top kill from Roundup was slower, but longer lasting than from Paraquat.

### PENSACOLA BAHIAGRASS SOD

#### Rye-ryegrass-arrowleaf clover

Sod-seeding of rye increased December-April forage production about 3,000 pounds per acre, table 1. Unseeded sod furnished only about 900 pounds of low-quality bahiagrass in autumn with nothing in winter. In contrast, nearly all of the forage on sod-seeded treatments was high-quality winter annuals. Summer (May-October) bahiagrass forage growth was reduced 1,000-1,500 pounds where Roundup had been applied. Paraquat had no effect on summer production. Thus, total annual yields were increased nearly 2,000 pounds per acre by sod seeding and overall forage quality was improved.

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<sup>2</sup>Roundup (common name, glyphosate) is a product of Monsanto Chemical Company, and Paraquat is a product of Chevron Chemical Company.

<sup>3</sup>Diazinon is a product of Ciba-Geigy Corporation.

TABLE 1. SEASONAL FORAGE PRODUCTION OF ABRUZZI RYE-GULF RYEGRASS-YUCHI ARROWLEAF CLOVER AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON PENSACOLA BAHIAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION, 3-YEAR AVERAGE, 1974-77

Sod treatment	Seeded	Dry forage per acre		
		Dec.-April	May-Oct.	Total
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	4,440 a*	6,090 b	10,530 b
Roundup, 1/2 lb./acre	+	4,380 a	6,400 b	10,780 b
Roundup, 1/4 lb./acre	+	4,390 a	6,830 b	11,220 ab
Paraquat, 1/2 lb./acre	+	4,100 ab	7,940 a	12,040 a
No chemical	+	3,940 b	7,830 a	11,770 a
No chemical	-	910 c	7,990 a	8,900 c

\*Means within a column having the same letters are not significantly different at 5 percent level.

High quality forage is especially important in supplying energy and protein during the critical winter period. Sod-seeding provided about 1,400 pounds rye forage per acre during November-February where Roundup was used, table 2. This was nearly twice the forage produced when the sod was seeded but no chemical applied to the sod. Rye plants on Roundup-treated sod were more vigorous, apparently a result of reduced bahiagrass competition for water, figure 1. Generally, there was little difference among the rates of Roundup used. Paraquat was ineffective in suppressing bahiagrass competition so rye production was similar to that of untreated seeded sod, table 2 and figure 2.

Spring production of arrowleaf clover was generally better on Roundup-treated bahiagrass sod, figure 3. Reduced competition by bahiagrass for moisture and light in autumn probably contributed to more successful establishment and growth of clover seedlings. Additional clover in the sward during late spring enhances the nutritive quality of the forage for grazing animals.

TABLE 2. NOVEMBER-FEBRUARY RYE FORAGE PRODUCTION AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON BAHIAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION, 3-YEAR AVERAGE, 1974-77

Sod treatment	Seeded	Dry forage yield per acre			
		1974-75	1975-76	1976-77	Average
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	1,390 a*	1,470 a	1,980 a	1,610 a
Roundup, 1/2 lb./acre	+	1,270 ab	1,470 a	1,710 ab	1,480 a
Roundup, 1/4 lb./acre	+	1,150 b	1,440 a	1,540 b	1,380 a
Paraquat, 1/2 lb./acre	+	800 c	570 b	1,110 c	830 b
No chemical	+	550 c	880 b	1,080 c	840 b
No chemical	-	0 d	0 c	0 d	0 c

\*Means within a column having the same letters are not significantly different at 5 percent level.



**FIG. 1.** Rye growth on bahiagrass is superior with Roundup (left) compared with untreated sod (right) in early December, Lower Coastal Plain Substation.



**FIG. 2.** Roundup-treated bahiagrass sod (right) resulted in more rapid establishment and greater rye forage production than with paraquat (left), November 11, Lower Coastal Plain Substation.

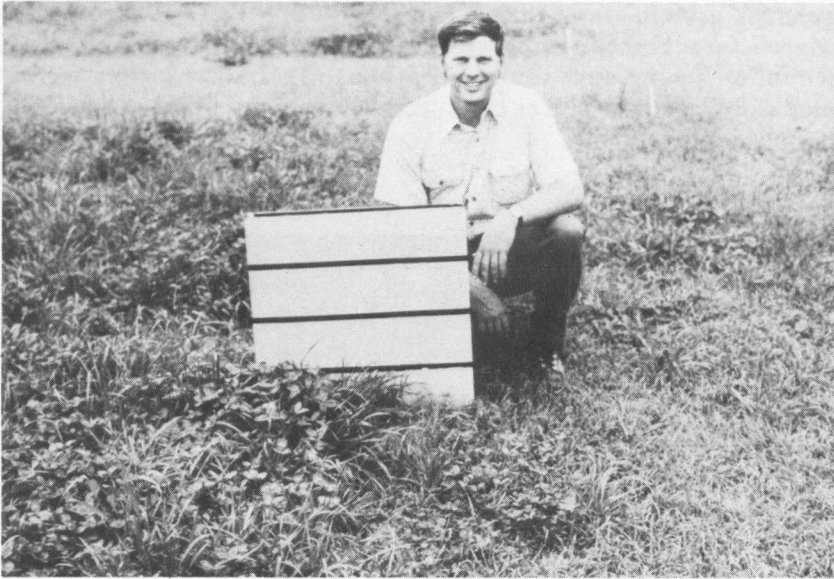


FIG. 3. Yuchi arrowleaf clover was more abundant on Roundup-treated (left) than on untreated sod (right), March 28, Lower Coastal Plain Substation.

### Ryegrass-arrowleaf clover

Broadcasting ryegrass and arrowleaf clover on bahiagrass sod can extend the grazing season at lower cost than sod-seeding rye. Winter-early spring production of ryegrass-clover was increased about 28 percent on Roundup-treated sod, table 3. However, Roundup decreased bahiagrass summer production about 1,000 pounds per acre.

Generally, ryegrass and arrowleaf clover do not provide much early winter forage on bahiagrass sod. In a favorable autumn,

TABLE 3. SEASONAL FORAGE PRODUCTION OF GULF RYEGRASS-YUCHI ARROWLEAF CLOVER AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON PENSACOLA BAHIAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION, 2-YEAR AVERAGE, 1975-77

Sod treatment	Seeded	Dry forage yield per acre		
		Dec.-April	May-October	Total
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	3,660 a*	6,060 b	9,720 a
Roundup, 1/2 lb./acre	+	3,660 a	6,820 b	10,480 a
Roundup, 1/4 lb./acre	+	3,520 a	6,700 b	10,220 a
Paraquat, 1/2 lb./acre	+	2,820 b	7,500 a	10,320 a
No chemical	+	2,780 b	7,710 a	10,490 a
No chemical	-	440 c	7,760 a	8,200 b

\*Means within a column having the same letter are not significantly different at 5 percent level.

ryegrass growth was enhanced by Roundup, figure 4. February-March forage production was nearly doubled by application of Roundup to the sod, table 4. Paraquat again was ineffective in increasing ryegrass-clover production during the February-March period.



FIG. 4. Roundup (right) reduced bahiagrass competition and improved Gulf ryegrass forage production over that of the untreated sod (left), November 11, Lower Coastal Plain Substation.

TABLE 4. FEBRUARY-MARCH GULF RYEGRASS FORAGE PRODUCTION AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON PENSACOLA BAHIAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION. 2-YEAR AVERAGE, 1975-77

Sod treatment	Seeded	Dry forage yield per acre		
		1975-76	1976-77	Average
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	710 a*	1,920 a	1,320 a
Roundup, 1/2 lb./acre	+	760 a	1,970 a	1,360 a
Roundup, 1/4 lb./acre	+	550 b	1,970 a	1,260 a
Paraquat, 1/2 lb./acre	+	200 c	1,500 ab	850 b
No chemical	+	220 c	1,300 b	760 b
No chemical	-	0 d	0 c	0 c

\*Means within a column having the same letter are not significantly different at 5 percent level.



## Rye

In a 2-year experiment at the Wiregrass Substation, broadcast-planted ryegrass and clover failed but sod-seeded rye was successful. Overall, rye yields were more than doubled by application of Roundup to the bahiagrass sod, table 5. During the first year, yields were tripled by Roundup. The benefit of Roundup in enhancing rye production was apparent until late winter, figure 5.

TABLE 5. NOVEMBER-MARCH WRENS ABRUZZI RYE FORAGE PRODUCTION AS AFFECTED BY ROUNDUP GROWTH SUPPRESSANT CHEMICAL ON PENSACOLA BAHIAGRASS SOD AT WIREGRASS SUBSTATION. 2-YEAR AVERAGE, 1977-79

Sod treatment	Dry forage yield per acre		
	1977-78	1978-79	Average
	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, ½ lb./acre .....	3,360*	2,260*	2,810*
None .....	1,100	1,320	1,210

\*Means within a column marked with an asterisk are significantly different at the 5 percent level.



FIG. 5. The superior rye forage production on Roundup-treated bahiagrass (left) as compared to untreated sod (right) was apparent in late winter at the Wiregrass Substation, March 6.

## COASTAL BERMUDAGRASS SOD

### Rye-ryegrass-arrowleaf clover

Sod-seeding into bermudagrass increased December-April forage yield five-fold or about 4,000 pounds per acre, table 6. This slightly reduced summer production of the bermudagrass but increased total annual yield. Rye production during November-February was unaffected by either Roundup or Paraquat, table 7. Rye yields on bermudagrass during this period were equal or greater than that obtained on bahiagrass, tables 2 and 7. Autumn competition from bermudagrass on rye is apparently much less than that from bahiagrass. Thus, there is no need for a growth suppressant chemical on bermudagrass.

TABLE 6. SEASONAL FORAGE PRODUCTION OF WRENS ABRUZZI RYE-GULF RYEGRASS-YUCHI ARROWLEAF CLOVER AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON COASTAL BERMUDA SOD AT LOWER COASTAL PLAIN SUBSTATION, 3-YEAR PERIOD, 1975-77

Sod treatment	Seeded	Dry forage yield per acre		
		Dec.-April	May-October	Total
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	5,440 a*	6,110 b	11,550 a
Roundup, ½ lb./acre	+	5,460 a	6,580 b	12,040 a
Roundup, ¼ lb./acre	+	5,400 a	6,520 b	11,920 a
Paraquat, ½ lb./acre	+	5,300 a	6,190 b	11,490 a
No chemical	+	5,380 a	6,620 b	12,000 a
No chemical	-	1,130 b	7,340 a	8,470 b

\*Means within a column having the same letter are not significantly different at 5 percent level.

TABLE 7. NOVEMBER-FEBRUARY WRENS ABRUZZI RYE FORAGE PRODUCTION AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON COASTAL BERMUDAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION, 3-YEAR AVERAGE, 1974-77

Sod treatment	Seeded	Dry forage yield per acre			
		1974-75	1975-76	1976-77	Average
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	1,740 a*	1,320 a	2,640 a	1,900 a
Roundup, ½ lb./acre	+	1,740 a	1,530 a	2,370 a	1,880 a
Roundup, ¼ lb./acre	+	1,640 a	1,230 a	2,480 a	1,780 a
Paraquat, ½ lb./acre	+	1,620 a	1,290 a	2,500 a	1,800 a
No chemical	+	1,600 a	1,060 a	2,570 a	1,740 a
No chemical	-	0 b	0 b	0 b	0 b

\*Means within a column having the same letter are not significantly different at 5 percent level.

**Ryegrass-arrowleaf clover**

Broadcasting ryegrass-arrowleaf clover on bermudagrass sod quadrupled December-April forage yields, table 8. There was little effect on summer production of bermudagrass. Total annual yields on bermudagrass were somewhat greater than on bahiagrass sod, tables 3 and 8. Neither Roundup nor Paraquat had any effect on yield.

During the critical February-March period, both Roundup and paraquat increased ryegrass production during 1 year, table 9. No explanation can be given for this since these chemicals had no effect on rye production in bermudagrass sod.

TABLE 8. SEASONAL FORAGE PRODUCTION OF GULF RYEGRASS-YUCHI ARROWLEAF CLOVER AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON COASTAL BERMUDAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION, 2-YEAR AVERAGE, 1975-77

Sod treatment	Seeded	Dry forage per acre		
		Dec.-April	May-October	Total
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	4,760 a*	7,140 a	11,900 a
Roundup, 1/2 lb./acre	+	4,570 a	6,640 b	11,210 a
Roundup, 1/4 lb./acre	+	4,820 a	5,410 b	11,230 a
Paraquat, 1/2 lb./acre	+	4,520 a	6,390 b	10,910 a
No chemical	+	4,270 a	7,000 a	11,270 a
No chemical	-	1,130 b	7,340 a	8,470 b

\*Means within a column having the same letter are not significantly different at 5 percent level.

TABLE 9. FEBRUARY-MARCH GULF RYEGRASS FORAGE PRODUCTION AS AFFECTED BY GROWTH SUPPRESSANT CHEMICALS ON COASTAL BERMUDAGRASS SOD AT LOWER COASTAL PLAIN SUBSTATION, 2-YEAR AVERAGE, 1975-77

Sod treatment	Seeded	Dry forage yield per acre		
		1975-76	1976-77	Average
		<i>Lb.</i>	<i>Lb.</i>	<i>Lb.</i>
Roundup, 1 lb./acre	+	560 a*	1,670 a	1,120 a
Roundup, 1/2 lb./acre	+	370 a	1,760 a	1,060 a
Roundup, 1/4 lb./acre	+	340 a	1,790 a	1,060 a
Paraquat, 1 lb./acre	+	410 a	1,380 a	900 a
No chemical	+	340 a	950 b	640 b
No chemical	-	0 b	0 c	0 c

\*Means within a column having the same letter are not significantly different at 5 percent level.

## SUMMARY

Experiments were conducted over a 3-year period at the Lower Coastal Plain Substation and a 2-year period at the Wiregrass Substation to evaluate effects of growth suppressants on establishment of September-planted winter annual forages on Pensacola bahiagrass and Coastal bermudagrass sods.

Sod-seeding Wrens Abruzzi rye-Gulf ryegrass-Yuchi arrowleaf clover increased December-April yields by 3,000 pounds dry forage on bahiagrass and over 4,000 pounds on bermudagrass at the Lower Coastal Plain Substation.

Rye production during November-February was almost doubled by application of Roundup to bahiagrass sod. There was no difference among Roundup rates of  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and 1 pound per acre. Paraquat had no effect on forage yield. Neither chemical enhanced rye production on bermudagrass.

Broadcast seeding Gulf ryegrass-Yuchi arrowleaf clover increased December-April yields by about 3,000 pounds dry forage on bahiagrass and 3,600 pounds on bermudagrass at the Lower Coastal Plain Substation.

Ryegrass production during February-March was almost doubled by application of Roundup to bahiagrass sod. There was no difference among Roundup rates of  $\frac{1}{4}$ ,  $\frac{1}{2}$ , and 1 pound per acre. Paraquat had no effect. Roundup and Paraquat increased ryegrass February-March production in 1 year out of 2 on bermudagrass.

Rye production during November-March was more than doubled by application of Roundup to bahiagrass sod at the Wiregrass Substation.

Yuchi arrowleaf clover production was generally improved by Roundup treatment of sod.

Roundup decreased summer production of bahiagrass by 1,000-1,500 pounds per acre but had no effect on bermudagrass.

Sod-seeding rye-ryegrass-arrowleaf clover or ryegrass-arrowleaf clover in September on bahia or bermudagrass sod is an effective way to extend the productive season of a pasture and improve forage quality. Application of Roundup offers the opportunity to reduce competition and substantially increase winter forage production on bahiagrass but not on bermudagrass sod. *Roundup is not yet labelled for use on pasture.*

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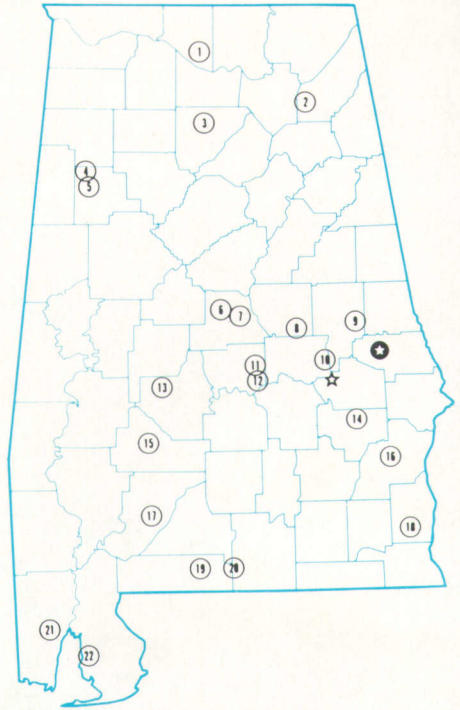
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- ☆ E. V. Smith Research Center, Shorter.

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. Foundation Seed Stocks Farm, Thorsby.
7. Chilton Area Horticulture Substation, Clanton.
8. Forestry Unit, Coosa County.
9. Piedmont Substation, Camp Hill.
10. Plant Breeding Unit, Tallassee.
11. Forestry Unit, Autauga County.
12. Prattville Experiment Field, Prattville.
13. Black Belt Substation, Marion Junction.
14. The Turnipseed-Ikenberry Place, Union Springs.
15. Lower Coastal Plain Substation, Camden.
16. Forestry Unit, Barbour County.
17. Monroeville Experiment Field, Monroeville.
18. Wiregrass Substation, Headland.
19. Brewton Experiment Field, Brewton.
20. Solon Dixon Forestry Education Center,  
Covington and Escambia counties.
21. Ornamental Horticulture Field Station, Spring Hill.
22. Gulf Coast Substation, Fairhope.