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Pesticide Assessment of Field Corn and Soybeans: Southeastern States

National Agricultural Pesticide Impact Assessment Program

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ABSTRACT

This report summarizes the pesticide assessment for corn and soybeans in the Southeast. Without insecticides, corn rootworm larvae and other soil insects would cause substantial corn yield losses. Corn earworms would cause the greatest losses to soybeans. The loss of fungicides would result in corn yield losses from seed rots and seedling blights. The loss of nematicides would cause substantial losses to both corn and soybeans. Among the herbicides, the loss of triazines would cause the greatest corn yield losses, while the loss of postemergence treatments, including bentazon, would cause the greatest losses in soybean yields. This report includes pest rankings, estimates of acreages treated with pesticides or other pest management practices, and estimates of pest losses with and without pesticide use, for insects, diseases, nematodes, and weeds.

Keywords: Corn, soybeans, pest losses, pest control, pesticide use, pesticide regulations

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INTRODUCTION

This report summarizes the field corn and soybean assessment for the Southeastern States of Alabama, Georgia, North Carolina, and South Carolina. Included are rankings of pests in order of economic importance, pesticide use, estimates of acreages where major pesticides and other pest management practices are used, estimates of yield losses caused by pests with current practices, and estimates of losses when no pesticides are used. Estimates of losses are averaged for each State, but losses incurred by some producers will be significantly greater than the State or regional averages.

Land planted to corn and soybeans constituted 75 percent of the land used for crops (excluding pasture or idle land) in the Southeastern States in 1978; corn accounted for 30 percent, while soybeans accounted for 45 percent. These States accounted for 6 percent of the U.S. acreage planted to corn and 11 percent of the U.S. acreage planted to soybeans. The average area planted to corn during 1976-80 was 692,000 acres for Alabama, 1,901,000 for Georgia, 1,912,000 for North Carolina, and 673,000 for South Carolina. The average area planted to soybeans during this same period was 1,830,000 acres for Alabama, 1,698,000 for Georgia, 1,690,000 for North Carolina, and 1,498,000 for South Carolina. The Southeast produced approximately 4 percent of the corn and 7 percent of the soybeans in the United States from 1976 to 1980.

The pesticide assessment by commodity program, a cooperative effort of the State universities and the U.S. Department of Agriculture (USDA) under the National Agricultural Pesticide Impact Assessment Program (NAPIAP), is employed because required information does not exist or has not been assembled in a readily usable format. The program improves response to Environmental Protection Agency (EPA) regulatory activity; provides information for Extension Service (ES) educational delivery systems; promotes information transfer among disciplines, regions, and States; identifies research needs and data gaps in pest control technology; and identifies emerging new pest problems.

The procedure draws upon the knowledge of experts in entomology, nematology, plant pathology, weed science, and related sciences. These experts, in consultation with colleagues both within and among disciplines, were asked to draw upon research and demonstration plots, field experience, and pest control surveys to develop the information base. Concern is always expressed over

compiling information not based completely on replicated field trials or systematically planned use surveys. However, information based on such trials has not been, and likely will not be, forthcoming for most crops and pest problems. Thus, the combined experiences of the scientists involved formed the bases for this report.

This regional pesticide assessment for field corn and soybeans represents an effort to estimate, in an orderly manner, yield losses and the effects of pesticide regulatory actions within the context of overall pest control practices. NAPIAP believes that this report and the underlying information base are useful for evaluating the effects of pesticide regulatory actions and the importance of pests. NAPIAP also believes that this study will contribute to future studies of this nature and indicate important areas for future research.

This report does not evaluate economic factors such as costs, crop prices, or pesticide price changes resulting from regulatory actions. It does not evaluate how pesticide price changes might influence pesticide use and crop losses. A future report will examine the effects of potential regulatory actions on costs and crop prices.

PROCEDURE FOR DATA COLLECTION

The NAPIAP State liaison representative for each State identified the participating specialists. The Agricultural Research Service (ARS), USDA, and the Economic Research Service (ERS), USDA, provided facilitators to guide the participants through the process.

The procedure followed several steps. All State specialists identified homogeneous production regions for corn and soybeans (equally subjected to pest problems, yield losses, and control practices). The specialists then estimated the percentage of field corn or soybeans planted under conventional, reduced, and no-till systems. Information was also included if irrigation significantly affected pest problems.

This report presents pest and pesticide information on insects, diseases, nematodes, and weeds. For each discipline, the 15 most important pest species were ranked for each production region, based on the acreage requiring treatment, the yield and quality losses, and the probability of recurrence. Pesticide treatments were identified by active ingredient, timing of application, and percentage of planted acres treated in each production region. Target pests for treatment were identified, and estimates of the proportion of planted acres treated for each were made. Also identified were nonchemical pest management practices, the target pests, and the percentage of planted acres treated.

Registered insecticides and fungicides were identified for each target pest and ranked by efficacy of yield. Pesticides with yield effects which were not significantly different received the same ranking.

Yield and percentage of planted acres were estimated where the pests in question caused no, low, medium, and high losses under current pest control practices used by growers. Yield and/or percentage of planted acreage were revised for each impact level by assuming that the most effective pesticide(s) is no longer available for use and that other pesticides and management practices can be used. This procedure continued by removing the second, then the third, and so forth, most effective pesticide(s) in succession while revising the yield and acreage estimates. Finally, estimates were made assuming no chemical pesticide control was available for the pest in question. Separate estimates were made for tillage systems or production regions where impacts differed.

Herbicides were not ranked by efficacy. Estimates of the effect on yield of removing important herbicides and groups of herbicides such as triazines, thiocarbamates, or phenoxys were made. First, yield estimates were made for no, low, medium, and high losses resulting from all weeds and the percentage of planted acreage for each impact level for the current pattern of weed control practices. Then, a specific herbicide or group of herbicides was assumed unavailable for use. Resulting new weed problems and alternative control practices were identified, and estimates of yield and percentage of planted acres for each new impact level were made. Next, the first herbicide or group of herbicides was assumed available for use again, while a second herbicide or group of herbicides was assumed unavailable. Then the procedure was repeated. This process continued until the effects of removing each major herbicide and group were examined. Finally, changes in cultivation practices were identified and yield effects were estimated assuming no herbicides could be used.

FIELD CORN

Tillage Systems

An estimated 94 percent of the acres planted to corn in the Southeastern States received conventional or reduced tillage (in terms of residue) and 6 percent received no-till planting (table 1). Since Alabama did not provide separate estimates for conventional and reduced tillage, it is difficult to provide regional estimates for these two tillage systems. However, there was more acreage in conventional than reduced tillage in Georgia, North Carolina, and South Carolina.

Insects, Insecticides, and Losses

The six most economically important insect pests in the Southeastern States were billbugs, European corn borers, black cutworms, wireworms, southern corn rootworms, and corn earworms (table 2). Billbugs ranked first in Georgia, North Carolina, and South Carolina. Alabama and Georgia ranked southern corn rootworms first. Georgia also ranked a large number of other insects first. North Carolina ranked European corn borers first.

Carbofuran was used on 28 percent of the acreage in the region, more than any other insecticide, for the soil insect complex in all four States and for European corn borers in North Carolina (table 3). Terbufos was used to control the soil insect complex on 16 percent of the acreage. Chlorpyrifos and methomyl were the only other insecticides used on more than 1 percent of the planted acreage: 7 percent and 2 percent, respectively.

A large number of nonchemical pest controls helped control insects in the Southeast (table 4). Scouting was used to identify problems with billbugs, European corn borers, fall armyworms, and true armyworms. Resistant varieties were used to control European corn borers and the soil complex. Early planting was extremely important for billbugs, corn earworms, European corn borers, fall armyworms, soil insects, and southwestern corn borers. Rotation helped control billbugs and the soil complex.

Soil insects caused yield losses of 5.1 percent in the Southeast, greater than any other corn insect (table 5). Losses would increase to 21.1 percent if no insecticides were available to use. European corn borers were the only other insect to cause more than a 1-percent loss with or without insecticide control. Losses

Table 1. Corn acreage under major tillage systems in the Southeastern States 1/

Tillage systems	Percentage of planted acres				
	AL	GA	NC	SC	Region 2/
	Percent				
Conventional 3/	91	90	51	96	94
Reduced 4/	*	9	39	1	*
No-till 5/	9	1	10	3	6

* = Estimate included in number directly above.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ The State estimates were weighted by planted acres and averaged to obtain the regional estimates.
3/ Chisel plowing, moldboard plowing, or subsoiling, including two passes with a disc; or disc-bedding (ridge tilling).
4/ Discing; chisel plowing or subsoiling, including one pass with disc.
5/ No tillage operations before, during, or after planting.

Table 2. Ranking of corn insect pests in the Southeastern States 1/

Insects	Rank 2/				
	AL	GA	NC	SC	Region
Billbugs	NR	1	1	1	1
European corn borers	2	4	1	4	2
Black cutworms	NR	1	2	5	3
Wireworms	NR	1	2	6	4
Southern corn rootworms	NR	1	NR	7	5
Corn earworms	5	1	NR	2	6
Fall armyworms	4	2	3	3	7
Sugarcane beetles	6	1	NR	NR	8
Carrot beetles	NR	1	NR	NR	9
Granulated cutworms	NR	1	NR	NR	9
Lesser cornstalk borers	NR	1	NR	NR	9
White-fringed beetle larvae	NR	1	NR	NR	9
Armyworms	NR	3	3	8	13
Southwestern corn borers	3	NR	NR	NR	14

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ 1 = Most serious, 2 = second-most serious, etc. Regional rankings were weighted averages of State-level rankings. State-level rankings were uniformly standardized so each would have the same mean and variance. The standardized variables were weighted by planted acres to construct the regional ordering.

Table 3. Corn insecticide use by timing and target pest in the Southeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres				
			AL	GA	NC	SC	Region 3/
			Percent				
Carbaryl	8	Cutworms	-	-	1	-	<1
	5,8	True armyworms	-	-	2	-	<1
		Total	-	-	3	-	1
Carbofuran	2,3,7,8	Soil complex 4/	10	40	19	32	27
	10	European corn borers	-	-	1	-	<1
		Total	10	40	20	32	28
Chlorpyrifos	3,7,8	Soil complex 5/	-	-	11	5	5
	8,10	European corn borers	-	-	<1	-	<1
	9,12	Corn earworms and fall armyworms	-	1	1	-	<1
	5,8	True armyworms	-	-	2	-	<1
		Total	-	1	14	5	7
Fenvalerate	8	European corn borers	-	-	1	-	<1
Methomyl	8	European corn borers	-	-	1	-	<1
	9,10,12	Corn earworms and fall armyworms	-	-	1	-	<1
	5,8	True armyworms	-	-	2	-	<1
		Total	-	<1	4	-	2
Phorate	10	European corn borers	-	-	1	-	<1
Terbufos	2,3,7	Soil complex 6/	5	10	25	16	16

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
2 = In furrow at planting.
3 = At planting as a band.
5 = Postplanting preemergence broadcast.
7 = Preemergence layby.
8 = Postemergence foliar or over row.
9 = Postemergence whorl directed.
10 = Postemergence aerial.
12 = Irrigation water treatment.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
4/ Includes wireworms, billbugs, cutworms, and Southern corn rootworms.
5/ Includes wireworms, billbugs, and cutworms.
6/ Includes armyworms, billbugs, cutworms, and Southern corn rootworms.

Table 4. Nonpesticide corn insect management in the Southeastern States 1/

Insects	Insect management practice	Percentage of planted acres			
		AL	GA	NC	SC
		Percent			
Billbugs	Early planting	-	-	-	90
	Rotation	-	-	90	90
	Scouting 2/	-	-	3/ 7	-
Corn earworms	Early planting	-	-	-	90
European corn borers	Corn stalk destruction	-	-	90	50
	Early planting	-	-	95	90
	Scouting 2/	-	-	3/ 7	-
	Varietal selection	-	-	44	-
Fall armyworms	Early planting	-	100	95	90
	Scouting 2/	-	-	3/ 7	-
Seedling insects	Starter fertilizer	-	-	26	-
Soil complex	Early planting	-	100	-	-
	Rotation	-	-	-	90
	Varietal selection	-	-	44	-
Southwestern corn borers	Early planting	22-23	-	-	-
True armyworms	Scouting 2/	-	-	4/ 7	-

- = Insignificant acreage.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ Scouting is a pest detection practice which can lead to the use of pesticide or nonpesticide management practices.

3/ Seven percent of acres scouted for billbugs, European corn borers, fall armyworms, and true armyworms.

would increase from 2.3 percent to 2.6 percent without insecticide control and would be concentrated in North Carolina.

Diseases, Fungicides, Nematicides, and Losses

The five most important corn diseases in the Southeastern States were Aspergillus storage mold, nematodes, stalk rots, viruses, and seed rots and seedling blights (table 6). Storage molds ranked first in Alabama and North Carolina, but third in Georgia and South Carolina. Georgia and South Carolina ranked stalk rots first, while North Carolina also ranked nematodes first. Storage molds, nematodes, viruses, and seed rots and seedling blights were the only diseases identified by all four States.

Table 5. Average percentage corn insect yield losses in the Southeastern States 1/

Insects and insect control practices	Average percentage yield loss 2/				
	AL	GA	NC	SC	Region 3/
			Percent		
Corn earworms and fall armyworms:					
Current controls	-	0.1	4/ 0.7	1.5	0.5
No pesticide controls	-	.4	1.4	1.5	.9
European corn borers:					
Current controls	-	-	5.6	1.5	2.3
No pesticide controls	-	-	6.4	1.5	2.6
Soil insect complex:					
Current controls	5/ 5.1	6/ 4.5	7/ 6.4	8/ 3.1	5.1
No pesticide controls	19.0	16.0	29.2	15.0	21.1
True armyworms:					
Current controls	-	-	.7	-	.2
No pesticide controls	-	-	1.3	-	.5

- = Insignificant yield loss.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ These estimates were averaged over the entire planted corn acres in each State. Estimates are losses from a yield where the pest causes no perceptible damage.

3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

4/ Only fall armyworms.

5/ Only southern corn rootworms.

6/ Includes billbugs, cutworms, wireworms, sugarcane beetles, carrot beetles, and lesser stalk borers.

7/ Losses from billbug-wireworm complex and cutworms were summed.

8/ Includes wireworms, billbugs, and cutworms.

Virtually all corn seed in this region was treated for seed rots and seedling blights (table 7). Captan was used on approximately 84 percent of the acreage alone or in combination with other fungicides such as thiram or carboxin (but sometimes maneb or HCB). Thiram was used on 28 percent of the acreage and carboxin on 4 percent. Large acreages of corn in the Southeast were also treated with nematicides. The primary nematicide was carbofuran, applied to about 16 percent of the acreage, while terbufos was applied to about 2 percent.

Nonpesticide management practices also controlled production losses from diseases (table 8). Resistant or tolerant hybrids helped control common smut, ear and kernel rots, foliar diseases, stalk rots, and viruses. Early planting was used for this same group of diseases except viruses. Crop rotation helped control ear and kernel rots, nematodes, and stalk rots. A variety of field practices reduced aflatoxin storage mold problems.

Nematodes caused an estimated 5.5-percent yield loss with current controls (table 9). If pesticides were no longer available, these losses could increase to 9 percent. The greatest increase in losses would occur in South Carolina. Seed rots and seedling blights caused 0.2-percent yield losses, which could increase to 1.9 percent without seed treatments.

Table 6. Ranking of corn diseases and nematodes in the Southeastern States 1/

Diseases and nematodes	Rank 2/				
	AL	GA	NC	SC	Region
Aspergillus storage mold	1	3	1	3	1
Nematodes	3	2	1	2	2
Stalk rots	NR	1	2	1	3
Viruses	2	4	3	5	4
Seed rots and seedling blights	3	4	3	6	5
Common smut	2	4	NR	4	6
Anthracnose	NR	NR	2	NR	7
Ear and kernel rots	3	4	NR	6	8
Common corn rust	3	4	NR	NR	9
Leaf spots (Zonate, yellow, or gray)	3	NR	3	NR	10
Southern corn leaf blight	NR	4	NR	7	11
Northern corn leaf blight	NR	4	NR	NR	12
Southern corn rust	NR	4	NR	NR	12
Helminthosporium leaf blights	3	NR	NR	NR	14

NR = Not reported.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ 1 = Most serious, 2 = second-most serious, etc. Regional rankings were weighted averages of State-level rankings. State-level rankings were uniformly standardized so each would have the same mean and variance. The standardized variables were weighted by planted acres to construct the regional ordering.

Table 7. Corn fungicide and nematicide use in the Southeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres				
			AL	GA	NC	SC	Region 3/
					Percent		
Captan	ST	Seed rots and seedling blights	-	60	100	80	69
Captan + maneb	ST	do.	5	-	-	-	<1
Captan + HCB + maneb	ST	do.	5	-	-	-	<1
Captan + thiram	ST	do.	85	-	-	-	11
Carbofuran	2	Nematodes	1	25	4/ 12	15	16
Carboxin + captan or thiram	ST	Seed rots and seedling blights	5	10	-	-	4
Ethoprop	2	Nematodes	-	-	4/	1	<1
PCNB + ETMT	ST	Seed rots and seedling blights	-	-	-	4	<1
Terbufos	2,3	Nematodes	-	5	4/	4	2
Thiram	ST	Seed rots and seedling blights	-	40	-	16	17

- = Insignificant acreage.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ Timing of application, where:
ST = Seed treatments (including planter box treatments).
2 = At planting.
3 = Banded, at planting.

3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

4/ Total of 12 percent is attributed to carbofuran, ethoprop, or terbufos.

Table 8. Nonpesticide corn disease and nematode management in the Southeastern States 1/

Diseases and nematodes	Disease/nematode management practice	Percentage of planted acres			
		AL	GA	NC	SC
		Percent			
Aflatoxin	Proper drying, cleaning, planting, harvesting, soil practices, and plant population management	30	60	-	20
Common smut	Early planting	-	-	-	15
	Tolerant hybrids	-	-	-	80
Ear and kernel rots	Early planting	-	20	-	-
	Plant population management	-	-	-	12
	Resistant hybrids	-	30	-	15
	Rotation	100	-	-	-
Foliar diseases	Early planting	-	1	-	-
	Resistant hybrids	-	10	-	50
Nematodes	Deep tillage	-	40	-	-
	Rotation	100	40	-	10
	Starter fertilizer	-	10	-	-
	Subsoiling	-	-	-	30
Stalk rots	Balanced fertility	-	10	-	-
	Early harvest	-	20	-	-
	Early planting	-	30	-	-
	Resistant hybrids	-	80	-	90
	Rotation	100	-	-	50
	Seeding rate	-	80	-	-
	Stalk destruction by discing	-	-	-	65
Viruses	Resistant hybrids	7	10	10	5
	Weed control	-	10	-	2

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

Table 9. Average percentage yield losses from corn diseases and nematodes controlled with pesticides in the Southeastern States 1/

Diseases, nematodes, and control practices	Average percentage yield loss 2/				
	AL	GA	NC	SC	Region 3/
	Percent				
Seed rots and seedling blights:					
Current controls	0.7	0.0	0.0	1.0	0.2
No pesticide controls	2.0	.1	.8	9.9	1.9
Nematodes:					
Current controls	.2	7.0	5.1	7.0	5.5
No pesticide controls	.5	7.8	7.8	22.8	9.0

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates were averaged over the entire planted acres in each State. Estimates are losses from a yield where the pest causes no perceptible loss.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Weeds, Herbicides, and Losses

The five most economically important corn weed pests were cocklebur, Johnsongrass, annual morningglory, sicklepod, and crabgrass (table 10). Alabama ranked annual morningglory first; Georgia gave this ranking to Texas panicum, North Carolina to crabgrass and fall panicum, and South Carolina to Johnsongrass. Cocklebur, Johnsongrass, annual morningglory, and sicklepod were the only weeds identified by all four States.

The most widely used corn herbicides in the Southeast included atrazine on 87 percent of the planted acreage, acetanilides (alachlor or metolachlor) on 53 percent, and thiocarbamates (butylate or EPTC) on 20 percent (table 11). Because Alabama did not estimate acreage treated with specific acetanilides or

Table 10. Ranking of corn weed pests in the Southeastern States 1/

Weeds	Rank 2/				
	AL	GA	NC	SC	Region
Cocklebur	5	3	2	3	1
Johnsongrass	6	4	2	1	2
Annual morningglory	1	5	3	2	3
Sicklepod	2	2	4	6	4
Crabgrass	NR	7	1	4	5
Fall panicum	3	NR	1	5	6
Pigweed	NR	6	2	7	7
Broadleaf signalgrass	4	NR	3	11	8
Ragweed	NR	8	3	10	9
Texas panicum	9	1	8	12	10
Lambsquarters	NR	NR	2	NR	11
Yellow nutsedge	10	NR	5	8	12
Goose grass	NR	NR	4	NR	13
Smartweed	NR	NR	4	NR	13
Horsenettle	NR	NR	6	NR	15
Purple nutsedge	10	NR	NR	9	16
Florida pusley	7	NR	NR	NR	17
Bristly starbur	NR	9	NR	NR	18
Florida beggerweed	10	10	NR	NR	19
Annual grasses	8	NR	NR	NR	20
Bermudagrass	NR	NR	NR	9	21
Giant ragweed	NR	NR	7	NR	22
Trumpet creeper	NR	NR	7	NR	22

NR = Not reported.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ 1 = Most serious, 2 = second-most serious, etc. Regional rankings were weighted averages of State-level rankings. State-level rankings were uniformly standardized so each would have the same mean and variance. The standardized variables were weighted by planted acres to construct the regional ordering.

Table 11. Corn herbicide use in the Southeastern States 1/

Active ingredients	Percentage of planted acres				
	AL	GA	NC	SC	Region 2/
	Percent				
Alachlor	-	10	4	-	5
Ametryn	-	1	7	-	3
Atrazine	46	35	<1	4	19
Butylate	-	10	-	-	4
Dicamba	-	5	3	26	7
Glyphosate	-	-	<1	-	<1
Linuron	-	2	6	1	3
Metolachlor	-	5	1	-	2
Paraquat	-	2	-	-	<1
Pendimethalin	-	1	-	-	<1
2,4-D	11	15	15	32	17
Alachlor + cyanazine	-	-	2	-	<1
Alachlor + glyphosate	-	-	<1	-	<1
Atrazine + paraquat	-	-	<1	-	<1
Atrazine + acetanilides	13	NA	NA	NA	42
Atrazine + alachlor	*	17	44	38	*
Atrazine + metolachlor	*	6	17	25	*
Atrazine + thiocarbamates	7	NA	NA	NA	16
Atrazine + butylate	*	15	18	15	*
Atrazine + EPTC	*	-	2	-	*
Atrazine + cyanazine	-	3	<1	-	2
Atrazine + paraquat	5	-	-	-	<1
Atrazine + pendimethalin	-	5	-	-	2
Atrazine + simazine	-	-	2	11	2
Atrazine + alachlor + glyphosate	-	-	1	-	<1
Atrazine + acetanilides + paraquat	3	-	7	7	4
Atrazine + alachlor + paraquat	*	-	6	5	*
Atrazine + metolachlor + paraquat	*	-	1	2	*
Atrazine + simazine + paraquat	-	-	2	-	<1

- = Insignificant acreage.
NA = Not applicable.
* = Estimate included in number directly above.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ State estimates were weighted by planted acreage and averaged to obtain regional estimates.

thiocarbamates, some regional estimates were not provided. However, the remaining three States indicated that butylate was the major thiocarbamate used and alachlor was the major acetanilide. Other important herbicides included cyanazine, simazine, and pendimethalin, each applied to 2 percent of the acreage, and paraquat applied to 4 percent. A wide variety of tank mixes were used: atrazine was applied to approximately 68 percent of the acreage, including 42 percent with acetanilides, 16 percent with thiocarbamates, and the remainder with cyanazine, simazine, pendimethalin, paraquat, or paraquat plus acetanilides. Postemergence herbicides included 2,4-D, dicamba, ametryn, and linuron, all of which were generally applied in sequence with atrazine, acetanilides, thiocarbamates, or paraquat. Dicamba was applied to 7 percent of the acreage, 2,4-D to 17 percent, ametryn to 3 percent, and linuron to 3 percent.

Crop rotation and scouting, nonpesticide weed management practices identified by three of the four States, were used on more acreage than any of the others identified (table 12).

Weeds caused approximately 9.2-percent yield losses in the Southeast (table 13). If alachlor were no longer available, losses would increase to 12 percent, with the greatest increase occurring in North Carolina. Losses would increase to 11.2 percent if atrazine were not available, to 10.3 percent if glyphosate were not available, and to 10 percent if 2,4-D were not available. Minor increases in losses would occur if either butylate or dicamba were no longer available. If all the triazines were removed from the market, losses would increase to 18.4 percent, more than for any herbicide family. Losses would increase to 16.7 percent with no acetanilides, to 15 percent with no thiocarbamates, or to 10.9 percent with no phenoxys. Without any herbicides, losses would be much greater, increasing to approximately 32.9 percent with additional cultivation and to 54.3 percent with current cultivation practices.

SOYBEANS

Tillage Systems

An estimated 84 percent of the soybean acreage in the Southeast received conventional or reduced tillage in terms of residue (table 14). The remaining 16 percent was in no-till planting. Since Alabama did not provide separate estimates for conventional and reduced tillage, it was difficult to provide regional estimates for those systems. However, more acreage received conventional than reduced tillage in North and South Carolina, while the opposite occurred in Georgia.

Insects, Insecticides, and Losses

Corn earworms (also known as bollworms or podworms), stinkbugs, loopers, and velvetbean caterpillars were the four most economically important soybean insects in the Southeast identified by all four States (table 15). Corn earworms ranked as the most important in all four States.

Methomyl, methyl parathion, permethrin, and carbaryl were the most widely used insecticides (table 16), generally targeted to the region's four most important insects. The treatments may control more than one pest. Methomyl was used on 21 percent of the acreage in the region, methyl parathion on 18 percent, permethrin on 19 percent, and carbaryl on 11 percent. Methomyl was used widely in all States, while permethrin and methyl parathion were used more extensively in Alabama and Georgia than in the Carolinas. Carbaryl was used more extensively

Table 12. Nonpesticide corn weed management in the Southeastern States 1/

Corn weed management practices	Percentage of planted acres			
	AL	GA	NC	SC
	Percent			
Early planting	74	-	-	-
Fertility practices	23	-	-	-
Mulch crops	5	-	-	-
Rotations	62	9	80	50
Row width	38	-	10	-
Scouting 2/	5	-	50	2
Tillage	73	-	-	-

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Scouting is a pest detection practice which can lead to the use of pesticide or nonpesticide pest management practices.

Table 13. Average percentage corn weed yield losses in the Southeastern States 1/

Weed control practices	Average percentage yield loss 2/				
	AL	GA	NC	SC	Region 3/
	Percent				
Current controls 4/	18.7	3.0	10.8	14.5	9.2
Remove: 5/					
Alachlor	18.7	3.5	17.8	14.5	12.0
Atrazine	18.7	4.8	14.4	14.5	11.2
Ametryn	18.7	3.0	10.8	14.5	9.2
Butylate	18.7	3.5	11.2	14.5	9.5
Dicamba	18.7	3.0	11.5	14.5	9.4
Glyphosate	18.7	3.0	13.7	14.5	10.3
Linuron	18.7	3.0	10.8	14.5	9.2
Metolachlor	18.7	3.2	10.8	14.5	9.2
Paraquat	18.7	3.0	10.8	14.5	9.2
Pendimethalin	18.7	3.2	10.8	14.5	9.2
Simazine	18.7	3.0	10.8	14.5	9.2
2,4-D	18.7	3.0	12.9	14.5	10.0
Acetanilides	18.7	3.5	30.1	14.5	16.7
Phenoxys	18.7	3.5	12.9	14.5	10.9
Thiocarbamates	19.6	3.5	24.1	18.3	15.0
Triazines	25.6	6.4	24.7	28.8	18.4
No chemical controls:					
With current cultivation	44.1	35.0	78.3	49.1	54.3
With extra cultivation	35.5	25.0	43.7	22.2	32.9

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates are average yield losses over the entire planted acreage in the State from a maximum where weeds cause no loss. Other problems and farm management practices were held constant.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
4/ These estimates assume the current pattern of weed control practices in each State.
5/ These estimates assume that only the specific herbicide or herbicide group is no longer available for use. Other herbicides or control practices were substituted, and all other pest problems and farm management practices were held constant.

Table 14. Soybean planted acreage under major tillage systems in the Southeastern States 1/

Tillage systems	Percentage of planted acres				
	AL	GA	NC	SC	Region 2/
	Percent				
Conventional 3/	87	21	42	53	84
Reduced 4/	*	65	32	38	*
No-till 5/	14	14	26	9	16

* = Included in number directly above.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ State estimates were weighted by planted acres and averaged to obtain the regional estimates.
3/ Chisel plowing, moldboard plowing, or subsoiling, including two passes with a disc; or disc-bedding (ridge tilling).
4/ Discing; chisel plowing or subsoiling, including one pass with a disc.
5/ No tillage operations before, during, or after planting.

Table 15. Ranking of soybean insect pests in the Southeastern States 1/

Insects	Rank 2/				
	AL	GA	NC	SC	Region
Corn earworms	1	1	1	1	1
Stinkbugs	3	1	3	3	2
Loopers	2	1	5	4	3
Velvetbean caterpillers	5	1	4	2	4
Bean leaf beetles	NR	NR	2	NR	5
Green cloverworms	NR	NR	3	6	6
Beet armyworms	NR	2	5	NR	7
Lesser stalk borers	6	2	NR	5	8
Three-cornered alfalfa hoppers	4	NR	NR	NR	9
Mexican bean beetles	NR	NR	5	NR	10
Japanese beetles	NR	NR	6	NR	11
Thrips	NR	NR	6	NR	11
Stem borers	NR	NR	7	NR	13

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ 1 = Most serious, 2 = second-most serious, etc. Regional rankings were weighted averages of State-level rankings. State-level rankings were uniformly standardized so each would have the same mean and variance. The standardized variables were weighted by planted acres to construct the regional ordering.

Table 16. Soybean insecticide use by timing and target pest in the Southeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres 3/				
			AL	GA	NC	SC	Region
					Percent		
Acephate	8,10	Corn earworms	<1	-	1	<1	<1
	8,10	Other	-	-	1	<1	<1
		Total	<1	-	2	<1	<1
Carbaryl	8,10	Bean leaf beetles	-	-	7	-	2
	8,10	Corn earworms	<1	-	26	12	8
	8,10	Japanese beetles	-	-	1	-	<1
	8,10	Mexican bean beetles	-	-	2	-	<1
	8,10	Other	<1	-	<1	-	<1
		Total	<1	-	36	12	11
Carbofuran	2,3	Thrips	-	-	3	-	<1
Chlorpyrifos	8,10	Corn earworms	-	-	1	-	<1
	3	Lesser stalk borers	-	1	-	-	<1
		Total	-	1	1	-	<1
Fenvalerate	8,10	Corn earworms	-	-	5	-	1
Methomyl	8,10	Beet armyworms	-	5	1	-	2
	8,10	Corn earworms	16	10	26	10	16
	8,10	Mexican bean beetles	-	-	2	-	<1
	8,10	Soybean loopers	4	-	<1	1	1
	8,10	Velvetbean caterpillars	4	1	<1	1	2
	8,10	Other	-	-	<1	-	<1
		Total	24	16	29	12	21
Methyl parathion	8,10	Corn earworms	9	-	2	-	3
	8,10	Stink bugs	3	40	4	6	13
	8,10	Velvetbean caterpillars	5	-	-	3	2
		Total	17	40	6	9	18
Permethrin	8,10	Corn earworms	2	40	3	2	12
	8,10	Soybean loopers	21	*	3	1	7
	8,10	Velvetbean caterpillars	-	*	-	1	<1
		Total	23	40	6	4	19
Phorate	2,3	Thrips	-	-	3	-	<1

- = Insignificant acreage.
* = Estimate included in number above.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
2 = In-furrow at planting.
3 = Banded at planting.
8 = Postemergence foliar over row.
10 = Postemergence broadcast (aerial).
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

in the Carolinas than in the other two States. Acephate, carbofuran, chlorpyrifos, fenvalerate, and phorate were used on small acreages in the region.

North Carolina identified a wider variety of nonpesticide insect management practices than did the other States (table 17). Scouting for major insect species, a detection practice which may lead to the use of pesticide or nonpesticide pest management practices, was the only practice identified by all four States. Such practices as rotation, early planting, varietal selection, cornstalk destruction, and starter fertilizer were also identified.

The four major insects were the only species to cause more than an estimated 1-percent yield loss with or without pesticides (table 18). Corn earworms

Table 17. Nonpesticide soybean insect management in the Southeastern States 1/

Insects	Insect management practice	Percentage of planted acres			
		AL	GA	NC	SC
		Percent			
Corn earworms	Early planting	1	-	-	-
	Narrow row width	-	-	30	-
	Reduce sprays or rates to protect beneficals	-	-	3/ 40	-
	Scouting 2/	-	-	-	33
Dectes stem borers	Rotation	-	-	15	-
Foliar and podfeeders	Scouting 2/	35	-	-	-
Green cloverworms	Reduce sprays or rates to protect beneficials	-	-	3/ 40	-
Soybean loopers	Reduce sprays or rates to protect beneficials	-	-	3/ 40	-
Velvetbean caterpillers	Early planting	2	-	-	-
Major insects	Early maturing variety	-	-	20	-
	Plant by May 20	-	-	20	-
	Scouting 2/	-	4	70	-

- = Insignificant acreage.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ Scouting is a pest detection practice which can lead to the use of pesticide or nonpesticide pest management practices.

3/ Sprays or application rates were reduced for corn earworms, green cloverworms, or loopers on 40 percent of the North Carolina acreage.

Table 18. Average percentage soybean insect yield losses in the Southeastern States 1/

Insects and control practices	Average percentage yield loss 2/				
	AL	GA	NC	SC	Region 3/
			Percent		
Bean leaf beetles:					
Current controls	-	-	0.2	-	<0.1
No pesticide controls	-	-	.5	-	.1
Beet armyworms:					
Current controls	-	0.3	1.1	-	.4
No pesticide controls	-	.3	2.7	-	.8
Corn earworms:					
Current controls	8.6	4.1	10.8	0.7	6.3
No pesticide controls	32.3	18.0	28.8	6.4	22.0
Deer:					
Current controls	-	-	.8	-	.2
No pesticide controls	-	-	1.4	-	.4
Green cloverworms:					
Current controls	-	-	.3	< .1	< .1
No pesticide controls	-	-	.4	< .1	< .1
Japanese beetles:					
Current controls	-	-	< .1	-	< .1
No pesticide controls	-	-	< .1	-	< .1
Lesser stalk borers:					
Current controls	-	.9	-	-	.2
No pesticide controls	-	.9	-	-	.2
Mexican bean beetles:					
Current controls	-	-	.4	-	.1
No pesticide controls	-	-	.9	-	.2
Soybean loopers:					
Current controls	6.5	9.5	.6	.5	4.4
No pesticide control	34.0	23.6	1.6	1.0	15.7
Stink bugs:					
Current controls	4.2	4.7	1.6	.5	2.8
No pesticide controls	16.5	15.6	2.9	1.1	9.4
Thrips:					
Current controls	-	-	.1	-	< .1
No pesticide controls	-	-	.5	-	.1
Velvetbean caterpillars:					
Current controls	2.2	4.1	< .1	.8	1.8
No pesticide controls	7.4	37.9	.4	2.0	12.1

- = Insignificant yield loss.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ These estimates were averaged over the entire planted soybean acres in each State. Estimates are losses from a yield where the pest causes no perceptible damage.

3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

caused 6.3-percent losses, which could increase to 22 percent if no pesticides were available. Damage from soybean loopers was 4.4 percent, and could increase to 15.7 percent without pesticides. Stinkbugs caused 2.8-percent losses; without pesticides, they could cause 9.4 percent. Velvetbean caterpillars caused 1.8-percent losses, which could increase to 12.1 percent without pesticide control.

Diseases, Fungicides, Nematicides, and Losses

The five most economically important soybean nematodes and diseases in the Southeastern States were cyst nematodes, root-knot nematodes, stem canker, brown spot, and pod and stem blight (table 19). Cyst nematodes ranked the highest in Alabama and North Carolina. Root-knot nematodes ranked first in South Carolina, while stem canker and cyst nematodes jointly ranked first in Georgia. Cyst nematodes, root-knot nematodes, and pod and stem blight were the only diseases and nematodes identified by all four States.

Approximately 23 percent of the acreage was treated with nematicides, including aldicarb on 8 percent, carbofuran on 2 percent, and EDB on 13 percent (table 20). However, use of EDB ended on September 1, 1984, so use patterns could change significantly. The major seed treatments for seed rots and seedling blights included captan on 3 percent of the acreage, captan plus carboxin on 2 percent, thiram on 3 percent, and thiram plus carboxin on 3 percent. Foliar fungicide treatments occurred on 7 percent of the acreage, and included benomyl, chlorothalonil, and thiabendazole.

Resistant or tolerant varieties and crop rotation were the most commonly identified nonpesticide management practices (table 21). Resistant varieties controlled various nematode species and stem canker. Rotation controlled anthracnose, pod and stem blight, all identified species of nematodes, southern blight, and stem canker. Various tillage practices controlled nematodes and southern blight. Soil samples, a scouting practice, detected nematode infestations. The practices identified by each State and the acreage estimates between States varied considerably.

Nematodes caused an estimated 6.3-percent yield loss to soybean acreage in the Southeastern States (table 22). These losses could increase to 10.4 percent without pesticides. Seed rots and seedling blights caused 1.1-percent losses, which could increase to 1.4 percent without pesticides. Foliar diseases caused very small losses, 0.3 percent, which would not change if no pesticides were available.

Weeds, Herbicides, and Losses

The five most economically important soybean weed pests identified in the Southeastern States were cocklebur, annual morningglory, sicklepod, pigweed, and Johnsongrass (table 23). Morningglory ranked first in Alabama, sicklepod in Georgia and South Carolina, and cocklebur in North Carolina. Other than the five most important weeds, only common ragweed and nutsedge were identified by all four States.

Because Alabama did not provide estimates for specific acetanilides and dinitroanilines or differentiate between bentazon and acifluorfen or between linuron and metribuzin, regional estimates for these materials were not included. Acetanilides or dinitroanilines were applied to at least 92 percent of the soybean acreage in the Southeastern States (table 24). Georgia, North Carolina, and South Carolina indicated that dinitroanilines were used on more acreage than acetanilides;

Table 19. Ranking of soybean disease and nematode pests in the Southeastern States 1/

Diseases and nematodes	Rank 2/				
	AL	GA	NC	SC	Region
Soybean cyst nematodes	1	1	1	2	1
Root-knot nematodes	2	2	2	1	2
Stem canker	3	1	NR	4	3
Brown spot	6	4	3	NR	4
Pod and stem blight	5	5	8	7	5
Anthracnose	4	4	NR	6	6
Seed rots and seedling blights	NR	3	4	NR	7
Southern stem blight	NR	3	7	NR	8
Lance nematodes	NR	6	NR	3	9
Sting nematodes	NR	8	11	5	10
Beanpod mottle virus	NR	NR	5	NR	11
Lesion nematodes	NR	NR	6	NR	12
Frogeye leafspot	NR	7	NR	NR	13
Phytophthora	NR	NR	9	NR	14
Cercospora blight	7	NR	NR	NR	15
Soybean mosaic virus	NR	NR	10	NR	16
Charcoal rot	NR	9	NR	NR	17
Purple seed stain	8	NR	NR	NR	18
Red crown rot	NR	NR	12	NR	19
Reniform nematodes	NR	10	NR	NR	20

NR = Not reported.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ 1 = Most serious, 2 = second-most serious, etc. Regional rankings were weighted averages of State-level rankings. State-level rankings were uniformly standardized so that each would have the same mean and variance. The standard variables were weighted by planted acres to construct the regional ordering.

Table 20. Soybean fungicide and nematicide use in the Southeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres				
			AL	GA	NC	SC	Region 3/
			Percent				
Aldicarb	2	Nematodes	7	2	15	6	8
Benomyl	7	Foliar diseases	8	5	2	8	7
Captan	ST	Seed rots and seedling blights	-	-	1	11	3
Captan + carboxin	ST	do.	-	3	-	5	2
Carbofuran	2	Nematodes	-	-	4	3	2
Carboxin	ST	Seed rots and seedling blights	-	-	1	-	<1
Chlorothalonil	7	Foliar diseases	*	*	*	*	*
EDB 4/	2	Nematodes	7	10	-	38	13
Ethoprop	2	do.	-	-	1	1	<1
Fenamiphos	2	do.	-	1	1	2	<1
Thiabendazole	7	Foliar diseases	*	*	-	*	*
Thiophanate-methyl	7	do.	*	*	-	*	*
Thiram	ST	Seed rots and seedling blights	-	-	5	7	3
Thiram + carboxin	ST	do.	-	10	-	3	3

- = Insignificant acreage.
* = Acreage included with benomyl.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
ST = Seed treatment.
2 = At planting.
7 = Two applications; one each at R3 and R5 stages.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
4/ EDB could not be used after September 1, 1984.

Table 21. Nonpesticide soybean disease and nematode management in the Southeastern States 1/

Diseases and nematodes	Disease/nematode management practice	Percentage of planted acres			
		AL	GA	NC	SC
		Percent			
Anthracnose and pod and stem blight	Rotation	-	-	-	10
Nematodes:					
All	Soil samples 2/	-	25	10	-
	Row subsoiling	-	-	-	60
	Tolerant varieties	-	-	-	38
	Winter discing	-	-	-	5
Cyst	Resistant varieties	60	17	75	30
	Rotation	24	15	20	10
Lance	Rotation	-	1	-	5
Root-knot	Resistant varieties	21	20	75	25
	Rotation	-	1	20	5
Sting	Rotation	-	-	5	-
Southern blight	Deep plowing	-	1	-	-
	Rotation	-	2	-	-
Stem canker	Resistant varieties	20	10	-	85
	Rotation	5	1	-	10

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Soil samples are a detection practice which can lead to the use of pesticide or nonpesticide pest management practices.

Table 22. Average percentage soybean yield losses from diseases and nematodes treated with pesticides in the Southeastern States 1/

Diseases, nematodes, and control practices	Average percentage yield loss 2/				
	AL	GA	NC	SC	Region 3/
	Percent				
Foliar diseases:					
Current controls	1.0	-	-	-	0.3
No pesticide controls	1.0	-	-	-	.3
Nematodes:					
Current controls	9.6	6.9	5.5	2.7	6.3
No pesticide controls	10.9	11.0	12.3	7.0	10.4
Seed rots and seedling blights:					
Current controls	-	2.5	1.9	-	1.1
No pesticide controls	-	3.3	2.4	-	1.4

- = Insignificant yield loss.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates were averaged over the entire planted acres in each State. Estimates are losses from a yield where the pest causes no perceptible loss.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Table 23. Ranking of soybean weed pests in the Southeastern States 1/

Weeds	Rank 2/				
	AL	GA	NC	SC	Region
Cocklebur	3	2	1	4	1
Annual morningglory	1	4	2	3	2
Sicklepod	2	1	9	1	3
Pigweed	4	3	3	2	4
Johnsongrass	7	5	5	5	5
Florida beggarweed	6	8	NR	6	6
Crabgrass	NR	7	8	7	7
Common ragweed	10	10	7	8	8
Nutsedge	9	11	13	9	9
Lambsquarters	11	NR	4	NR	10
Fall panicum	NR	NR	6	11	11
Prickly sida	6	NR	14	NR	12
Annual grasses	5	NR	NR	NR	13
Texas panicum	NR	6	NR	15	14
Bristly starbur	10	9	NR	NR	15
Signalgrass	NR	NR	10	NR	16
Florida pusley	8	NR	NR	NR	17
Jimsonweed	NR	NR	11	NR	18
Goosegrass	NR	NR	12	NR	19
Cowpea	NR	NR	NR	10	20
Tropic criton	NR	NR	NR	12	21
Foxtails	NR	NR	15	NR	22
Common bermuda grass	NR	NR	NR	13	23
Pennsylvania smartweed	NR	NR	16	NR	24
Spotted spurge	NR	NR	NR	14	25
Hemp sesbania	12	NR	NR	NR	26
Velvetleaf	NR	NR	17	NR	27

NR = Not reported.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ 1 = Most serious, 2 = second-most serious, etc. Regional rankings were weighted averages of State-level rankings. State-level rankings were uniformly standardized so each would have the same mean and variance. The standardized variables were weighted by planted acres to construct the regional ordering.

Table 24. Soybean herbicide use in the Southeastern States 1/

Active ingredients	Percentage of planted acres				
	AL	GA	NC	SC	Region 2/
			Percent		
Acifluorfen	20	5	25	15	28
Bentazon	*	7	21	21	*
Acetanilides	88	NA	NA	NA	68
Alachlor	*	5	24	29	*
Metolachlor	*	2	4	5	*
Fluchloralin	*	4	-	3	*
Oryzalin	*	3	-	21	*
Pendimethalin	*	9	-	2	*
Trifluralin	*	31	13	28	*
Dinoseb	-	1	-	-	<1
Glyphosate	2	-	5	-	2
Linuron	57	1	1	14	26
Metribuzin	*	17	-	11	*
Paraquat	-	2	-	-	<1
Sethoxydim or fluazifop-butyl	-	1	-	-	<1
Toxaphene	-	20	-	-	5
Vernolate	-	3	3	-	2
2,4-DB	-	2	-	-	<1
Acifluorfen + bentazon	21	2	-	-	7
Acifluorfen + linuron	-	-	-	8	2
Acifluorfen + metribuzin	-	-	-	2	<1
Acifluorfen + toxaphene	-	4	-	-	1
Alachlor + linuron	-	-	4	-	1
Alachlor + metribuzin	-	7	4	-	3
Alachlor + naptalam	-	2	-	-	<1
Alachlor + linuron + glyphosate	-	-	11	-	3
Alachlor + linuron + paraquat	-	-	16	-	4
Bentazon + linuron	-	-	-	12	3
Bentazon + metribuzin	-	-	-	4	1
Bentazon + toxaphene	-	4	-	-	1
Dinoseb + naptalam	8	4	7	-	5
Linuron + metolachlor	-	-	2	-	<1
Linuron + 2,4-DB	5	3	-	-	2
Metribuzin + metolachlor	-	7	-	-	2
Metribuzin + oryzalin	-	7	-	-	2
Metribuzin + pendimethalin	-	5	-	-	1
Metribuzin + trifluralin	-	2	6	-	2
Metribuzin + 2,4-DB	-	1	-	-	<1
Paraquat + acetanilides + linuron	-	-	-	1	<1
Paraquat + acetanilides + metribuzin	5	5	-	1	6
Paraquat + dinitroanilines + linuron	*	-	-	6	*
Paraquat + dinitroanilines + metribuzin	*	6	-	1	*
Trifluralin + vernolate	-	2	-	1	<1

* = Acreage included in number directly above.
NA = Not applicable.
- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

trifluralin was the primary dinitroaniline, and alachlor was the primary acetanilide. Linuron or metribuzin was applied to approximately 58 percent of the acreage. Acifluorfen or bentazon was applied to approximately 31 percent of the acreage, while a combination of both was applied to an additional 7 percent. These two herbicides are often applied postemergence in sequence with acetanilides or dinitroanilines. Paraquat, used on no-till, was applied to 6 percent of the acreage. Other less important herbicides included dinoseb, naptalam, toxaphene, vernolate, glyphosate, and 2,4-DB.

Crop rotation, the primary nonpesticide weed management practice, was identified by all four States (table 25). Scouting, a weed detection practice, was identified by three States, while narrow row spacing was identified by two.

Weeds caused 14.1-percent yield losses to soybeans. Among the individual herbicides, removing bentazon would have the greatest effect, increasing losses to 15 percent. If either acifluorfen or metribuzin were not available, losses would increase to 14.6 percent. If toxaphene were not available, losses would increase to 14.5 percent. If no acetanilides were available, losses would increase to 14.4 percent, while losses would increase to 14.5 percent if no dinitroanilines were available. If no herbicides were available, losses would be much greater, increasing to 36.2 percent with extra cultivation and to 69.5 percent with current cultivation.

RESEARCH AND DATA NEEDS

The field corn and soybean pesticide assessment reveals several important research and data needs. First, State and Federal pesticide use surveys should continue in order to provide current information. The surveys should identify major target pests for pesticide treatments. These surveys need to identify the the relative importance of nonpesticide pest management practices. There are wide variations in the practices identified and the estimates of use between States. Therefore, State pest control experts should develop standardized definitions of practices and identify practices to be included in survey questionnaires.

Second, there should be more empirical field research concerning pest damage to crop yield and quality because satisfactory baseline data do not exist for many economic analyses. Existing projects which estimate pest damage under various circumstances should be expanded to include how pests interact to damage crops and how additional factors such as climate influence crop damage and quality. Research should also estimate the extent of various degrees of yield and quality damage.

These needs might be accomplished by sampling farmers' fields over a number of years to estimate pest infestations and their effect on yield and quality. With such studies, researchers could project the likelihood of various degrees of pest damage. Such research would provide a stronger basis for estimating the economic effects of potential regulatory actions and the production effects of new and improving technologies.

Table 25. Nonpesticide soybean weed management in the Southeastern States 1/

Nonpesticide weed	Percentage of planted acres			
	AL	GA	NC	SC
	Percent			
Burning grain stubble in cover crop	-	-	-	5
Certified seed	65	-	-	-
Fall tillage	4	-	-	-
Narrow row spacing and plant population	53	-	30	-
Planting date	17	-	-	-
Rotation	24	16	80	12
Scouting 2/	6	-	5	11
Timely planting after small grains in double crop	9	-	-	-
Varietal selection	-	-	5	-

- = Insignificant acreage.

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ Scouting is a pest detection practice which can lead to the use of pesticide or nonpesticide pest management practices.

Table 26. Average percentage soybean weed yield losses in the Southeastern States 1/

Weed control practices	Average percentage yield loss 2/				
	AL	GA	NC	SC	Region 3/
	Percent				
Current controls 4/	13.9	8.9	5.6	29.8	14.1
Remove: 5/					
Acifluorfen	14.6	10.3	5.6	29.8	14.6
Bentazon	14.6	10.0	7.3	29.8	15.0
Dinoseb	13.9	8.9	5.6	29.8	14.1
Glyphosate	13.9	8.9	5.6	29.8	14.1
Linuron	13.9	8.9	5.6	29.8	14.1
Naptalam	13.9	8.9	5.6	29.8	14.1
Metribuzin	15.5	9.4	5.6	29.8	14.6
Paraquat	13.9	8.9	5.6	29.8	14.1
Toxaphene	13.9	10.5	5.6	29.8	14.5
2,4-DB	13.9	9.1	5.6	30.0	14.2
Acetanilides	13.9	8.9	5.6	31.3	14.4
Dinitroanilines	15.3	8.9	5.6	29.8	14.5
Diphenyl ethers	13.9	8.9	5.6	29.8	14.1
Thiocarbamates	13.9	8.9	5.6	29.8	14.1
No chemical controls:					
With current cultivation	100	14.5	97.7	62.8	69.5
With extra cultivation	55	14.5	20.6	55.5	36.2

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

2/ These estimates are average yield losses over the entire planted acreage in the State from a maximum where weeds cause no perceptible loss. Other pest problems and farm management practices were held constant.

3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

4/ These estimates assume the current pattern of weed control practices in each State.

5/ These estimates assume that only the specific herbicide or herbicide group is no longer available for use. Other herbicides or control practices were substituted, and all other pest problems and farm management practices were held constant.

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