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Pesticide Assessment of Field Corn and Soybeans: Delta States

National Agricultural Pesticide Impact Assessment Program

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ABSTRACT

This report summarizes the pesticide assessment for corn and soybeans in the Delta States. Without insecticides, corn rootworm larvae and other soil insects would cause substantial corn yield losses, while corn earworms or loopers would cause the greatest losses to soybeans. The loss of fungicides would result in corn yield losses from seed rots and seedling blights and soybean losses from foliar diseases. The loss of nematicides would cause soybean yield losses. Among the herbicides, the loss of triazines would cause the greatest corn yield losses, while either the phenoxys or bentazon would cause the greatest soybean yield losses. 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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National Agricultural Pesticide Impact
Assessment Program

INTRODUCTION

This report summarizes the field corn and soybean assessment for the Delta States of Arkansas, Kentucky, Louisiana, Mississippi, and Tennessee. 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. The estimates of losses are averaged for each State, but losses incurred by some producers will be significantly greater than the State or regional averages.

Acreage planted to corn and soybeans accounted for approximately 40 percent of U.S. acreage planted to crops (excluding pasture or idle land) in 1978. Field corn constituted 22 percent of that acreage and soybeans 18 percent. Approximately 3.5 percent of the U.S. corn acreage and 24 percent of the U.S. soybean acreage was planted in the Delta States. Acreage planted to corn or soybeans accounted for 71 percent of acreage used for crops in the Delta States in 1978. The average area planted to corn during 1976-80 was 49,000 acres in Arkansas, 1,574,000 in Kentucky, 66,000 in Louisiana, 247,000 in Mississippi, and 834,000 in Tennessee. The average area planted to soybeans during this same period was 4,752,000 acres for Arkansas, 1,454,000 for Kentucky, 2,956,000 for Louisiana, 3,837,000 for Mississippi, and 2,424,000 for Tennessee. The Delta States produced approximately 3 percent of the U.S. corn and 14 percent of the U.S. soybeans 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 75 percent of the corn acreage in the Delta States was under conventional tillage (in terms of crop residue) (table 1). The acreage under conventional tillage ranged from 65 percent for Kentucky, to 88 percent for Mississippi and Tennessee, to 100 percent for Arkansas. In addition, 9 percent of the acreage in the region was under reduced tillage, and 16 percent under no-till.

Insects, Insecticides, and Losses

Of the five States, only Tennessee and Kentucky ranked corn insect pests or provided estimates of insecticide use and insect losses. There was very little insecticide use on corn in Mississippi and Arkansas, while Louisiana did not provide information on any corn pests. The five most important insect pests in this region, based on Kentucky and Tennessee rankings, were European corn borers, black cutworms, true armyworms, and white grubs (table 2). Kentucky ranked wireworms, corn rootworms, and corn leaf aphids third -- the same ranking as for true armyworms and white grubs. Tennessee ranked corn earworms third and Japanese beetles fifth.

Carbofuran, used on more acreage (18 percent of planted acres) in the region than any other insecticide, controlled European corn borers, true armyworms, and soil insects (table 3). Methomyl treated about 4 percent of the planted acreage in the region for true armyworms, corn borers, corn earworms, and fall armyworms. Methomyl was used almost exclusively in Tennessee. Chlorpyrifos and toxaphene were each used on about 8 percent of the planted acreage, primarily in Kentucky. Chlorpyrifos was used for cutworms and soil insects and toxaphene for cutworms, true armyworms, and fall armyworms. Carbaryl was applied to 3 percent of the acreage, primarily in Tennessee, for European corn borers and Japanese beetles. Diazinon was used on 2 percent of the acreage for fleabeetle and armyworm control.

A variety of nonpesticide pest management practices were identified (table 4). Early planting to avoid pest damage was the most common and the primary method in Arkansas and Mississippi for all pests. Early planting was also used against European corn borers in Kentucky and Tennessee as well as against corn earworms

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

Tillage systems	Percentage of planted acres 2/				
	AR	KY	MS	TN	Region 3/
	Percent				
Conventional 4/	100	65	88	88	75
Reduced 5/	0	16	0	0	9
No-till 6/	0	19	12	12	16

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Louisiana did not provide information on corn.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
4/ Chisel plowing, moldboard plowing, or subsoiling, including two passes with a disc; or disc-bedding (ridge-tilling).
5/ Discing; chisel plowing or subsoiling, including one pass with a disc.
6/ No tillage operations before, during, or after planting.

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

Insects	Rank 2/ 3/		
	KY	TN	Region
European corn borers	1	1	1
Black cutworms	2	4	2
True armyworms	3	2	3
Fall armyworms	4	2	4
White grubs	3	6	5
Wireworms	3	6	5
Corn rootworms	3	NR	7
Corn leaf aphids	3	NR	7
Corn earworms	NR	3	9
Southwestern corn borers	5	NR	10
Fleabeetles	6	7	11
Japanese beetles	7	5	12
Seedcorn maggots	NR	6	13
Sugarcane beetles	NR	6	13

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Insects were not generally significant corn pests in Arkansas or Mississippi. Louisiana provided no information on corn.
3/ 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 Delta States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres 3/		
			KY	TN	Region 4/
				Percent	
Carbaryl	8,9,10	European corn borers	1	5	NA
	8,9,10	Japanese beetles	*	1	NA
	8,9,10	Other	*	2	NA
		Total	1	8	3
Carbofuran	2,8,10	European corn borers	20	20	NA
	2	Soil insects	*	4	NA
	2	True armyworms	*	-	NA
		Total	20	24	18
Chlorpyrifos	3,8,10	Cutworms	12	4	NA
	3,8	Soil insects	*	-	NA
		Total	12	4	8
Diazinon	8	Fleabeetles	1	-	NA
	8,10	True armyworms	-	5	NA
		Total	1	5	2
Fenvalerate	8,10	Cutworms	1	-	<1
Methomyl	8,10	Armyworms and corn borers	-	5	NA
		Corn earworms and fall armyworms	1	5	NA
		Total	1	10	4
Methyl parathion	8,10	Armyworms	-	1	NA
	8,10	European corn borers	-	2	NA
	8,10	Fall armyworms	-	1	NA
		Total	-	4	1
Terbufos	2	Soil insects	1	-	<1
Toxaphene	1,8	Cutworms and true armyworms	13	-	NA
	10	Cutworms, fall armyworms, true armyworms	1	-	NA
		Total	14	-	8

NA = Not applicable.
* = Estimate included in number directly above.
- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
1 = Preplant broadcast with or without incorporation.
2 = In furrow at planting.
3 = At planting as a band.
8 = Postemergence foliar or over row.
9 = Postemergence whorl directed.
10 = Postemergence aerial.
3/ Corn insecticide use is very low in Arkansas and Mississippi. Louisiana did not estimate for corn.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

and fall armyworms in Tennessee. Kentucky also identified some scouting acreage, using rotation for corn earworms, and planting resistant varieties for southwestern corn borers. Tennessee identified clean cultivation to control cutworms and the soil complex.

None of the insects controlled with pesticides caused a production loss greater than 1 percent in any of the Delta States (table 5). European corn borers had the greatest potential for yield losses, which could increase from 0.6 percent with current controls to 3.4 percent without pesticide controls. If no pesticides were used to control fall armyworms, losses could increase from 0.2 percent to 1.9 percent. Losses from corn earworms and true armyworms could each increase by approximately 3 percent if no pesticides were available. Losses from the soil insect complex could increase from 0.3 percent with current controls to 1.8 percent without pesticide controls.

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

Insects	Insect management practice	Percentage of planted acres 2/			
		AR	KY	MS	TN
		Percent			
All insects	Early planting	100	-	100	-
	Scouting 3/	-	4	-	-
Corn earworms	Early planting	—	—	—	50
Corn rootworms	Rotation	-	55	-	-
Cutworms	Clean cultivation	-	-	-	30
European corn borers	Early planting	-	50	-	50
Fall armyworms	Early planting	-	-	-	50
Soil complex	Clean cultivation	-	-	-	30
Southwestern corn borers	Early planting	-	-	-	30-50
	Tolerant hybrids	-	95	-	-

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Louisiana provided no estimates for corn.
3/ Scouting is a pest detection practice which can lead to the use of pesticide or nonpesticide pest management practices.

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

Insects and insect control practices	Average percentage yield loss 2/ 3/		
	KY	TN	Region 4/
		Percent	
Armyworms:			
Current controls	0.5	0.1	0.3
No pesticide controls	.7	9.8	3.4
Corn earworms:			
Current controls	-	.1	< .1
No pesticide controls	-	9.8	3.0
Cutworms:			
Current controls	.1	-	< .1
No pesticide controls	.3	2.0	.8
European corn borers:			
Current controls	.9	.1	.6
No pesticide controls	1.6	8.0	3.4
Fall armyworms:			
Current controls	.3	.1	.2
No pesticide controls	.6	5.0	1.9
Fleabeetles:			
Current controls	.1	-	< .1
No pesticide controls	.1	-	< .1
Japanese beetles:			
Current controls	.3	-	.2
No pesticide controls	.3	2.3	.9
Soil complex:			
Current controls	.5	-	.3
No pesticide controls	2.8	.4	1.8

- = Insignificant yield loss.

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

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

3/ Arkansas and Mississippi did not estimate corn insect yield losses. Louisiana did not provide information on corn.

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

Diseases, Fungicides, and Losses

Charcoal rot, a stalk rot, was the most important corn disease in the Delta States (table 6). Charcoal rot ranked first in all States except Mississippi, which ranked it second (Louisiana did not evaluate pests and losses for corn). Other stalk rots ranked second, ear and kernel rots third, viruses fourth, and Helminthosporium leaf blights and leaf spot fifth. Only the top five pests were identified by all States in the region. Tennessee and Kentucky also ranked other stalk rots first, while Mississippi and Arkansas ranked them second. Mississippi ranked ear and kernel rots first.

Almost 100 percent of the corn seed was treated against seed rots and seedling blights, primarily with captan on 69 percent of the acres (table 7). Thiram was used on approximately 25 percent of the acres, while a mix of captan and thiram was used on 3 percent. Chemical pesticides other than seed treatments were generally not used to treat corn diseases in the Delta States. Seed rots and seedling blights cause an estimated 1.3-percent yield loss across the region. Without pesticides, these losses could increase to 7.5 percent (table 9).

The Delta States identified a wide variety of nonchemical disease management practices, especially resistant varieties, rotation, and variations in planting or harvest date. Resistant varieties were planted to combat Anthracnose leaf blight, bacterial wilt, ear and kernel rots, gray leaf spot, Helminthosporium leaf spot, other leaf spots, seed rots and seedling blights, stalk rots, and viruses. Rotation helped prevent common smut, Helminthosporium leaf spot, gray leaf spot, nematodes, and stalk rots. Variations in planting dates controlled ear and kernel rots, rusts, and seed rots and seedling blights, while early harvest controlled ear and kernel rots and stalk rots. Practices identified and the extent of use varied among the States.

Weeds, Herbicides, and Losses

Johnsongrass, fall panicum, giant foxtail, smooth crabgrass, and large crabgrass ranked as the five most important weed pests in the Delta States (table 10). Arkansas, Kentucky, and Tennessee ranked Johnsongrass first, while Mississippi ranked it third (Louisiana did not provide field corn information). Mississippi identified cocklebur and annual morningglory as the most important weed pests. Johnsongrass, fall panicum, smooth crabgrass, large crabgrass, and cocklebur were the only weeds identified by all Delta States.

The four most widely used herbicides in the Delta States, applied individually or in tank mixes, included atrazine on 96 percent of the acreage, alachlor on 27 percent, metolachlor on 20 percent, and paraquat on 19 percent (table 11). Other important herbicides included butylate, applied to 20 percent of the acreage; EPTC to 14 percent; and simazine to 7 percent. A wide variety of tank mixes were used: Atrazine was applied to 65 percent of the acreage mixed with alachlor, butylate, cyanazine, EPTC, simazine, paraquat, or glyphosate. The postemergence herbicides, dicamba and 2,4-D, applied to 5 percent and 6 percent of the acreage, respectively, were often applied in sequence with treatments of triazines, acetanilides, thiocarbamates, and mixes of such chemicals (applying herbicides in combination or sequence resulted in the sums of acreage treated with various chemicals to exceed 100 percent).

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

Diseases and nematodes	Rank 2/ 3/				
	AR	KY	MS	TN	Region
Charcoal rot	1	1	2	1	1
Stalk rots	2	1	2	1	2
Ear and kernel rots	2	3	1	3	3
Viruses	3	2	3	5	4
Helminthosporium leaf blights and leaf spot	NR	4	NR	2	5
Seed rots and seedling blights	3	8	4	4	6
Storage molds	NR	6	6	7	7
Gray leaf spot	NR	7	NR	9	8
Anthracnose leaf blight	NR	5	NR	NR	9
Root lesion nematodes	NR	10	NR	8	10
Bacterial wilt	NR	9	NR	NR	11
Common rust	4	11	5	NR	12
Southern rust	NR	11	5	NR	13
Common smut	4	12	NR	NR	14
Root-knot nematodes	4	NR	NR	8	15
Yellow leaf blight	4	NR	NR	NR	16
Brown leaf spot	4	NR	NR	NR	16

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Louisiana did not provide information on corn.
3/ 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 use in the Delta States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres 3/				
			AR	KY	MS	TN	Region 4/
			Percent				
Captan	ST	Seed rots and seedling blights	65	90	20	45	69
Carboxin	ST	do.	20	-	-	-	<1
Thiram	ST	do.	15	10	60	45	25
Captan and thiram	ST	do.	-	-	20	5	3

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where: ST = Seed treatment (including planter box treatments).
3/ Louisiana did not provide information on corn.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

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

Diseases and nematodes	Disease/nematode management practice	Percentage of planted acres 2/			
		AR	KY	MS	TN
		Percent			
Anthracnose leaf blight	Resistant varieties	-	3	-	-
Bacterial wilt	do.	-	1	-	-
Common smut	Rotation	50	-	-	-
Ear and kernel rots	Early harvest	-	8	-	25
	Early planting	-	-	25	-
	Good cultural practices	-	-	25	-
	Insect control	-	8	-	-
	Resistant varieties	-	-	-	50
Gray leaf spot	Rotation	-	10	-	-
	Resistant varieties	-	10	-	-
	Tillage	-	10	-	2
Helminthosporium leaf spot	Resistant varieties	-	10	-	-
	Rotation	-	-	-	5
Leaf spots	Resistant varieties	100	-	-	-
Nematodes	Rotation	50	-	-	25
Rusts	Early planting	-	-	50	-
Seed rots and seedling blights	Delayed planting	-	95	55	85
	Resistant varieties	-	-	-	80
	Seedbed preparation	-	-	-	95
Stalk rots	Early harvest	-	30	-	10
	Fertility	-	-	-	75
	Irrigation	15	-	-	-
	Plant population control	-	30	-	-
	Resistant varieties	100	30	-	50
	Rotation	50	30	-	25
Viruses	Johnsongrass control	-	15	-	75
	Resistant varieties	100	15	50	75

- = Insignificant acreage.

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

2/ Louisiana did not provide information on corn.

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

Diseases and disease control practices	Average percentage yield loss 2/ 3/				
	AR	KY	MS	TN	Region 4/
	Percent				
Seed rots and seedling blights:					
Current controls	0.5	1.3	2.8	0.7	1.3
No pesticide controls	5.0	10.3	3.3	3.3	7.5

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/ Louisiana did not provide information on corn.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Few nonpesticide weed management practices or acre treatments were identified (table 12). Kentucky identified cultivating, fall plowing, and scouting, Arkansas identified field selection, and Mississippi identified scouting.

Weeds caused an estimated 18.6-percent yield loss in the Delta States (table 13). Among the individual chemicals, the greatest increase in losses would occur if EPTC were no longer available for use: up to 22.4 percent. If atrazine, dicamba, or 2,4-D were no longer available, losses would increase to 21 to 22 percent. If entire groups of chemicals were no longer available, losses would be greater because the subsititutes would be less satisfactory. Without triazines, losses could increase to 31.8 percent. Losses could increase to 26.6 percent without acetanilides and to 26 percent without thiocarbamates. Without herbicides, losses would be much greater, increasing to approximately 50 percent with additional cultivation and to 73 percent with current cultivation practices.

SOYBEANS

Tillage Systems

An estimated 51 percent of the soybean acreage in the Delta States was under conventional tillage (in terms of crop residue) (table 14). Another 37 percent was under reduced tillage and 12 percent under no-till. The majority of the acreage was under conventional tillage in all States except Mississippi.

Insects, Insecticides, and Losses

Corn earworms (also known as bollworms or podworms), loopers, stink bugs, velvetbean caterpillars, and green cloverworms ranked as the five most important soybean insect pests in this region (table 15). Corn earworms ranked first in Arkansas,

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

Weeds	Rank 2/ 3/				
	AR	KY	MS	TN	Region
Johnsongrass	1	1	3	1	1
Fall panicum	4	3	5	2	2
Giant foxtail	13	2	NR	7	3
Smooth crabgrass	13	3	2	4	4
Large crabgrass	7	3	2	8	5
Yellow foxtail	13	3	NR	7	6
Redroot pigweed	NR	4	5	9	7
Shattercane	NR	3	NR	NR	8
Giant ragweed	NR	4	NR	13	9
Broadleaf signalgrass	3	NR	2	1	10
Cocklebur	5	6	1	5	11
Bur cucumber	NR	4	NR	14	12
Annual morningglory	2	NR	1	3	13
Honeyvine milkweed	NR	4	NR	NR	14
Pennsylvania smartweed	9	5	NR	NR	15
Trumpet creeper	13	5	NR	NR	16
Common ragweed	13	NR	NR	6	17
Horsenettle	NR	NR	6	10	18
Sicklepod	NR	NR	4	12	19
Yellow nutsedge	13	6	5	NR	20
Velvetleaf	13	6	NR	NR	21
Goose grass	8	NR	6	NR	22
Bracharia	NR	NR	5	NR	23
Purple nutsedge	NR	NR	5	NR	23
Ryegrass	NR	NR	5	NR	23
Barnyardgrass	13	NR	6	NR	26
Smooth pigweed	6	NR	NR	NR	27
Pale smartweed	10	NR	NR	NR	28
Redvine	11	NR	NR	NR	29
Lambsquarters	12	NR	NR	NR	30
Perennial vines	NR	NR	NR	15	31
Climbing milkweed	13	NR	NR	NR	32
Hemp sesbania	13	NR	NR	NR	32
Northern joint vetch	13	NR	NR	NR	32
Purslane	13	NR	NR	NR	32

NR = Not reported.

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

2/ Louisiana did not provide information on corn.

3/ 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 Delta States 1/

Active ingredients	Percentage of planted acres 2/				
	AR	KY	MS	TN	Region 3/
	Percent				
Alachlor	2	-	2	21	7
Ametryn	-	-	2	-	<1
Atrazine	60	1	15	90	31
Butylate + safener	5	-	2	1	<1
Cyanazine	2	<1	1	3	2
Dicamba	2	6	10	2	5
EPTC + safener	2	-	5	9	3
Linuron	2	-	3	-	<1
Metolachlor	2	-	3	8	3
Paraquat	-	-	1	12	4
Pendimethalin	1	-	-	3	<1
Simazine	-	-	-	7	2
2,4-D	30	5	20	3	6
Atrazine + alachlor	8	16	30	-	12
Atrazine + butylate	-	20	-	1	12
Atrazine + EPTC	-	14	-	9	11
Atrazine + metolachlor	15	11	30	-	9
Atrazine + oil	7	1	5	-	1
Atrazine + simazine	-	5	-	-	3
Paraquat + atrazine	-	2	8	-	2
Paraquat + atrazine + alachlor	-	11	1	-	6
Paraquat + atrazine + metolachlor	-	10	1	-	6
Paraquat + triazines	-	2	-	-	1
Paraquat + triazines + acetanilides	-	4	-	-	2
Glyphosate + triazines + acetanilides	-	3	-	-	2

- = Insignificant acreage.

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

2/ Louisiana did not provide estimates for corn.

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

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

Weed management practices	Percentage of planted acres 2/			
	AR	KY	MS	TN
	Percent			
Cultivation	-	*	-	-
Fall plowing	-	*	-	-
Field section (primarily Johnsongrass)	80	-	-	-
Scouting 3/	-	*	1	-

- = Insignificant acreage.
* = Practice identified but no acreage reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Louisiana did not provide information on corn.
3/ 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 Delta States 1/

Weed control practices	Average percentage yield loss 2/ 3/				
	AR	KY	MS	TN	Region 4/
	Percent				
Current controls 5/	4.3	16.2	34.4	19.3	18.6
Remove: 6/					
Atrazine	13.3	21.7	34.4	19.3	21.9
Cyanazine	4.8	16.2	34.4	19.3	18.6
Dicamba	4.8	21.1	34.4	19.3	21.4
EPTC	4.8	22.8	34.4	19.3	22.4
Glyphosate	4.8	16.2	34.4	19.3	18.6
Paraquat	4.8	16.2	34.4	19.3	18.6
2,4-D	9.7	20.2	34.4	19.3	21.0
Acetanilides	4.8	27.0	42.9	21.8	26.6
Thiocarbamates	4.8	27.3	34.4	22.5	26.0
Triazines	13.3	30.9	49.1	29.5	31.8
No chemical controls:					
With current cultivation	60.0	90.1	75.2	40.8	72.9
With extra cultivation	27.0	60.7	53.2	29.0	49.6

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/ Louisiana did not provide information for corn.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
5/ These estimates assume the current pattern of weed control practices in each State.
6/ 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 acreage under major tillage systems in the Delta States 1/

Tillage systems 2/	Percentage of planted acres					
	AR	KY	LA	MS	TN	Region 3/
	Percent					
Conventional 4/	50	51	60	33	73	51
Reduced 5/	49	15	30	57	0	37
No-till 6/	1	34	10	10	27	7

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ The estimates include both single- and double-crop acreage.
3/ State estimates were weighted by planted acres and averaged to obtain the regional estimates.
4/ Chisel plowing, moldboard plowing, or subsoiling, including two passes with a disc; or disc bedding (ridge-tilling).
5/ Discing; chisel plowing or subsoiling, including one pass with a disc.
6/ No tillage operations before, during, or after planting.

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

Insects	Rank 2/					
	AR	KY	LA	MS	TN	Region
Corn earworms	1	NR	6	1	1	1
Loopers	2	NR	3	2	3	2
Stink bugs	5	NR	1	3	2	3
Velvetbean caterpillars	3	NR	2	4	NR	4
Green cloverworms	5	1	7	4	3	5
Bean leaf beetles	4	NR	4	6	4	6
Three-cornered alfalfa hoppers	3	NR	5	5	NR	7
Armyworms	5	NR	NR	5	5	8
Mexican bean beetles	NR	2	NR	NR	4	9
Grasshoppers	NR	NR	NR	5	NR	10
Cutworms	NR	NR	NR	5	NR	10
Grape colaspis	5	NR	NR	NR	NR	12
Blister beetles	NR	NR	NR	NR	7	13
Japanese beetles	NR	NR	NR	NR	8	14

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ 1 = most important, 2 = second-most important, 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 Delta States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres					
			AR	KY	LA	MS	TN	Region 3/
			Percent					
Acephate	10	Armyworms	-	-	-	<1	-	<1
	8,10	Blister beetles and grasshoppers	-	-	-	2	<1	<1
	8,10	Corn earworms	-	-	-	<1	<1	<1
	8,10	Green cloverworms	-	-	-	-	<1	<1
	10	Soybean loopers	-	-	1	<1	-	<1
	10	Stink bugs	-	-	3	-	-	<1
	8,10	Other	-	-	-	-	<1	<1
		Total	-	-	4	3	2	2
Azinphosmethyl	10	Bean leaf beetles	-	-	1	-	<1	<1
	10	Three-cornered alfalfa hoppers	-	-	1	-	-	<1
	8,10	Other	-	-	-	-	<1	<1
		Total	-	-	2	-	<1	<1
Carbaryl	8,10	Blister beetles and grasshoppers	-	-	-	-	<1	<1
	8,10	Corn earworms	-	-	-	-	<1	<1
	8,10	Green cloverworms	-	1	-	-	<1	<1
	c,10	Mexican bean beetles	-	1	-	-	-	<1
	7,8,10	All except loopers	1	-	-	-	-	<1
		Other	-	-	-	-	1	<1
		Total	1	2	-	-	2	<1
Chlorpyrifos	3,8	Cutworms	-	-	-	<1	-	<1
Fenvalerate	8,10	All except soybean loopers	1	-	-	-	-	<1
	8,10	Green cloverworms	-	<1	-	-	<1	<1
	8,10	Corn earworms	-	-	-	<1	<1	<1
		Total	1	<1	-	<1	<1	<1
Malathion	8,10	Corn earworms	-	-	-	-	<1	<1
Methomyl	7,8,10	All	2	-	-	-	-	<1
	8,10	Green cloverworms	-	<1	-	-	<1	<1
	8,10	Corn earworms	-	-	1	<1	1	<1
	10	Soybean loopers	-	-	5	1	-	1
	8,10	Other	-	-	-	-	<1	<1
		Total	2	<1	6	1	2	3

See footnotes at end of table.

--Continued

Table 16. Soybean insecticide use by timing and target pest in the Delta States 1/ (Continued)

Active ingredients	Timing 2/	Target pest	Percentage of planted acres					
			AR	KY	LA	MS	TN	Region 3/
			Percent					
Methyl parathion	7,8,10	All except loopers	1	-	-	-	-	<1
	10	Bean leaf beetles	-	-	1	<1	-	<1
	8,10	Corn earworms	-	-	-	1	2	<1
	10	Stink bugs	-	-	26	<1	-	5
	10	Three-cornered alfalfa hoppers	-	-	1	<1	-	<1
	10	Velvet bean caterpillars	-	-	19	<1	-	4
		Total	1	-	47	3	2	11
Methyl parathion + EPN	8,10	All except loopers	1	-	-	-	-	<1
	10	Corn earworms	-	-	-	<1	-	<1
		Total	1	-	-	<1	-	<1
Methyl parathion + toxaphene	8,10	All except loopers	1	-	-	-	-	<1
Parathion	8,10	Fall armyworms	-	-	-	-	<1	<1
Permethrin	8,10	Corn earworms	-	-	4	<1	<1	<1
	8,10	Green cloverworms	-	-	-	-	<1	<1
	10	Soybean loopers	-	-	25	1	-	5
	10	Velvet bean caterpillars	-	-	11	-	-	2
		Total	-	-	40	1	<1	8
Toxaphene	3,8	Cutworms	-	-	-	2	-	<1

- = Insignificant acreage.

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

2/ Timing of application, where:
3 = Banded, at planting.
7 = Postemergence layby.
8 = Postemergence foliar over row.
10 = Postemergence broadcast (aerial).

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

Mississippi, and Tennessee; ranked sixth in Louisiana; but were not identified in Kentucky. Stink bugs ranked first in Louisiana, and green cloverworms ranked first in Kentucky.

Insecticides were used on a variety of soybean insects in this region, but little acreage was actually treated (table 16). Insecticides were used on more acreage in Tennessee and Louisiana than in the other States. Methyl parathion was the most extensively used, with 11 percent of the planted acres treated. Methyl parathion was sometimes mixed with EPN or toxaphene. Permethrin was used on approximately 8 percent of the acreage, methomyl on 3 percent, and acephate on 2 percent. Azinphosmethyl, carbaryl, chlorpyrifos, fenvalerate, malathion, parathion, and toxaphene were each used on less than 1 percent of the acreage.

Scouting, the most common nonpesticide soybean insect management practice in the Delta States, was used on approximately 47 percent of the planted acreage in Lousisiana, 10 percent in Kentucky, and 1 percent in Tennessee (table 17). Arkansas indicated that scouting was used but did not indicate the extent.

Corn earworms, soybean loopers, stink bugs, velvetbean caterpillars, and three-cornered alfalfa hoppers could cause significant increases in pest damage if insecticides were no longer available (table 18). Corn earworms and soybean loopers have the greatest potential for damage; corn earworms caused an estimated 0.5-percent yield loss, which could increase to 4.5 percent without pesticides. The greatest losses would occur in Arkansas, where the 1-percent yield losses from soybean loopers could increase to 4.9 percent without pesticides. Losses would also be great in Louisiana. Losses from stink bugs, velvetbean caterpillars,

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

Insects	Insect management practice	Percentage of planted acreage				
		AR	KY	LA	MS	TN
		Percent				
All insects	Scouting 2/	*	-	47	-	1
Corn earworms	Early planting	*	-	-	-	-
	Narrow rows with late planting	*	-	-	-	-
Green cloverworms	Scouting	-	5	-	-	-
Mexican bean beetles	do.	-	5	-	-	-
Three-cornered alfalfa hoppers	Crop overseed rate	-	-	-	5	-

- = Insignificant acreage.
* = Practice was indicated but no estimate of use was provided.
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 18. Average percentage soybean insect yield losses in the Delta States 1/

Insects and insect control practices	Average percentage yield loss 2/					
	AR	KY	LA	MS	TN	Region 3/
	Percent					
Armyworms:						
Current controls	-	-	-	-	-	-
No pesticide controls	-	-	-	0.1	-	<0.1
Beanleaf beetles:						
Current controls	-	-	<0.1	-	-	< .1
No pesticide controls	-	-	.8	< .1	-	.2
Blister beetles and grasshoppers:						
Current controls	-	-	-	-	-	-
No pesticide controls	-	-	-	-	0.1	< .1
Corn earworms:						
Current controls	1.4	-	.3	.1	.1	.5
No pesticide controls	11.3	-	1.1	3.1	.4	4.5
Green cloverworms:						
Current controls	-	<0.1	-	-	-	-
No pesticide controls	-	< .1	-	.1	< .1	< .1
Mexican bean beetles:						
Current controls	-	.1	-	-	-	< .1
No pesticide controls	-	.2	-	-	-	< .1
Soybean loopers:						
Current controls	.3	-	4.4	.1	-	1.0
No pesticide controls	3.9	-	16.4	1.8	-	4.9
Stink bugs:						
Current controls	-	-	1.2	< .1	-	.3
No pesticide controls	-	-	13.2	2.7	-	3.3
Velvetbean caterpillars:						
Current controls	-	-	4.4	< .1	-	.9
No pesticide controls	-	-	14.7	.8	-	3.1
Three-cornered alfalfa hoppers:						
Current controls	-	-	2.8	-	-	.6
No pesticide controls	-	-	11.6	< .1	-	2.1

- = 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.

and three-cornered alfalfa hoppers were concentrated in Louisiana and Mississippi; such losses would increase by 3 percent, 2.2 percent, and 1.5 percent, respectively.

Diseases, Fungicides, Nematicides, and Losses

Anthracnose leaf blight, cyst nematodes, pod and stem blight, charcoal rot, and seed rots and seedling blights ranked as the five most important soybean diseases in the Delta States (table 19). Anthracnose did not rank first in any State but ranked second in four. Cyst nematodes ranked first in Arkansas, Kentucky, and Tennessee. Pod and stem blight ranked first in Louisiana, while charcoal rot ranked first in Mississippi. In addition to the five most important pests, only brown spot and viruses were identified by all five States.

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

Diseases and nematodes	Rank 2/					
	AR	KY	LA	MS	TN	Region
Anthracnose	2	4	2	2	2	1
Soybean cyst nematodes	1	1	3	6	1	2
Pod and stem blight	2	5	1	3	7	3
Charcoal rot	3	6	6	1	4	4
Seed rots and seedling blights	4	2	6	9	5	5
Frogeye leaf spot	2	NR	5	8	NR	6
Purple seed stain	2	NR	NR	4	NR	7
Brown spot	5	3	7	10	3	8
Stem cankers	NR	8	4	5	6	9
Viruses	5	7	6	12	9	10
Aerial web blight	NR	NR	4	7	NR	11
Downy mildew	5	10	NR	12	NR	12
Other nematodes	5	NR	NR	NR	8	13
Southern stem blight	6	NR	NR	11	NR	14
Bacterial diseases	6	12	NR	12	NR	15
Phytophthora root rot	6	NR	NR	NR	NR	16
Brown stem spot	NR	9	NR	NR	NR	17
Target spot	NR	NR	NR	13	NR	18
Sclerotinia stem rot	NR	11	NR	NR	NR	19

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 standardized variables were weighted by planted acres to construct the regional ordering.

Seed treatments for seed rots and seedling blights were used on approximately 68 percent of the acreage (table 20). Captan was the most commonly used and was applied to 16 percent of the acreage individually and to 14 percent in various combinations. Thiram was applied to 8 percent of the acreage individually and to 20 percent in combination with either captan or carboxin. Carboxin was applied to less than 1 percent of the acreage individually and to another 18 percent mixed with captan or thiram. Fungicides were applied to approximately 12 percent of the acreage for foliar disease control. Benomyl, applied to 10 percent of the

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

Active ingredients	Timing 2/	Target pest	Percentage of planted acres					
			AR	KY	LA	MS	TN	Region 3/
					Percent			
Captan	ST	Seed rots and seedling blights	12	1	35	21	-	16
Captan + carboxin	ST	do.	-	-	-	21	2	6
Captan + PCNB	ST	do.	-	-	-	21	4	6
Captan + thiram	ST	do.	-	-	-	-	15	2
Captan mixes 4/	ST	do.	-	6	-	-	-	<1
Carboxin	ST	do.	2	1	-	-	-	<1
Carboxin + thiram	ST	do.	10	10	20	11	15	13
ETMT + PCNB	ST	do.	12	-	5	11	4	8
Thiram	ST	do.	12	1	15	-	10	8
Benomyl	7,8	Foliar diseases	6	<1	30	8	4	10
Chlorothalonil	7	do.	1	-	1	-	-	<1
Thiabendazole	7	do.	1	-	3	-	1	1
Thiophanate-methyl	7	do.	1	<1	5	2	-	2
Aldicarb	2	Nematodes	2	<1	5	1	3	2
Carbofuran	2	do.	1	-	3	-	2	1
Fenamiphos	2	do.	-	-	2	-	-	<1

- = Insignificant acreage.

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

2/ Timing of application, where:
ST = Seed treatment.
2 = In-furrow at planting.
7 = Foliar treatments R3 and R4.
8 = As needed.

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

4/ Captan mixed with carboxin, maneb, PCNB, thiram, zineb, and HCB + maneb. Estimates for each mix were not provided.

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

Diseases and nematodes	Disease/nematode management practices	Percentage of planted acres				
		AR	KY	LA	MS	TN
		Percent				
Aerial web blight	Wider row spacing	-	-	25	2-3	-
	Increased seedling rate	-	-	25	2-3	-
	Resistant varieties	-	-	25	2-3	-
Anthracnose and brown spot	Bury residue	-	-	15	-	35
	Rotation	-	10	-	-	15
	Scouting 2/	-	-	-	-	1
Bacterial diseases	Resistant varieties	100	-	-	-	-
Charcoal rot	Irrigation	-	-	-	5	-
	Rotation	3	-	-	-	-
Foliar and stem diseases	Debris destruction	55	-	-	-	-
	Scouting 2/	25	-	-	-	-
	Disease-free seed	-	-	-	20	-
	Maintain good fertility	-	-	-	20	-
	Resistant varieties	-	-	-	20	-
Frogeye leaf spot	Resistant varieties	-	-	50	-	-
	Early fall plowing	-	-	15	-	-
Phytophthora root rot	Resistant varieties	95	-	15	-	-
Pod and stem blight	Bury residue	-	-	15	-	35
	Delayed planting	-	10	-	-	-
	Rotation	-	10	-	-	15
	Scouting 2/	-	-	-	-	1
	Varietal selection	-	10	-	-	-
Root-knot nematodes	Resistant varieties	1	-	-	-	10
	Rotation	3	-	-	-	-
Soybean cyst and other nematodes	Resistant varieties	75	40	75	60	75
	Rotation	10	40	75	60	20
	Soil sampling 2/	2	3	-	-	5
Seed rots and seedling blights	Adjust planting	40	60	-	-	50
	Rotation	4	60	-	-	-
	Seedbed preparation	-	10	-	-	65
	Seed quality	56	75	-	-	-
Stem canker	Bury residue	-	-	-	-	1
	Delayed planting	-	-	-	-	1
	Resistant varieties	-	-	50	-	-
	Rotation	-	-	-	-	1
	Scouting 2/	-	-	-	-	1
Viruses	Resistant varieties	-	-	-	-	25

- = Insignificant acreage.

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

2/ Scouting and soil sampling are pest detection practices which may lead to the use of pesticide or nonpesticide management practices.

acreage, was the most important foliar fungicide. Nematicides were applied to approximately 3 percent of the acreage, with aldicarb being the most commonly used.

A wide variety of nonpesticide disease management practices were identified (table 21). Planting resistant varieties, the most common nonpesticide practice, controlled aerial web blight, bacterial diseases, foliar and stem diseases, frogeye leafspot, nematodes, phytophthora root rot, pod and stem blight, stem canker, and viruses. Crop rotation was also identified for managing Anthracnose and brown spot, nematodes, pod and stem blight, seed rots and seedling blights, and stem canker.

Foliar diseases had the greatest potential for increasing damage if pesticides were no longer available. Foliar diseases caused 12.3-percent yield losses, which could increase to 19 percent if no pesticides were available (table 22). The greatest losses would occur in Arkansas and Louisiana where losses from seed rots and seedling diseases were about 0.9 percent but could increase to 5.1 percent without pesticides. Losses from soybean cyst nematodes could increase to 6.8 percent from 4.5 percent if pesticides were no longer available.

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

Diseases, nematodes, and control practices	Average percentage yield loss 2/					
	AR	KY	LA	MS	TN	Region 3/
			Percent			
Seed rots and seedling blights:						
Current controls	0.7	1.2	1.0	-	2.2	0.9
No pesticide controls	.9	2.9	20.0	-	4.2	5.1
Foliar diseases:						
Current controls	17.0	10.4	12.0	12.3	4.8	12.3
No pesticide controls	23.3	11.1	35.0	12.3	5.3	19.0
Soybean cyst nematodes:						
Current controls	6.9	8.0	4/ 6.0	-	3.3	4.5
No pesticide controls	8.0	8.4	15.0	-	4.3	6.8

- = Insignificant yield loss.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates were averaged over the entire planted acres in the 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/ All nematodes.

Weeds, Herbicides, and Losses

The five most important soybean weed pests in the Delta States were Johnsongrass, annual morningglory, cocklebur, pigweed, and barnyardgrass (table 23). Johnsongrass ranked first in Kentucky and Mississippi, second in Louisiana and Tennessee, and third in Arkansas. Annual morningglory ranked the highest in Louisiana and Mississippi, while cocklebur ranked highest in Arkansas and Kentucky. Johnsongrass, morningglory, cocklebur, and pigweed were the only weeds identified by all five Delta States.

Estimates on herbicide use in the region were based upon Kentucky, Louisiana, Mississippi, and Tennessee data because the Arkansas estimates were not comparable with those from the rest of the Delta States. (Arkansas provided estimates by timing of application, which are included in footnote 2 of table 24.) Some States did not report using tank mixes but instead reported the materials separately. Metribuzin, the most widely used herbicide, was used most extensively in Louisiana and the least in Kentucky. Metribuzin use, on 55 percent of the planted acreage, included 43 percent applied individually and 12 percent combined with alachlor, trifluralin, 2,4-DB, paraquat, or glyphosate. Acifluorfen was applied to 32 percent of the acreage, bentazon to 39 percent, dinoseb to 21 percent, linuron to 34 percent, naptalam to 9 percent, and 2,4-DB to 18 percent (most materials were often applied postemergence). Important combinations of these materials included acifluorfen plus bentazon on 18 percent of the acreage, linuron plus 2,4-DB on 12 percent, bentazon plus 2,4-DB on 6 percent, and naptalam plus 2,4-DB on 4 percent. Fluazifop-butyl and sethoxydim, new postemergence herbicides, were each used on approximately 3 percent of the acreage. Trifluralin was applied to 37 percent of the acreage, 5 percent of which was mixed with metribuzin. Pendimethalin was applied to about 14 percent of the acreage, alachlor to 16 percent, and metolachlor to 8 percent. Glyphosate and paraquat, used primarily with reduced tillage and no-till planting, were applied to 15 percent and 14 percent of the acreage, respectively. Kentucky reported combinations of these two materials with acetanilides, linuron, and metribuzin (applying herbicides in sequence or in combination resulted in the sums of acreage treated with various chemicals to exceed 100 percent).

Important nonpesticide soybean weed management included cultivating, rotating, row spacing, scouting, and seed cleaning (table 25). The practices identified and the acreages estimated varied among States.

Weeds caused an estimated 21-percent soybean yield loss in the Delta States. Among the individual herbicides, removing acifluorfen, bentazon, or 2,4-DB from the market would cause the greatest increases in losses--to 23.9 percent, 25.8 percent, and 25.9 percent, respectively. Removing glyphosate, linuron, metribuzin, sethoxydim, or fluazifop-butyl would cause minor increases in production losses. Losses would increase to 22.8 percent if dinitroanilines were not available, to 22.6 percent if triazines were not available, and to 21.2 percent if acetanilides were not available. Losses would be much greater if no herbicides were available, increasing to 69.2 percent with current cultivation practices and to 54.2 percent with additional cultivation.

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

Weeds	Rank 2/					
	AR	KY	LA	MS	TN	Region
Johnsongrass	3	1	2	1	2	1
Annual morningglory	2	5	1	1	3	2
Cocklebur	1	4	4	3	1	3
Pigweed	3	7	8	4	4	4
Barnyardgrass	4	NR	11	5	NR	5
Sickle pod	10	NR	9	6	6	6
Prickly sida	6	NR	7	6	NR	7
Sesbania hemp	7	NR	5	9	NR	8
Hairy crabgrass	NR	5	13	5	7	9
Bracharia	NR	NR	10	4	NR	10
Common ragweed	NR	8	NR	7	5	11
Large crabgrass	5	NR	NR	NR	NR	12
Johnsongrass seedling	NR	NR	3	NR	NR	13
Spotted spurge	9	NR	NR	10	NR	14
Broadleaf signalgrass	8	NR	NR	NR	NR	15
Pennsylvania smartweed	NR	6	NR	11	7	16
Wild poinsettia	NR	NR	6	NR	NR	17
Goosegrass	NR	NR	14	8	NR	18
Red rice	14	NR	12	NR	NR	19
Giant foxtail	NR	2	NR	NR	NR	20
Yellow foxtail	NR	2	NR	NR	NR	20
Red vine	11	NR	NR	NR	NR	22
Common lambsquarters	NR	7	NR	NR	11	23
Shattercane	NR	3	NR	NR	NR	24
Velvetleaf	13	NR	NR	NR	13	25
Black nightshade	NR	8	NR	NR	10	26
Fall panicum	NR	4	NR	NR	NR	27
Pale smartweed	12	NR	NR	NR	NR	28
Nutsedge	NR	NR	NR	8	NR	29
Ground cherry	NR	NR	NR	NR	9	30
Ivyleaf morningglory	NR	5	NR	NR	NR	31
Smooth crabgrass	NR	NR	13	NR	NR	32
Trumpet creeper	14	9	NR	NR	NR	33
Jimsonweed	NR	NR	NR	NR	12	34
Itchgrass	NR	NR	15	NR	NR	35
Giant ragweed	NR	8	NR	NR	NR	36
Redweed	NR	NR	16	NR	NR	37
Balloon vine	15	NR	NR	NR	NR	38
Perennial vines	NR	NR	NR	NR	14	39
Sweet cherry	NR	9	NR	NR	NR	40
Climbing milkweed	NR	9	NR	NR	NR	40
Purslane	NR	NR	17	NR	NR	42
Mares tail	NR	NR	NR	NR	15	43

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 Delta States 1/

Active ingredients	Percentage of planted acres				
	KY	LA	MS	TN	Region 2/
	Percent				
Acifluorfen	23	18	8	2	12
Alachlor	3	8	7	26	14
Bentazon	20	15	13	4	13
Dinoseb	-	28	12	-	12
Fluazifop-butyl	8	7	-	-	3
Fluchloralin	-	25	9	4	11
Glyphosate	4	12	25	4	14
Linuron	-	25	-	48	18
Metolachlor	-	23	-	6	8
Metribuzin	-	80	30	45	43
Naptalam	4	-	-	-	<1
Oryzalin	-	-	-	4	<1
Paraquat	-	18	2	26	12
Pendimethalin	-	15	27	-	14
Sethoxydim	7	7	-	-	3
Trifluralin	2	35	33	44	32
2,4-DB	-	-	<1	3	1
Acifluorfen + bentazon	-	17	34	5	18
Acifluorfen + 2,4-DB	-	-	<1	6	2
Alachlor + linuron	10	-	-	-	1
Alachlor + metribuzin	9	-	-	-	1
Bentazon + 2,4-DB	-	-	2	24	6
Bentazon + mefluidide	-	8	-	-	2
Linuron + metolachlor	5	-	-	-	<1
Linuron + pendimethalin	3	-	-	-	<1
Linuron + 2,4-DB	-	15	23	-	12
Metribuzin + trifluralin	9	-	10	-	5
Metribuzin + 2,4-DB	-	5	-	-	1
Metribuzin + other	12	-	-	-	2
Naptalam + dinoseb	-	5	17	3	8
Glyphosate + acetanilides + linuron	9	-	-	-	1
Glyphosate + acetanilides + metribuzin	6	-	-	-	<1
Naptalam + dinoseb + 2,4-DB	-	-	-	5	1
Paraquat + acetanilides + linuron	13	-	-	-	2
Paraquat + acetanilides + metribuzin	6	-	11	-	5
Paraquat + oryzalin + linuron	10	-	-	-	1
Paraquat + oryzalin + metolachlor	5	-	-	-	<1

- = Insignificant acreage.

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

2/ State estimates were weighted by planted acres and averaged to obtain regional estimates. The estimates provided for Arkansas were not sufficiently detailed to be compared with estimates from other States. For this table, Arkansas estimates were excluded. Four States were used to calculate weights. In Arkansas, 70 percent of acreage was estimated to be treated preplant incorporated, 41 percent preemergence (proportions preemergent to crop and to weeds were not specified), 75 percent early postemergence, 20 percent post-directional to crop, and 19 percent layby overall.

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

Nonpesticide weed controls	Percentage of planted acres 2/			
	AR	KY	LA	MS
	Percent			
Cultivation	-	-	65-80	-
Rotation	40	50	3/ 18	
Row spacing	10	5	-	-
Scouting 4/	-	10	-	1
Seed cleaning	-	8	-	5/ 100

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Tennessee specified no significant nonpesticide practices for soybeans.
3/ Thirteen percent to milo or rice and 5 percent to sugarcane.
4/ Scouting is a pest detection practice which may lead to the use of pesticide or nonpesticide pest management practices.
5/ Balloon vine, red vine, and Crotalaria.

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

Weed control practices	Average percentage yield loss 2/					
	AR	KY	LA	MS	TN	Region 3/
	Percent					
Current controls 4/	8.4	20.8	30.1	22.1	32.7	21.0
Remove: 5/						
Acifluorfen	8.4	20.8	36.6	28.1	34.0	23.9
Alachlor	8.4	20.8	30.1	22.1	32.7	21.0
Bentazon	8.4	20.8	47.4	26.1	35.8	25.8
Dinoseb	8.4	20.8	30.1	22.1	32.7	21.0
Fluchloralin	8.4	20.8	30.1	22.1	32.7	21.0
Glyphosate	8.4	24.4	30.1	22.1	32.8	21.3
Linuron	8.4	20.8	30.1	22.1	34.0	21.2
Metolachlor	8.4	20.8	30.1	22.1	32.7	21.0
Metribuzin	8.4	21.6	32.5	22.1	36.4	22.1
Paraquat	8.4	20.8	30.1	22.1	32.7	21.0
Pendimethalin	8.4	20.8	30.1	22.1	32.7	21.0
Sethoxydim or fluazifop-butyl	8.4	20.8	36.6	22.1	32.7	22.3
Trifluralin	8.4	20.8	30.1	22.1	32.7	21.0
2,4-DB	19.6	22.2	35.3	22.1	35.0	25.9
Acetanilides	8.4	20.8	30.1	22.1	33.9	21.2
Dinitroanalines	12.4	20.8	30.1	22.1	36.7	22.8
Triazines	8.4	20.8	30.1	28.1	32.7	22.6
No chemical controls:						
With extra cultivation	34.0	67.3	100.0	47.0	39.5	54.2
With current cultivation	62.0	91.9	100.0	62.6	44.6	69.7

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.

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 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.

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