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Pesticide Assessment of Field Corn and Soybeans: Northeastern States

National Agricultural Pesticide Impact Assessment Program

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ABSTRACT

This report summarizes the pesticide assessment for corn and soybeans in the Northeast. Without insecticides, cutworms would cause the greatest corn yield losses and Mexican bean beetles the greatest soybean yield losses. Seed rots and seedling blights would cause substantial corn yield losses without pesticide control, while nematodes would reduce soybean yields. Among the herbicides, the loss of triazines would cause the greatest corn yield losses and acetanilides the greatest soybean 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 Northeast: Delaware, Maryland, New Jersey, New York, Pennsylvania, and Virginia. Included are rankings of important 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 the losses incurred by some producers will be significantly greater than the State or regional averages.

Acreage planted to corn or soybeans accounted for approximately 40 percent of the U.S. acreage planted to crops (excluding pasture or idle land) in 1978. Field corn accounted for 22 percent and soybeans accounted for 18 percent of that acreage. Approximately 6 percent of the U.S. corn acreage and 1.5 percent of the U.S. soybean acreage were planted in the Northeastern region. This region produced approximately 4 percent of the corn and 2 percent of the soybeans in the United States from 1976 to 1980. Acreage planted to corn or soybeans accounted for approximately 43 percent of acreage used for crops in this region in 1978. The average area planted to corn between 1976 and 1980 was 186,000 acres for Delaware, 723,000 for Maryland, 149,000 for New Jersey, 1,306,000 for New York, 1,697,000 for Pennsylvania, and 436,000 for Virginia. The average planted soybean area during this same period was 247,000 acres for Delaware, 358,000 for Maryland, 188,000 for New Jersey, 20,000 for New York, 80,000 for Pennsylvania, and 494,000 for Virginia.

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 representatives 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 each 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 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 impact 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 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 38 percent of the planted corn acreage in the Northeastern States was under conventional tillage, 30 percent under reduced tillage, and 32 percent under no-till (table 1). However, there were wide variations among States. Estimates for Pennsylvania and Virginia showed a relatively even distribution of planted acreage between the three tillage systems. Estimates for New Jersey and New York showed a concentration of acreage in conventional and reduced tillage systems, while Maryland and Delaware showed a concentration in the reduced and no-till systems.

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

Tillage systems	Percentage of planted acres					
	MD and DE	NJ	NY	PA	VA	Region 2/
	Percent					
Conventional 3/	13	41	67	30	33	38
Reduced 4/	24	47	28	34	28	30
No-till 5/	63	12	5	36	39	32

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ State estimates were weighted by planted acres to obtain the regional estimates.
3/ Moldboard plowing, two passes with disc or field cultivator before planting, one or more cultivations after crop emergence.
4/ Disc-plowing: disc stubble one or two times before planting, one cultivation after crop emergence; chisel-plowing: chisel plow, one cultivation after crop emergence; or rotary-tillage: disc stubble, roto-till and plant in one pass, one cultivation after crop emergence.
5/ No tillage operations before, during, or after planting.

Insects, Insecticides, and Losses

European corn borers were the most economically important insects of field corn in the Northeastern States, followed by armyworms, black cutworms, northern corn rootworm larvae, stalk borers, and seed corn maggots, respectively (table 2). Other less important insects were fall armyworms, wireworms, slugs, and corn earworms. Flea beetles, corn leaf aphids, northern corn rootworm adults, garden centipedes, and certain other insects were less severe.

Ranking insects by number of acres chemically treated did not equal the pest ranking. Approximately 23 percent of the acreage in the Northeast was treated for seedcorn maggots: 17 percent with lindane and 6 percent with diazinon (tables 3 and 4). Approximately 19 percent of the acreage was treated for armyworms, 16.5 percent of which was treated with toxaphene. Considerably

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

Insects	Rank 2/					
	MD and DE	NJ	NY	PA	VA	Region
European corn borers	1	2	1	8	1	1
Armyworms	6	1	2	3	1	2
Black cutworms	3	6	2	4	3	3
Northern corn rootworm larvae	5	3	2	2	7	4
Stalk borers	8	NR	3	1	4	5
Seed corn maggots	9	5	2	5	NR	6
Fall armyworms	2	9	3	NR	2	7
Wireworms	7	4	2	11	5	8
Slugs	NR	8	2	6	NR	9
Corn earworms	2	NR	3	NR	7	10
Flea beetles	4	12	3	10	NR	11
Corn leaf aphids	6	NR	4	9	NR	12
Northern corn rootworm adults	NR	10	3	9	NR	13
Garden centipedes	NR	13	NR	7	NR	14
Japanese beetles	NR	NR	NR	9	8	15
White grubs	9	7	3	NR	NR	16
Grasshoppers	NR	NR	NR	NR	6	17
Thrips	NR	NR	3	NR	NR	18
Seed corn beetles	9	NR	NR	NR	NR	19
Cereal leaf beetles	NR	NR	NR	NR	9	20
Stink bugs	NR	NR	NR	NR	10	21
Mites	NR	11	NR	NR	NR	22
Western corn rootworms	NR	NR	4	NR	NR	23

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.

less acreage was treated with carbofuran, methomyl, malathion, and carbaryl. Northern corn rootworm larvae were treated on approximately 17 percent of the acreage, primarily with carbofuran and fonofos on 12 percent and 5 percent, respectively.

Fewer acres, approximately 10 percent, were treated for a generally undefined group of insects called the soil complex, such as cutworms, rootworms, seed corn maggots, centipedes, white grubs, and wireworms (table 5). However, the soil complex also included pests not specified in the table, such as rose chafers, seed corn beetles, root aphids, and nematodes (discussed under diseases). The soil complex was treated with carbofuran and terbufos on almost equal numbers of acres, followed by fewer acres of phorate treatments. Fewer acres were treated with disulfoton, fonofos, isofenfos, ethoprop, and fensulfothion, respectively.

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

Active ingredients	Timing 2/	Target pest	Percentage of planted acres					
			MD and DE	NJ	NY	PA	VA	Region 3/
					Percent			
Carbaryl	10	Armyworms	-	-	-	-	1	<1
	10	European corn borers	2	-	-	-	-	<1
	Bait 8,10	Cutworms	-	3	-	-	-	<1
	10	Other	<1	-	<1	-	-	<1
Carbofuran	3	Armyworms	-	-	-	2	<1	<1
	3	Rootworms and soil complex	6	21	17	23	<1	14
	3	European corn borers	-	-	*	-	9	6
	7	do.	-	-	-	-	4	<1
Chlorpyrifos	1	Cutworms	1	2	3	-	1	1
	8	do.	1	<1	*	-	1	<1
Diazinon	1	do.	-	-	-	1	-	<1
	10	Grasshoppers	-	-	-	-	<1	<1
	10	Mites	-	-	-	-	<1	<1
	ST	Seed corn maggots	-	8	-	17	-	6
	ST	Other	-	-	1	-	-	<1
Disulfoton	3	Soil complex	1	-	3	-	-	1
Ethoprop	3	do.	1	-	-	-	-	<1
Fensulfothion	3	do.	1	-	-	-	-	<1
Fenvalerate	8,9,10	European corn borers	2	-	-	-	-	<1
	8,9,10	Cutworms	<1	-	-	-	-	<1

See footnotes at end of table.

--Continued

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

Active ingredients	Timing 2/	Target pest	Percentage of planted acres					
			MD and DE	NJ	NY	PA	VA	Region 3/
					Percent			
Fonofos	3	Garden centipedes	–	–	–	<1	–	<1
	3	Rootworms and soil complex	5	17	7	6	1	6
	10	European corn borers	–	–	*	–	2	<1
	3	Wireworms	–	–	–	–	1	<1
Isofenfos	3	Soil complex	1	<1	–	–	–	<1
Lindane	ST	Seed corn maggots	75	–	–	8	–	17
Malathion	8,10	Armyworms	1	–	<1	–	–	<1
	10	Grasshoppers	–	–	–	–	1	<1
Methomyl	10	Armyworms	3	–	<1	–	–	<1
	10	Fall armyworms	–	6	*	–	2	<1
Methyl parathion	10	European corn borers	4	2	<1	–	–	<1
Parathion	10	do.	–	7	<1	–	–	<1
Phorate	3	Soil complex	1	3	4	–	–	1
Terbufos	3	do.	5	3	7	–	–	3
Toxaphene	3	Armyworms	–	–	–	–	12	2
	3	Cutworms	–	–	–	–	19	3
	8,9,10	Armyworms	78	–	–	–	–	14
	8,9,10	Cutworms	*	–	–	–	–	*
Trichlorfon	8,9,10	do.	2	–	–	–	<1	<1

– = Insignificant acreage.
* = Included in number directly above.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
ST = Seed treatments (including planter box treatments).
1 = Preplant broadcast with or without incorporation.
3 = At planting as a band.
7 = Postemergence layby, with or without incorporation.
8 = Postemergence foliar or over row.
9 = Postemergence whorl directed.
10 = Postemergence aerial.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Approximately 10 percent of the corn acreage was treated with toxaphene at planting time for cutworms. The planting time treatments for cutworms were likely directed against armyworms, and vice-versa. Considerably less acreage was treated with rescue treatments of toxaphene, chlorpyrifos, diazinon, trichlorfon, carbaryl, and fenvalerate.

Considerably fewer acres (approximately 5 percent) were treated for European corn borers, predominantly treated with carbofuran or fonofos (table 5). Methyl parathion was the next commonly applied insecticide followed by carbaryl, parathion, and fenvalerate.

All of the Northeastern States indicated pest management practices exclusive of pesticides (table 6). The nonpesticide practices most frequently identified were resistant and tolerant varietal selection and certain cultural procedures for which no estimates were reported. Only Maryland and Delaware identified regular ongoing scouting efforts (table 6).

Table 4. Corn insecticide use: total acreage treated by active ingredient in the Northeastern States 1/

Active ingredients	Percentage of planted acres treated					
	MD and DE	NJ	NY	PA	VA	Region 2/
	Percent					
Carbaryl	3	3	1	–	1	1
Carbofuran	6	21	17	25	14	17
Chlorpyrifos	1	3	3	–	1	2
Diazinon	–	8	1	18	1	7
Disulfoton	1	–	3	–	–	1
Ethoprop	1	–	–	–	–	<1
Fensulfothion	1	–	–	–	–	<1
Fenvalerate	2	–	–	–	–	<1
Fonofos	5	17	7	6	1	6
Isofenfos	1	1	–	–	–	<1
Lindane	75	–	–	8	–	17
Malathion	1	–	–	1	–	<1
Methomyl	3	6	1	–	2	1
Methyl parathion	4	2	1	–	–	1
Parathion	–	7	1	–	–	<1
Phorate	1	3	4	–	–	1
Terbufos	5	3	7	–	–	3
Toxaphene	78	–	–	–	–	14
Trichlorfon	2	–	–	–	1	<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.

Table 5. Percentage of field corn planted acres treated with insecticides for each insect in the Northeastern States 1/

Insects	Insecticide	Percentage of acres treated
		Percent
Armyworms	Carbaryl	<1
	Carbofuran	<1
	Malathion	<1
	Methomyl	<1
	Toxaphene	17
	Total	19
Corn rootworm larvae	Carbofuran	12
	Fonofos	5
	Total	17
Cutworms (all species)	Carbaryl	<1
	Chlorpyrifos	2
	Diazinon	<1
	Fenvalerate	<1
	Toxaphene	7
	Trichlorfon	<1
	Total	10
European corn borers	Carbaryl	<1
	Carbofuran	2
	Fenvalerate	<1
	Fonofos	1
	Methyl parathion	1
	Parathion	<1
	Total	5
Fall armyworms	Methomyl	<1
Garden centipedes	Fonofos	<1
Grasshoppers	Diazinon	<1
	Malathion	<1
	Total	<1
Seed corn maggots	Diazinon	6
	Lindane	17
	Total	23
Soil complex 2/	Carbofuran	3
	Disulfoton	1
	Ethoprop	<1
	Fensulfothion	<1
	Fonofos	<1
	Isofenfos	<1
	Phorate	2
	Terbufos	3
	Total	10
Wireworms	Fonofos	<1
Other (unidentified) 2/		<1

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ May include insects already listed.

Armyworms, cutworms, European corn borers, corn rootworm larvae, and the soil complex had the greatest potential for damage in the region (table 7). Only armyworms, cutworms, and corn borers caused a regional yield loss greater than 1 percent. If no pesticides were available, each of these three pests would cause almost a 4-percent regional yield loss.

Table 6. Nonpesticide corn insect management in the Northeastern States 1/

Insects	Insect management practices	Percentage of planted acres 2/		
		MD and DE	NY	PA
		Percent		
Armyworms	Scouting 3/	50-60	4/	-
Black cutworms	do.	50-60	4/	-
Corn earworms	do.	30-40	-	-
European corn borers	Resistant variety	20	4/	100
	Scouting 3/	30-40	4/	-
Fall armyworms	do.	30-40	-	-
Flea beetles	do.	50-60	-	-
Northern corn rootworms	Tolerant variety	-	-	100
Stalk borers	Scouting 3/	30-40	-	-

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ New Jersey and Virginia reported no formal programs.
3/ Scouting is a pest detection practice which may lead to the use of pesticide or nonpesticide pest management practices.
4/ New York reported that the practices occur but made no acreage estimates.

Table 7. Average percentage corn insect yield losses in the Northeastern States 1/

Insects and insect control practices	Average percentage yield loss 2/					
	MD and DE	NJ	NY	PA	VA	Region 3/
	Percent					
Armyworms:						
Current controls	0.1	1.2	-	2.3	1.5	1.5
No pesticide controls	3.4	2.5	u	3.5	5.0	3.8
Black cutworms:						
Current controls	.5	.9	1.2	.7	2.1	1.0
No pesticide controls	8.5	1.2	u	1.5	6.2	4.4
Cereal leaf beetles:						
Current controls	-	-	-	-	<.1	<.1
No pesticide controls	-	-	-	-	<.1	<.1
Corn earworms:						
Current controls	4/	-	-	-	.3	<.1
No pesticide controls	4/	-	-	-	.7	<.1

See footnotes at end of table.

--Continued

Table 7. Average percentage corn insect yield losses in the Northeastern States 1/--Continued

Insects and insect control practices	Average percentage yield loss 2/					
	MD and DE	NJ	NY	PA	VA	Region 3/
	Percent					
Corn rootworm adults:						
Current controls	-	-	0.3	-	-	<0.1
No pesticide controls	-	-	u	-	-	<.1
Corn rootworm larvae:						
Current controls	-	-	5/	0.2	1.0	.3
No pesticide controls	1.8	1.5	-	.3	3.0	1.4
European corn borers:						
Current controls	.5	1.3	8.5	-	4.0	1.1
No pesticide controls	7.5	2.4	u	-	7.4	3.7
Fall armyworms:						
Current controls	3.6	2.2	.1	-	.2	.1
No pesticide controls	17.0	5.3	u	-	.5	.3
Flea beetles:						
Current controls	-	-	-	-	.2	<.1
No pesticide controls	-	-	-	-	.4	.1
Garden centipedes:						
Current controls	-	-	-	.5	-	.2
No pesticide controls	-	-	-	.6	-	.3
Grasshoppers:						
Current controls	-	-	-	-	.1	<.1
No pesticide controls	-	-	-	-	.4	.1
Seedcorn maggots:						
Current controls	-		-	.3	-	.1
No pesticide controls	-	1.8	-	.3	-	.2
Slugs:						
Current controls	-	.2	-	-	-	<.1
No pesticide controls	-	.4	-	-	-	<.1
Soil complex:						
Current controls	1.0	-	2.0	-	-	.3
No pesticide controls	6.0	-	u	-	-	1.5
Stalk borers:						
Current controls	-	-	-	.8	1.0	.6
No pesticide controls	-	-	-	1.1	1.0	.8
Wireworms:						
Current controls	-	-	-	-	.9	.2
No pesticide controls	-	-	-	-	3.1	.7

- = Insignificant yield loss.
u = Magnitude of losses unknown.
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/ Losses combined with fall armyworms.
5/ Losses from corn rootworm larvae in New York are reported under soil complex.

Diseases, Fungicides, Nematicides, and Losses

The most important diseases of field corn in the Northeastern States were stalk rots, the most frequently cited causal agents of which were *Fusarium moniliforme*, *Gibberella zeae*, *Colletotrichum graminicola*, and *Diplodia* spp. (table 8). The second-most important group of diseases was the Helminthosporium leaf blights. A variety of foliar diseases and ear rots fall into a third grouping of notable corn diseases in the Northeast. Other diseases of lesser importance in the Northeast included viruses, nematodes, seed rots and damping-off, smuts, and rusts. However, even with comprehensive protective treatments, seed rots and seedling blights ranked the highest in New Jersey (table 8).

Table 8. Ranking of corn disease and nematode pests in the Northeastern States 1/

Disease and nematode pests	Rank 2/					
	MD and DE	NJ	NY	PA	VA	Region
Fusarium stalk rot	1	2	1	1	1	1
Gibberella stalk rot	1	2	1	1	1	1
Anthracnose stalk rot	5	NR	1	1	3	3
Helminthosporium leaf spot	3	NR	2	3	2	4
Northern corn leaf blight	2	5	NR	2	3	5
Diplodia stalk rot	1	NR	NR	1	NR	6
Gray leaf spot	4	NR	NR	3	5	7
Fusarium kernel and ear rot	6	3	1	6	6	8
Stewart's wilt	6	5	5	4	8	9
Anthracnose leaf blight	5	5	2	NR	3	10
Gibberella kernel and ear rot	NR	3	1	6	6	11
Aspergillus ear rot	NR	NR	2	6	4	12
Seed rots and damping-off	3	1	NR	6	9	13
Eyespot	NR	NR	2	5	NR	14
MDMV	6	NR	5	6	7	15
Southern corn leaf blight	6	5	NR	7	3	16
Common corn rust	6	5	4	6	NR	17
Common smut	6	NR	6	6	NR	18
Diplodia ear rot	6	NR	NR	6	NR	19
MCDV	NR	NR	NR	7	7	20
Maize white line virus	NR	NR	3	NR	NR	21
Nematodes	7	4	7	NR	10	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.

All corn seed planted in the Northeast was treated with captan, maneb, or thiram (table 9). While seed rots and seedling blights were relatively unimportant in the Northeast, they would cause an approximate 11-percent yield loss without treatment (table 10).

Chemical control methods were generally not used for field corn diseases other than nematodes, seed rots, and seedling diseases. Use of resistant varieties was the primary disease management practice for field corn in the Northeast (table 11). The results showed a high degree of variability in the acreage where resistant varieties were used.

Nematodes did not significantly affect the Northeast except in the sandy coastal soils of Virginia (table 10). Thus, nematicide use was insignificant in the Northeast except in Virginia, where approximately 27 percent of the acreage was treated with carbofuran, ethoprop, terbufos, or fensulfothion (table 9). Nematodes caused a 1.3-percent yield loss in Virginia but could cause a 6.5-percent loss if no pesticides were available (table 10).

Table 9. Corn fungicide and nematicide use in the Northeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of acres treated					
			MD and DE	NJ	NY	PA	VA	Region 3/
					Percent			
Captan	ST	Seed rots and damping-off	75	30	80	100	70	83
Maneb	ST	do.	1	32	5	-	-	3
Thiram	ST	do.	24	38	15	-	30	15
Carbofuran	3	Nematodes	<1	<1	-	-	15	3
Ethoprop	3	do.	<1	-	-	-	5	<1
Terbufos	3	do.	<1	<1	-	-	3	<1
Fensulfothion	3	do.	-	-	-	-	4	<1

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
ST = Seed treatment (including planter box treatments).
3 = Banded, at planting.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Table 10. Average percentage corn yield losses from diseases controlled with pesticides in the Northeastern States 1/

Diseases and disease control practices	Average percentage yield loss 2/					
	MD and DE	NJ	NY	PA	VA	Region 3/
			Percent			
Seed rots and seedling blights:						
Current controls	0.2	1.3	-	-	-	0.3
No pesticide controls	15.0	3.2	u	10.1	9.6	10.9
Nematodes:						
Current controls	-	-	-	-	1.3	.5
No pesticide controls	-	<.1	u	-	6.5	1.1

- = Insignificant acreage.
u = Magnitude of losses unknown.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates were averaged over the entire planted acres in each area. 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 11. Nonpesticide corn disease management in the Northeastern States 1/

Diseases	Disease management practice	Percentage of acres treated				
		MD and DE	NJ	NY	PA	VA
				Percent		
Anthracnose leaf blight	Resistant variety	-	-	*	-	10
H. carbonum III	do.	-	*	*	15	-
Gray leaf spot	do.	-	-	*	-	10
Northern corn leaf blight	do.	H	*	*	15	70
Southern corn leaf blight	do.	H	*	*	100	100
Stalk rots	do.	H	-	*	90	20
Stewart's wilt	do.	H	*	*	-	30

- = Insignificant acreage.
* = Reported but no estimate provided.
H = Reported at an unspecified high percentage of planted acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.

Weeds, Herbicides, and Losses

Fall panicum, giant foxtail, green foxtail, common lambsquarters, redroot pigweed, and large crabgrass ranked as the six most economically important corn weed problems in the Northeast (table 12). These weeds were the only ones identified by all the States. Fall panicum ranked highest in Maryland, Delaware, New York, and Pennsylvania. However, there were highly ranked weeds

Table 12. Ranking of corn weed pests in the Northeastern States 1/

Weeds	Rank 2/					
	MD and DE	NJ	NY	PA	VA	Region
Fall panicum	1	2	1	1	2	1
Giant foxtail	2	3	2	1	5	2
Green foxtail	4	NR	2	1	NR	3
Common lambs-quarters	5	6	2	3	7	4
Redroot pigweed	5	10	2	3	7	5
Large crabgrass	4	9	2	6	4	6
Yellow nutsedge	NR	12	1	2	7	7
Smooth pigweed	6	NR	NR	3	8	8
Johnsongrass	3	NR	NR	10	1	9
Velvetleaf	7	4	NR	4	7	10
Quackgrass	NR	7	1	7	NR	11
Smooth crabgrass	4	NR	NR	6	NR	12
Barnyardgrass	NR	7	3	5	NR	13
Horsenettle	NR	NR	3	8	5	14
Bindweed	NR	1	3	6	NR	15
Common ragweed	5	8	3	NR	7	16
Smartweed	NR	NR	3	6	NR	17
Morningglory	7	NR	NR	NR	3	18
Common cocklebur	7	NR	NR	NR	5	19
Witchgrass	NR	NR	2	10	NR	20
Canada thistle	NR	5	NR	8	NR	21
Mustard	NR	NR	2	NR	NR	22
Wirestem muhly	NR	NR	3	9	NR	23
Dogbane	NR	13	NR	8	NR	24
Jimsonweed	7	11	NR	NR	9	25
Bermudagrass	NR	NR	NR	NR	6	26
Milkweed	NR	NR	3	NR	10	27
Corn chamomille	NR	NR	3	NR	NR	28
Shattercane	NR	14	NR	10	NR	29
Common purslane	8	NR	NR	NR	NR	30

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.

in some States that were not mentioned in other States. Horsenettle ranked highest in New Jersey, yellow nutsedge and quackgrass in New York, and Johnsongrass in Virginia.

The most widely used herbicides in all the Northeast were atrazine, applied on approximately 91 percent of the corn acreage and alachlor on 33 percent (table 13). Other herbicides included cyanazine, metolachlor, simazine, dicamba, and butylate, used on approximately 20 percent, 19 percent, 16 percent, 13 percent, and 4 percent of the acreage, respectively. Paraquat was used on 26 percent of the acreage in the region, primarily on no-till acreage in Maryland, Delaware, and Virginia. Other herbicides used on relatively small acreages were EPTC, glyphosate, pendimethalin, and 2,4-D.

Weeds caused 2-percent yield losses to corn in the Northeast (table 14). If atrazine were no longer available for use, the yield losses due to weeds would increase to 13 percent; the losses would be much higher in Maryland, Delaware, and Pennsylvania than in Virginia. Removing paraquat from the market would

Table 13. Corn herbicide use in the Northeastern States 1/

Active ingredients	Percentage of planted acres 2/					
	MD and DE	NJ	NY	PA 3/	VA	Region 4/
	Percent					
Atrazine	100	96	90	81	100	91
Alachlor	40	62	30	24	40	33
Butylate + Safener	5	10	5	2	5	4
Cyanazine	30	7	10	19	30	20
Dicamba	25	20	15	4	15	13
EPTC + Safener	5	-	5	-	5	3
Glyphosate	-	-	10	-	-	3
Metolachlor	35	22	10	8	35	19
Paraquat	55	-	5	4	55	26
Pendimethalin	-	-	10	-	-	3
Simazine	35	2	5	6	35	16
2,4-D	-	15	15	-	-	4

- = Insignificant acreage.

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

2/ Estimates include acres treated with the active ingredient both individually or in tank mixes. Hence, there is double counting of acres treated with tank mixes.

3/ Estimates from Michael Hanthorn, Craig Osteen, Robert McDowell, and Larry Roberson, 1980 Pesticide Use in Field Corn in the Major Producing States. ERS Staff Report No. AGES820202, Economic Research Service, USDA.

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

cause the second-highest yield loss, approximately 11 percent, especially in Maryland and Delaware where losses of about 35 percent would occur. If dicamba, 2,4-D, or cyanazine were no longer available, losses would increase to approximately 9 percent, 4 percent, and 3 percent, respectively. Losses would not increase if simazine were no longer available because there were other registered herbicides with similar efficacy.

If triazines were not available, losses would increase to about 28 percent; the highest of which would occur in Pennsylvania, with about a 44-percent loss. If acetanilides or thiocarbamates were no longer available, losses would increase to about 6 percent and 3 percent, respectively. If all herbicides were no longer available, weed losses would increase significantly to about 61 percent if cultivation were not increased and to 37 percent even if two to three cultivations were added. The long-term effect would be a significant increase in perennial broadleaf weeds and grass species.

Table 14. Average percentage corn weed yield losses in the Northeastern States 1/

Weed control practices	Average percentage yield loss 2/ 3/				
	MD and DE	NJ	PA	VA	Region 4/
			Percent		
Current controls	4.9	7.1	0.7	1.3	2.2
Remove:					
Atrazine	17.8	7.1	17.5	1.3	13.0
Cyanazine	4.9	7.1	1.5	7.9	2.6
Dicamba	14.2	9.7	8.7	3.0	8.8
Paraquat	35.3	7.1	.7	6.2	10.7
Simazine	4.9	7.1	.7	2.8	2.2
2,4-D	4.9	7.1	6.2	3.9	4.1
Acetanilides	15.4	7.9	1.5	3.6	5.8
Thiocarbamates	4.9	7.1	1.6	2.1	2.8
Triazines	17.9	14.9	43.8	10.1	28.1
No chemical controls:					
With current cultivation	54.0	NR	75.0	40.5	60.9
Additional tillage on reduced and no-till	NR	35.0	57.5	35.5	36.7

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates are average yield losses over the entire planted acres in the State from a maximum where weeds cause no loss. Other problems and farm management practices were held constant.
3/ No yield loss estimates were provided by New York.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

SOYBEANS

Tillage Systems

An estimated 24 percent of the soybean planted acreage in the Northeast was under conventional tillage, 33 percent under reduced tillage, and 43 percent under no-till (table 15). Maryland and Delaware had a greater proportion of no-till and reduced tillage. New Jersey had a somewhat greater proportion of reduced tillage, and Virginia had a reasonably equal distribution of tillage practices.

Insects, Insecticides, and Losses

Mexican bean beetles were the most important soybean pest in the Northeast (table 16). Corn earworms and mites followed in importance. The following insect pests were not reported to be important in every State: stink bugs, green cloverworms, bean leaf beetles, fall armyworms, and Japanese beetles, respectively.

Table 15. Soybean planted acreage under major tillage systems in the Northeastern States 1/

Tillage systems	Percentage of planted acres 2/			
	MD and DE	NJ	VA	Region 3/
	Percent			
Conventional 4/	17	21	33	24
Reduced 5/	32	47	28	33
No-till 6/	51	32	39	43

1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ New York and Pennsylvania did not provide estimates for soybeans.
3/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
4/ Moldboard plowing, two passes with disc or field cultivator before planting, one or more cultivations after crop emergence.
5/ Disc-plowing: disc stubble one or two times before planting, one cultivation after crop emergence; chisel-plowing: chisel plow, one cultivation after crop emergence; or rotary-tillage: disc stubble, roto-till and plant in one pass, one cultivation after crop emergence.
6/ No tillage operations before, during, or after planting.

More acres were treated for Mexican bean beetle control than for any other insect (table 17). Roughly a third as many were treated for corn earworms, and few acres were treated to control green cloverworms, bean leaf beetles, mites, and fall armyworms. None of the acres were treated for Japanese beetles or stink bugs.

New Jersey practiced nonchemical pest management practices on an undetermined but small number of acres (table 18). New Jersey growers primarily used hymenopterous parasites to control Mexican bean beetles.

Maryland, Delaware, and Virginia each reported scouting for specific insect pests of soybeans, and each indicated moderate use of the hymenopterous parasite to control Mexican bean beetles. Delaware and Maryland also irrigated as a cultural method of suppressing mites.

The Northeastern region reported low yield losses from insect infestations (table 19). The more pronounced of the low-level losses occurred through infestations of Mexican bean beetles, corn earworms, and mites, each of which caused a regional yield loss greater than 1 percent. If no pesticides were available, a 3-percent loss would be attributed to Mexican bean beetles, 1.8 percent to corn earworms, and 1 percent to mites.

Table 16. Ranking of soybean insect pests in the Northeastern States 1/

Insects	Rank 2/ 3/			
	MD and DE	NJ	VA	Region
Mexican bean beetles	1	1	2	1
Corn earworms	2	NR	1	2
Mites	3	2	4	3
Stink bugs	NR	NR	3	4
Green cloverworms	NR	4	4	5
Bean leaf beetles	NR	NR	4	6
Fall armyworms	NR	NR	4	6
Japanese beetles	NR	3	NR	8

NR = Not reported.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ New York and Pennsylvania did not provide estimates for soybeans.
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 17. Soybean insecticide use in the Northeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres 3/			
			MD and DE	NJ	VA	Region 4/
			Percent			
Acephate	8,10	Corn earworms	5/1	-	-	<1
	8,10	Mexican bean beetles	-	<1	-	<1
		Total	1	<1	-	<1
Aldicarb	3	Mexican bean beetles	2	-	-	1
Carbaryl	8,10	Corn earworms	-	-	3	1
	8,10	Green cloverworms	-	-	<1	<1
	8,10	Mexican bean beetles	1	9	1	2
		Total	1	9	5	4
Carbofuran	3	Bean leaf beetles	-	-	<1	<1
	3	Mexican bean beetles	19	2	2	10
		Total	19	2	2	11
Carbophenothion	8,10	Mites	<1	<1	-	<1
Dimethoate	8,10	Mexican bean beetles	3	<1	1	2
Dipel	10	Corn earworms	<1	-	-	<1
Disulfoton	3	Mexican bean beetles	2	-	-	<1
Fenvalerate	8,10	Corn earworms and Mexican bean beetles	5/2	-	-	<1
Malathion	8,10	Bean leaf beetles	-	-	2	<1
	8,10	Corn earworms	5/<1	-	8	3
	8,10	Mexican bean beetles	-	1	4	2
	8,10	Fall armyworms	-	-	1	<1
	8,10	Green cloverworms	-	-	2	<1
		Total	<1	1	17	7
Methyl parathion (micro-encapsulated)	10	Corn earworms and Mexican bean beetles	5/<1	-	-	<1
Parathion	8,10	Mites	-	1	-	<1
Phorate	3	Mexican bean beetles	<1	-	-	<1

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
3 = Banded at planting.
8 = Postemergence foliar over row.
10 = Postemergence broadcast (aerial).
3/ New York and Pennsylvania did not provide estimates for soybeans.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
5/ Maryland growers controlled corn earworms and Mexican bean beetles simultaneously with these pesticides.

Table 18. Nonpesticide soybean insect management in the Northeastern States 1/

Insects	Insect management practice	Percentage of planted acres 2/		
		MD and DE	NJ	VA
			Percent	
Bean leaf beetles	Scouting 3/	-	-	55
Corn earworms	do.	25	-	55
Fall armyworms	do.	-	-	55
Green cloverworms	do.	-	-	55
Mexican bean beetles	Delayed planting	<1	-	-
	Pediobius foviolatus	8	-	30
	Scouting 3/	36	-	55
	Trap crop	<1	-	30
Mites	Irrigation	2	-	-
	Scouting	27	-	55

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ New York and Pennsylvania did not provide estimates for soybeans.
3/ Scouting is a pest detection practice which may lead to the use of pesticide or nonpesticide pest management practices.

Table 19. Average percentage soybean insect yield losses in the Northeastern States 1/

Insects	Average percentage yield loss 2/ 3/			
	MD and DE	NJ	VA	Region 4/
		Percent		
Bean leaf beetles:				
Current controls	-	-	0.1	<0.1
No pesticide controls	-	-	.2	<.1
Corn earworms:				
Current controls	0.2	-	1.4	.6
No pesticide controls	1.3	-	3.4	1.8

See footnotes at end of table. --Continued

Table 19. Average percentage soybean insect yield losses in the Northeastern States 1/--Continued

Insects	Average percentage yield loss 2/ 3/			
	MD and DE	NJ	VA	Region 4/
		Percent		
Fall armyworms:				
Current controls	-	-	.1	<.1
No pesticide controls	-	-	.3	.1
Green cloverworms:				
Current controls	-	-	.1	<.1
No pesticide controls	-	-	.2	<.1
Japanese beetles:				
Current controls	-	-	-	-
No pesticide controls	-	0.2	-	<.1
Mexican bean beetles:				
Current controls	.7	.3	.4	.5
No pesticide controls	4.7	2.4	.9	3.0
Mites:				
Current controls	1.0	.2	.4	<.1
No pesticide controls	1.5	.4	.5	1.0
Stink bugs:				
Current controls	-	-	.2	<.1
No pesticide controls	-	-	.8	.3

\- = Insignificant acreage.
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/ New York and Pennsylvania did not provide estimates.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Diseases, Fungicides, Nematicides, and Losses

The most serious soybean diseases in the Northeast were anthracnose, brown stem spot, pod and stem blight, stem canker, and nematodes. The most troublesome nematodes were the cyst, lesion, root-knot, and sting nematodes (table 20).

Less than 3 percent of the total acreage in the reporting States was ever treated with foliar fungicides. Fungicide seed treatments were not reported by Maryland, Delaware, or Virginia, and were reportedly used on only 10 percent of the New Jersey acreage. Nematicide use was reported on nearly half of the

Table 20. Ranking of soybean disease and nematode pests in the Northeastern States 1/

Diseases and nematodes	Rank 2/ 3/		
	MD and DE	NJ	VA
Anthracnose	m	1	3
Bean pod mottle virus	NR	NR	8
Brown spot	m	NR	9
Brown stem spot	m	NR	2
Bud blight	m	NR	NR
Charcoal rot	NR	NR	5
Downy mildew	m	NR	9
Frogeye leaf spot	NR	NR	10
Fusarium	NR	NR	6
Nematodes	*	3	*
Cyst	1	NR	4/1
Dagger	NR	NR	3
Lance	NR	NR	2
Lesion	1	NR	1
Ring	NR	NR	4
Root-knot	1	NR	1
Sting	NR	NR	1
Stubby root	NR	NR	2
Peanut mottle virus	m	NR	7
Pod and stem blight	m	2	2
Powdery mildew	NR	NR	9
Purple seed stain	NR	5	4
Rhizoctonia root rot	NR	NR	6
Sclerotinia stem rot	NR	NR	4
Seed decay (*Phomopsis* sp.)	NR	NR	2
Seed rots and blights	NR	4	NR
Soybean mosaic virus	m	NR	6
Stem canker	m	NR	1

NR = Not reported.
* = Rankings were provided for nematode species.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ New York and Pennsylvania did not provide estimates for soybeans.
3/ 1 = Most important disease, 2 = second-most important disease, etc., m = minor problem. State rankings were determined for each disease by weighting regional rankings by the region's percentage of planted acres in the State and summing. The ranking "1" was assigned to the disease in the State with the lowest weighted rank, "2" to the second lowest, etc. The ranking in one State is not directly comparable with the ranking in any other State.
4/ Nematode rankings in Virginia are separate and not directly comparable with the ranking of other diseases in Virginia.

Virginia soybean acreage, yet was virtually unreported in other Northeastern States (table 21). The loss of nematicides in Virginia is the only case where significant yield losses would result from the cancellation of soybean fungicides or nematicides in the Northeast (table 22).

While crop rotation and resistant varieties were mentioned as nonpesticide disease management practices in the Northeast, the relative significance of these practices is uncertain (table 23).

Table 21. Soybean fungicide and nematicide use in the Northeastern States 1/

Active ingredients	Timing 2/	Target pest	Percentage of planted acres 3/			
			MD and DE	NJ	VA	Region 4/
				Percent		
Aldicarb	3	Nematodes	5/2-3	<1	15	6/14
Carbofuran	3	do.	NA	-	-	NA
Fenamiphos	3	do.	NA	<1	20	NA
EDB 7/	3	do.	-	-	8	3
Ethoprop	3	do.	-	-	5	2
Benomyl	5	Pod and stem blight 8/	9/2-3	<1	3	10/2
Chlorothalonil	5	Brown spot 8/	NA	-	-	NA
Thiabendazole	5	Stem canker 8/	NA	-	-	NA
Thiophanate methyl	5	Anthracnose 8/	NA	-	-	NA
Thiram	ST	Seedling rots and blights	-	10	-	2

NA = Not applicable.
- = Insignificant acreage treated.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Timing of application, where:
3 = At planting, banded.
5 = One treatment at pod set and one treatment 14 days later.
ST = Seed treatment.
3/ New York and Pennsylvania did not provide estimates.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.
5/ This was the total acreage treated with aldicarb, carbofuran, and fenamiphos in MD and DE.
6/ Total for aldicarb, carbofuran, and fenamiphos.
7/ Registered in Virginia under Sec. 24(c), Special Local Needs (prior to cancellation notice).
8/ These four fungicides controlled each of these four diseases.
9/ This was the total acreage treated with benomyl, chlorothalonil, thiabendazole, and thiophanate methyl in MD and DE.
10/ Total for benomyl, chlorothalonil, thiabendazole, and thiophanate methyl.

Table 22. Average percentage soybean yield losses from diseases and nematodes treated with fungicides and nematicides in the Northeastern States 1/

Pests and pest control practices	Average percentage yield loss 2/ 3/			
	MD and DE	NJ	VA	Region 4/
		Percent		
Anthracnose, purple coat:				
Current controls	-	<0.1	-	<0.1
No pesticide controls	-	<.1	-	<.1
Anthracnose, brown spot, pod and stem blight, stem canker:				
Current controls	1.7	-	-	.8
No pesticide controls	1.7	-	-	.8
Nematodes:				
Current controls	1.4	-	2.1	1.4
No pesticide controls	1.9	<.1	8.0	3.8
Pod and stem blight:				
Current controls	-	<.1	-	<.1
No pesticide controls	-	<.1	-	<.1
Seedling rots and blights:				
Current controls	-	.1	-	<.1
No pesticide controls	-	2.5	-	.4

- = Insignificant yield loss.

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

2/ The 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/ New York and Pennsylvania did not provide estimates for soybeans.

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

Table 23. Nonpesticide soybean disease and nematode management in the Northeastern States 1/

Diseases and nematodes	Disease/nematode management practice	Percentage of planted acres 2/	
		MD and DE	VA
		Percent	
Diseases	Crop rotation	30	NA
	Resistant varieties	*	NA
Anthracnose	Crop rotation	NA	*
Brown stem	do.	NA	*
Fusarium root rot	do.	NA	*
Pod and stem blight	do.	NA	*
Powdery mildew	do.	NA	*
Purple seed stain	do.	NA	*
Stem canker	do.	NA	*
Nematodes	Crop rotation	30	NA
	Resistant varieties	*	NA
Cyst nematode	Crop rotation	NA	*

NA = Not applicable.

* = Reported but no estimate for acreage provided.

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

2/ New York and Pennsylvania did not provide soybean estimates. New Jersey did not provide estimates for nonpesticide disease management practices.

Weeds, Herbicides, and Losses

Morningglory, common cocklebur, jimsonweed, Johnsongrass, and large crabgrass were the five most economically important soybean weed pests in the Northeastern States (table 24). Morningglory ranked the highest in all States. Common cocklebur, jimsonweed, and velvetleaf ranked the highest in Maryland and Delaware, while common cocklebur and Johnsongrass ranked the highest in Virginia.

The most widely used soybean herbicides in the Northeast were linuron, applied to 76 percent of the acreage; alachlor to 50 percent; paraquat to 43 percent; metolachlor to 30 percent; acifluorfen to 15 percent; metribuzin to 12 percent; bentazon to 10 percent; and trifluralin to 8 percent (table 25). Relatively small acreages of nonchemical weed control management practices such as scouting, rotating to corn, or rotating from reduced-till soybeans to conventional till were also reported (table 26).

Table 24. Ranking of soybean weed pests in the Northeastern States 1/

Weeds	Rank 2/			
	MD and DE	NJ	VA	Region
Morningglory	1	1	1	1
Common cocklebur	1	2	1	2
Jimsonweed	1	8	2	3
Johnsongrass	3	NR	1	4
Large crabgrass	2	12	2	5
Fall panicum	2	NR	2	6
Velvetleaf	1	3	5	7
Giant foxtail	2	9	4	8
Redroot pigweed	4	14	2	9
Yellow nutsedge	NR	11	2	10
Barnyard grass	NR	13	2	11
Green foxtail	2	NR	NR	12
Smooth crabgrass	2	NR	NR	13
Common ragweed	4	4	4	14
Bermuda grass	NR	NR	3	15
Common lambsquarters	4	6	5	16
Volunteer corn	NR	5	NR	17
Bur cucumber	NR	7	NR	18
Yellow foxtail	NR	10	NR	19
Common purslane	5	NR	NR	20
Smooth pigweed	6	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 each would have the same mean and variance. The standardized variables were weighted by planted acres to construct the regional ordering.

Table 25. Soybean herbicide use in the Northeastern States 1/

Active ingredients	Percentage of planted acres 2/ 3/			
	MD and DE	NJ	VA	Region 4/
	Percent			
Acifluorfen	15	17	13	15
Alachlor	55	63	38	50
Alanap	-	5	-	<1
Bentazon	10	10	10	10
Dinoseb	-	-	4	1
Glyphosate	-	5	12	5
Linuron	90	87	58	76
Metolachlor	35	42	18	30
Metribuzin	5	8	22	12
Oryzalin	5	-	10	6
Paraquat	50	25	40	43
Sethoxydim	-	2	-	<1
Trifluralin	5	-	15	8
Vernolate	-	3	5	2
2,4-DB	-	-	2	<1

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ Estimates include acres treated with the active ingredient both singly or tank mixed. Hence, there was double counting of acres treated with tank mixes.
3/ New York and Pennsylvania did not provide estimates for soybeans.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

Table 26. Nonpesticide soybean weed management in the Northeastern States 1/

Nonpesticide weed controls	Percentage of planted acres 2/	
	MD and DE	VA
	Percent	
Scouting 3/	-	5
Rotate to corn	5	-
Rotate to conventional soybeans	5	-

- = Insignificant acreage.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ New York and Pennsylvania did not provide soybean estimates. New Jersey did not provide estimates for nonpesticide soybean weed management practices.
3/ Scouting is a pest detection practice which may lead to the use of pesticide or nonpesticide pest management practices.

Weeds caused losses to soybeans of about 5 percent. If linuron were no longer available, regional losses would increase to 16 percent, with losses in Maryland and Delaware of 23 percent (table 27). Regional losses would increase to 10 percent if acifluorfen or bentazon were no longer available; these losses would be concentrated entirely in Maryland and Delaware. Removing metribuzin, vernam, and trifluralin from use would not change losses significantly. If the acetanilides were no longer available, losses would increase to 22 percent, with about 40 percent in Maryland and Delaware. If no herbicides were available, losses would increase to 55 percent if cultivation were not increased and to 20 percent if additional cultivations were included.

Table 27. Average percentage soybean weed yield losses in the Northeastern States 1/

Weed control practices	Average percentage yield loss 2/ 3/			
	MD and DE	NJ	VA	Region 4/
	Percent			
Current controls	7.5	7.0	1.8	5.4
Remove:				
Acifluorfen	16.7	7.0	1.8	10.0
Bentazon	16.7	7.0	1.8	10.0
Linuron	23.3	15.8	5.1	15.7
Metribuzin	7.5	7.0	2.8	5.8
Trifluralin	7.5	7.0	4.2	6.3
Vernam	7.5	7.0	1.9	5.4
Acetanilides	40.0	7.0	3.2	22.0
No chemical controls:				
With current cultivation	67.5	*	37.1	54.9
Additional cultivations	*	18.9	20.0	19.7

* = No estimates provided.
1/ Corn and Soybean Commodity Assessment, NAPIAP, USDA.
2/ These estimates are average yield losses over the entire planted acres in the State from a maximum where weeds cause no loss. Other pest problems and farm management practices were held constant.
3/ New York and Pennsylvania provided no estimates for soybeans.
4/ State estimates were weighted by planted acres and averaged to obtain regional estimates.

RESEARCH AND DATA NEEDS

The field corn and soybean pesticide assessment reveals several important research 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 variabilities 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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