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1980 PESTICIDE USE ON SOYBEANS
IN THE SOUTHEAST

by

Michael Hanthorn, Craig Osteen,
Robert McDowell, and Larry Roberson

February 1982

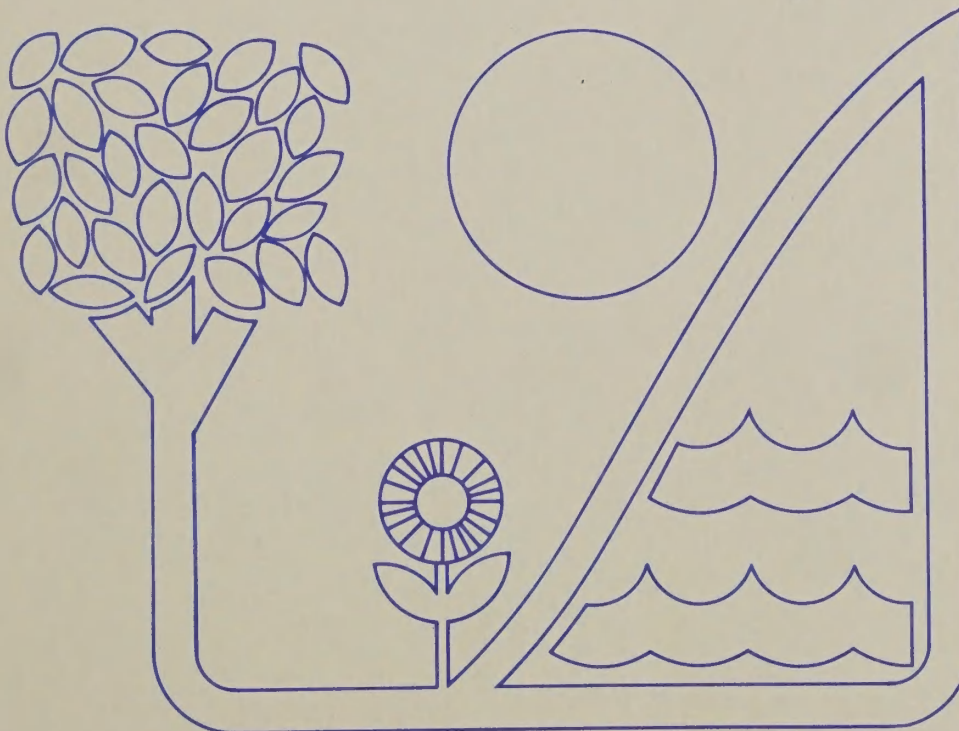
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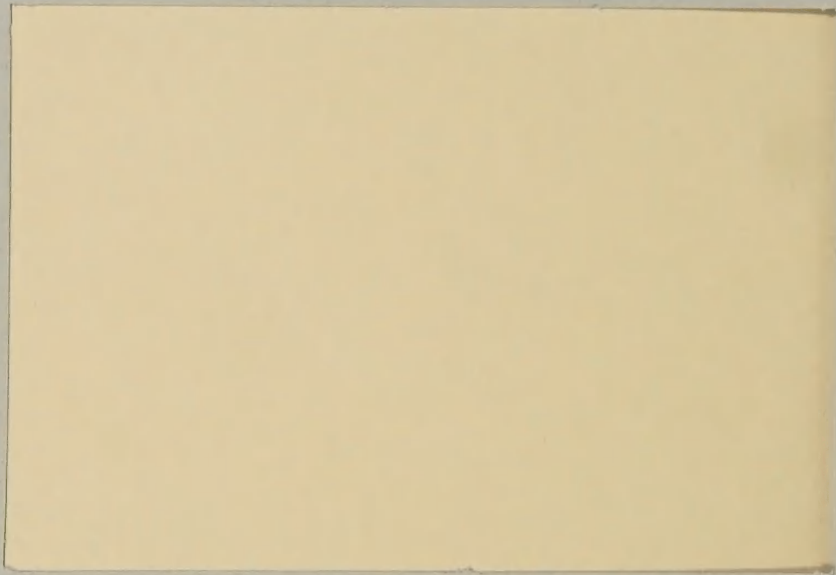
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1980 PESTICIDE USE ON SOYBEANS IN THE SOUTHEAST. By Michael Hanthorn, Craig Osteen, Robert McDowell, and Larry Roberson; Natural Resource Economics Division, Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 20250; February 1982.

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ABSTRACT

Farmers reported that 18.1 million pounds active ingredient (a.i.) of pesticides were applied to soybeans in the Southeast during 1980. This consisted of 11.3 million pounds (a.i.) of herbicides, 5.1 million pounds (a.i.) of insecticides, 1.4 million pounds (a.i.) of nematicides, and 234,000 pounds (a.i.) of fungicides. Pesticide acre-treatments totaled 16.4 million and consisted of 9.7 million with herbicides, 5.8 million with insecticides, 555,000 with nematicides, and 384,000 with fungicides. The primary herbicides were alachlor, bentazon, metribuzin, and trifluralin. The major insecticides were carbaryl and methomyl. Aldicarb and ethylene dibromide were the primary nematicides and benomyl was the major fungicide. Herbicides were applied primarily to control cocklebur and crabgrass infestations, while insecticides were mainly used for armyworm and corn earworm control. Anthracnose and pod and stem blight were the major diseases. Coefficients of variation were computed for acres of soybeans treated with specific pesticide materials.

Key words: Pesticides, herbicides, insecticides, nematicides, fungicides, active ingredient, acres treated, acre-treatments, application rates, primary target pests, soybeans, and Southeast.

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AUTHORS

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PREFACE

This report presents data for pesticides applied to soybeans in the Southeast during 1980. Pesticide use data for the major producing States not included in the Southeast and for all major producing regions are available in the following ERS Staff Reports:

- "1980 Pesticide Use on Soybeans in the North Central States"
- "1980 Pesticide Use on Soybeans in the Mississippi Valley"
- "1980 Pesticide Use on Soybeans in the Major Producing States".

CONTENTS

	<u>Page</u>
INTRODUCTION	1
METHODOLOGY AND TERMINOLOGY	1
RELIABILITY OF ESTIMATES	2
SOUTHEAST	3
Description	3
Trends in Pesticide Use	3
Pesticide Use	7
ALABAMA	14
GEORGIA	16
NORTH CAROLINA	18
SOUTH CAROLINA	21
REFERENCES	24
APPENDIX TABLES	25

INTRODUCTION

This report presents pesticide use data for soybeans grown in the Southeast during 1980. The data include usage patterns and quantities of specific herbicides, insecticides, nematicides, and fungicides applied to soybeans. This information should be useful to policymakers, academic institutions, government agencies, and private and commercial entities in evaluating the impacts of regulatory actions on specific pesticides, conducting economic analyses of pesticide use, developing more effective pest management programs, and conducting pesticide market analyses.

METHODOLOGY AND TERMINOLOGY

The Economics and Statistics Service collected pesticide use data as part of the 1980 Soybean Objective Yield Survey. A total of 1,915 farmers were personally interviewed by enumerators in the 17 major soybean producing States. In the Southeast, 310 farmers were interviewed and the sample size by State was as follows: Alabama, 80; Georgia, 75; North Carolina, 80; and South Carolina, 75.

Sample fields for each State were randomly selected from farmers who reported through the June Enumerative Survey that they had planted or intended to plant soybeans in 1980. Each soybean acre in a State had an equal probability of being selected. Consequently, the probability of a field being chosen was directly correlated to its size.

Several terms pertinent to this report are defined as follows. An "active ingredient" (a.i.) is that portion of a pesticide material that provides the control activity. "Acres treated" are the number of acres receiving one or more applications of a specific pesticide during the growing season. Acres treated with different pesticide materials cannot be summed because more than

one material may have been applied on a given acre during the growing season. Therefore, the addition of these numbers would result in multiple counting.

"Acre-treatments" are the number of acres treated with a pesticide material multiplied by the number of applications made during the growing season. Acre-treatments are summed for each material at the State and regional level. "Pesticide mixes" are two or more pesticide materials that are premixed during formulation or tank-mixed at the time of application.

Pesticide application rates vary as a result of weather conditions, soil type, weed spectrum, insect species, and disease type. Also, the method of application influences the amount of a material used per acre. Herbicide and foliar insecticide application rates are generally expressed as broadcast rates. The amount of a material applied on an acre in either a band, in-furrow, or spot application is generally one-fourth to one-third the amount applied in a broadcast application. The application rate listed for each material in this report is an aggregation of band, broadcast, in-furrow, and spot applications.

RELIABILITY OF ESTIMATES

Estimates based upon sample surveys have varying degrees of statistical reliability. Confidence in data depends upon sample size, sampling methods, and the variability of the responses. To provide the user of the data with some indication of the reliability of the estimates, coefficients of variation (CV's) are presented in Appendix Table 1. The CV is a measure of relative variation (expressed in percentage terms) and can be used to indicate the degree of confidence a user can place in the estimate. The smaller the CV, the more reliable the estimate.

In simplest terms, it can be said there is 95 percent confidence that the sample represents the true population and that the true value for the population

lies within an interval defined as ± 2 CV's times the estimated value. For example, with a CV of 10 percent and an estimate of 40, the interval would be 32 to 48. However, there is also a 5 percent chance that the true value does not fall within the interval as defined above because the sample is not representative of the population.

CV's were calculated only for acres treated with specific pesticides. The estimates of acres treated are expected to have greater variation than other data reported. Consequently, for most other information included in this report, the level of reliability should be equal to or greater than that reported for acres treated.

SOUTHEAST

Description

The Southeast includes Alabama, Georgia, North Carolina, and South Carolina (Figure 1). About 12 percent of the U.S. soybean acreage (8.5 million acres) was planted in this region, from which 6 percent of the national crop (116 million bushels) was produced (Table 1). The farm value of soybeans grown in this region during 1980 was \$886 million.

Trends in Pesticide Use

There was a substantial increase in the number of acres planted to soybeans and treated with pesticides in the Southeast between 1972 and 1980. Acres planted more than doubled from 3.9 to 8.5 million, while the percent of planted acres treated with herbicides and insecticides increased 65 and 370 percent, respectively (Table 2). Approximately three-fourths of the planted acres were treated with herbicides in 1980, while 47 percent were treated with insecticides. Planted acres treated with nematicides totaled 531,000 (6 percent) and fungicide treated acres totaled 208,000 (2 percent).

Figure 1. States included in the 1980 Soybean Pesticide Use Survey

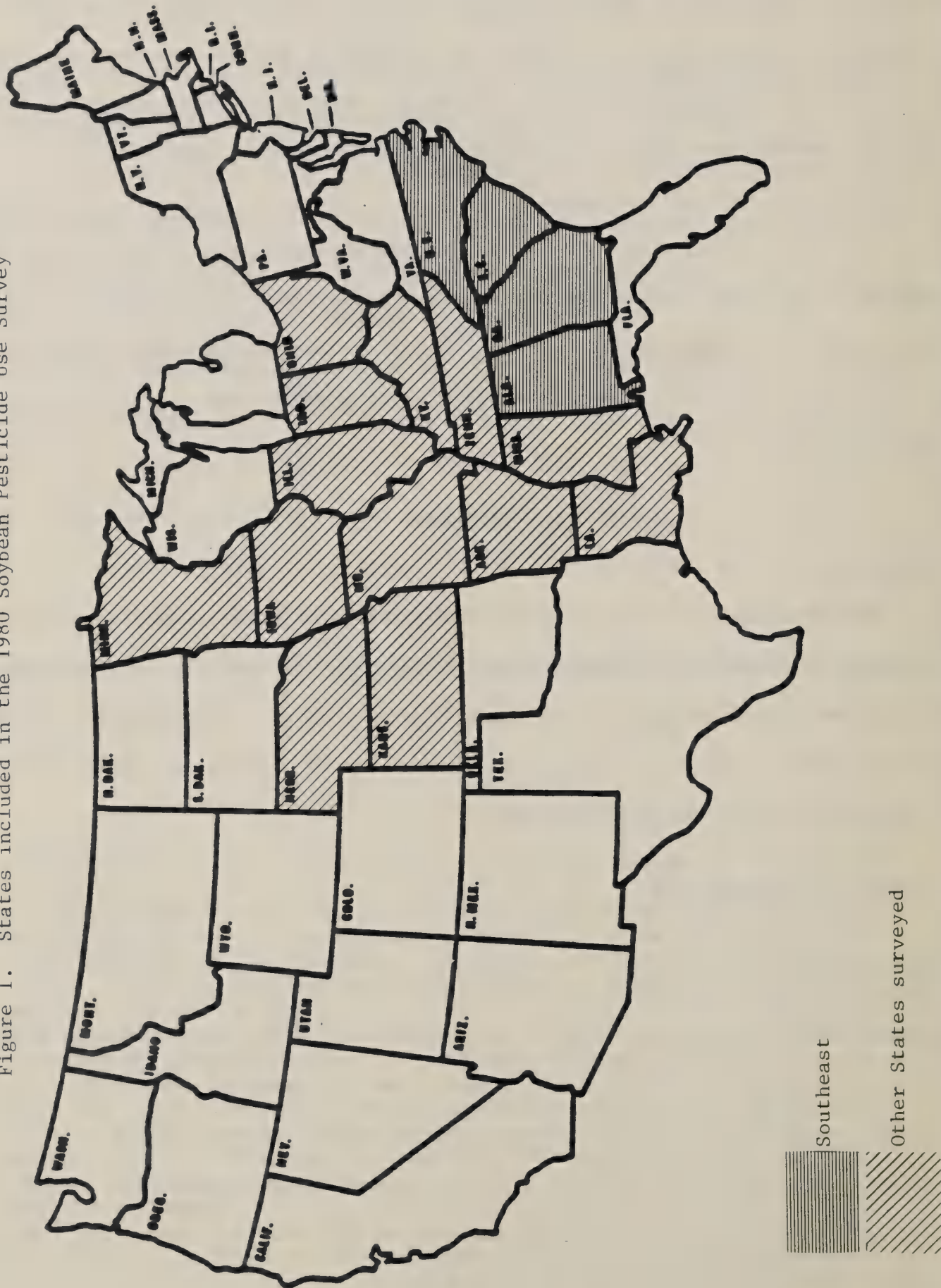


Table 1. Soybean acreage planted and harvested, production, and value in the Southeast, 1980

States	: Total acres a/ :		Total	Total
	: Planted	: Harvested	: production a/	: value b/
	-----Million-----		Million bushels	Million dollars
Alabama	2.3	2.1	32	239
Georgia	2.5	2.2	26	194
North Carolina	2.0	1.9	36	280
South Carolina	1.7	1.6	22	173
Region	8.5	7.8	116	886
U.S. Total	70.1	67.9	1,817	13,825
Percent of U.S. Total	12	11	6	6

a/ "Crop Production-1980 Annual Summary", USDA, ESS, Crop Reporting Board, CrPr 2-1(81), January 14, 1981.

b/ "Field Crops-Production, Disposition, Value 1979-80", USDA, ESS, Crop Reporting Board, CrPr 1(81), April 1981.

Table 2. Soybean acreage planted and treated for weed, insect, nematode, and disease control in the Southeast, 1972 and 1980

States	Planted acres		Treated acres a/				Percent of planted acres treated			
	1972 b/	1980 c/	Herbicides		Insecticides		Herbicides		Insecticides	
	1972	1980	1972	1980	1972	1980	1972	1980	1972	1980
	-----Thousand-----						-----Percent-----			
Alabama	830	2,250	-	1,832	-	547	-	81	-	24
Georgia	720	2,450	-	1,881	-	1,517	-	77	-	62
North Carolina	1,250	2,030	535	1,421	126	821	43	70	10	40
South Carolina	1,130	1,700	567	1,298	108	1,086	50	76	10	64
Region	3,930	8,430	1,102	6,432	234	3,971	46f/	76	10f/	47

- Not surveyed in 1972.

a/ Nematicide and fungicide use was not reported in these States in 1972.

In 1980, the number of planted acres treated with nematicides in these States was as follows: Alabama, 161,000 (7 percent); Georgia, none reported; North Carolina, 87,000 (4 percent); and South Carolina, 283,000 (17 percent). Fungicide treated acres were as follows: Alabama, 32,000 (1 percent); Georgia, 71,000 (3 percent); North Carolina, 58,000 (3 percent); and South Carolina, 47,000 (3 percent).

b/ "Agricultural Statistics, 1974", U.S. Department of Agriculture.

c/ "Crop Production-1980 Annual Summary", USDA, ESS, Crop Reporting Board, CrPr 2-1(81), January 14, 1981.

d/ Herman W. Delvo, "1972 Soybean Objective Yield Survey", USDA, ERS, Farm Production Economics Division, 1972, (unpublished).

e/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

f/ Computed excluding planted acres for Alabama and Georgia.

Pesticide Use

The major soybean weed, insect, and disease pests, as reported by farmers in the Southeast, are listed in Tables 3, 4, and 5, respectively. Although several pests may have been present at any given time and caused varying degrees of damage, farmers were asked to report what they perceived to be the primary target pest for each material applied to soybeans. In 1980, farmers reported that cocklebur was the primary target pest for 34 percent of the herbicide acre-treatments, crabgrass for 25 percent, and Johnsongrass for 8 percent (Table 3). Insecticide acre-treatments for corn earworm and armyworm control totaled 39 and 31 percent, respectively (Table 4). Two-thirds of the fungicide acre-treatments were made to control pod and stem blight and 23 percent were made for anthracnose control (Table 5).

About 18.1 million pounds (a.i.) of pesticides were applied to soybeans in 1980 (Table 6). Of these, 6.5 million were single material herbicides, 4.8 million were herbicide mixes, 3.9 million were single material insecticides, 1.2 million were insecticide mixes, 1.4 million were nematicides, and 234,000 were fungicides. Application rates for herbicides, applied alone and in mixes, were 0.9 and 2.2 pounds (a.i.) per acre-treatment, respectively. Insecticide application rates averaged 0.8 pound (a.i.) per acre-treatment for single materials and 1.6 pounds (a.i.) per acre-treatment for mixes. Nematicide and fungicide rates averaged 2.6 and 0.6 pounds (a.i.) per acre-treatment, respectively.

Farmers made 16.4 million pesticide acre-treatments, comprised of 7.5 million with single material herbicides, 2.2 million with herbicide mixes, 5 million with single material insecticides, 764,000 with insecticide mixes, 555,000 with nematicides, and 384,000 with fungicides.

About 2.8 million (37 percent) of the single material herbicide acre-treatments were trifluralin, while alachlor, bentazon, and metribuzin acre-treatments

Table 3. Percentage of soybean herbicide acre-treatments by primary weeds controlled as reported by farmers in the Southeast, 1980 a/

Weeds	:	:	: North	: South	:	
		: Alabama	: Georgia	: Carolina	: Carolina	: Region
		----- <u>Percent</u> -----				
<u>Grasses</u>						
Barnyardgrass	3	-	-	-	-	1
Broadleaf signalgrass	-	4	5	4	4	3
Crabgrass	13	36	19	34	34	25
Johnsongrass	15	2	11	3	3	8
Panicum	1	-	5	4	4	2
Other	4	8	5	3	3	5
<u>Broadleaves</u>						
Cocklebur	40	29	26	39	39	34
Morningglory	5	-	10	2	2	4
Pigweed	3	6	5	6	6	5
Ragweed	3	-	5	-	-	2
Sicklepod	8	8	2	2	2	5
Smartweed	1	-	-	-	-	1
Other	3	6	5	2	2	4
Nutsedge	1	1	2	1	1	1

- None reported.

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

Table 4. Percentage of soybean insecticide acre-treatments by primary insects controlled as reported by farmers in the Southeast, 1980 a/

Insects	:	:	:	North	:	South	:	Region
				Alabama		Georgia		Carolina
				----- Percent -----				
Armyworm		33	42	15		23		31
Bean leaf beetle		-	-	-		8		2
Cabbage looper		-	10	19		3		7
Corn earworm		48	34	35		42		39
Cutworm		-	6	6		1		4
Grasshopper		-	4	-		-		2
Green cloverworm		-	-	9		-		2
Other beetles		-	-	-		11		3
Spider mite		-	-	9		-		2
Velvetbean caterpillar		-	2	3		8		4
Other		19	2	4		4		4

- None reported.

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

Table 5. Percentage of soybean fungicide acre-treatments by primary diseases controlled as reported by farmers in the Southeast, 1980 a/

Diseases	:	:	: North	: South	:
	: Alabama	: Georgia	: Carolina	: Carolina	: Region
	----- <u>Percent</u> -----				
Anthracnose	-	-	100	-	23
Leaf blight	-	33	-	-	9
Pod and stem blight	100	67	-	100	68

- None reported.

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

Table 6. Usage patterns and quantities of specific pesticides applied to soybeans in the Southeast, 1980 a/

Pesticides	: Acres <u>b/</u> : Acre- <u>c/</u> :		Pounds of active ingredient	
	treated	treatments:	Total	Per treatment
----- <u>Thousand</u> -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	1,082	1,082	1,719	1.6
Bentazon	1,085	1,176	765	.7
Metribuzin	896	896	481	.5
Pendimethalin	262	262	252	1.0
Trifluralin	2,713	2,769	2,000	.7
Other	-	1,297	1,243	1.0
Total	-	7,482	6,460	.9
<u>Tank-mix materials</u>				
Alachlor + linuron	263	263	593+221	2.3+ .8
Dinoseb + naptalam	587	587	428+839	.7+1.4
Metribuzin + trifluralin	290	290	107+218	.4+1.8
Other	-	1,068	2,433	2.3
Total	-	2,208	4,839	2.2
Total herbicides	-	9,690	11,299	1.2
INSECTICIDES				
<u>Single materials</u>				
Carbaryl	877	1,282	1,358	1.1
Methomyl	1,716	2,542	1,198	.5
Methyl parathion	248	248	190	.8
Parathion	144	208	187	.9
Toxaphene	342	484	889	1.8
Other	-	273	91	.3
Total	-	5,037	3,913	.8
<u>Tank-mix materials</u>				
Methyl parathion + toxaphene	150	324	372+425	1.1+1.3
Other	-	440	400	.9
Total	-	764	1,197	1.6
Total insecticides	-	5,801	5,110	.9
NEMATICIDES				
Aldicarb	214	214	279	1.3
Carbofuran	114	114	91	.8
Ethoprop	53	53	117	2.2
Ethylene dibromide	142	142	783	5.5
Other	-	32	154	4.8
Total	-	555	1,424	2.6

-- continued

Table 6. Usage patterns and quantities of specific pesticides applied to soybeans in the Southeast, 1980 a/ -- continued

Pesticides	: Acres <u>b/</u>	: Acre- <u>c/</u>	:Pounds of active ingredient	
	: treated	:treatments:	Total	: Per treatment
	----- <u>Thousand</u> -----			
FUNGICIDES				
Benomyl	150	297	83	.3
Benomyl + other	-	87	90+61	1.0+ .7
Total	-	384	234	.6
TOTAL PESTICIDES	-	16,430	18,067	1.1

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Most farmers applied herbicides, insecticides, nematocides, and fungicides one time during the growing season. The average number of applications per season for each material can be determined by dividing acre-treatments (column 2) by acres treated (column 1).

totalled 3.2 million (42 percent). Dinoseb plus naptalam acre-treatments accounted for 587,000 (27 percent) of the herbicide mix acre-treatments. Also, one-fourth (553,000) of these acre-treatments were made with alachlor plus linuron and metribuzin plus trifluralin.

Crabgrass control accounted for 35 percent of the alachlor acre-treatments and 50 percent of the trifluralin acre-treatments (Appendix Table 2). About 12 percent of the alachlor acre-treatments, 91 percent of the bentazon acre-treatments, 41 percent of the metribuzin acre-treatments, and 15 percent of the trifluralin acre-treatments were made to control cocklebur infestations. Approximately 18 percent of the metribuzin acre-treatments were made to control morningglory infestations and 15 percent of the trifluralin acre-treatments were made for Johnsongrass control.

Methomyl accounted for 2.5 million (45 percent) of the single material insecticide acre-treatments (Table 6). Also, 1.3 million (23 percent) were carbaryl. Methyl parathion plus toxaphene accounted for 324,000 (42 percent) of the insecticide mix acre-treatments. Carbaryl acre-treatments totaled 37 and 30 percent, respectively, for suppression of armyworm and corn earworm infestations (Appendix Table 3). Nearly one-half of the methomyl acre-treatments were made for corn earworm control and one-fifth were made to suppress armyworm infestations. Armyworm control accounted for 43 percent of the methyl parathion acre-treatments and velvetbean caterpillar control accounted for 10 percent.

Aldicarb, carbofuran, and ethylene dibromide accounted for 470,000 (85 percent) of the nematicide acre-treatments (Table 6). Three-fourths (297,000) of the fungicide acre-treatments were made with benomyl and the remainder (87,000) were benomyl plus other pesticides. About 88 percent of the benomyl acre-treatments were made to control pod and stem blight and all of the benomyl mixed with other pesticides was used for anthracnose control (Appendix Table 4).

ALABAMA

In 1980, Alabama farmers planted 2.3 million acres of soybeans, of which 1.8 million were treated with herbicides, 547,000 were treated with insecticides, 161,000 were treated with nematicides, and 32,000 were treated with fungicides (Table 2). Approximately 3.8 million pounds (a.i.) of pesticides were applied to soybeans, which included 1.5 million pounds of single material herbicides, 1 million pounds of herbicide mixes, 425,000 pounds of single material insecticides, 450,000 pounds of insecticide mixes, 305,000 pounds of nematicides, and 24,000 pounds of fungicides (Table 7). Application rates for herbicides averaged 0.7 pound (a.i.) per acre-treatment for single materials and 1.6 pounds (a.i.) per acre-treatment for mixes. Insecticide rates averaged 0.7 pound (a.i.) per acre-treatment for single materials and 2 pounds (a.i.) per acre-treatment for mixes. Nematicide and fungicide rates averaged 1.9 and 0.3 pounds (a.i.) per acre-treatment, respectively.

Pesticide acre-treatments totaled 4.1 million, comprised of 2.4 million with single material herbicides, 644,000 with herbicide mixes, 580,000 with single material insecticides, 225,000 with insecticide mixes, 160,000 with nematicides, and 96,000 with fungicides.

One-third (788,000) of the single material herbicide acre-treatments were trifluralin, one-fourth (583,000) were bentazon, and 15 percent (354,000) were metribuzin. One-fourth (161,000) of the herbicide mix acre-treatments were metribuzin plus trifluralin and 10 percent (64,000) were acifluorfen plus bentazon. Cocklebur, crabgrass, and sicklepod control each accounted for one-sixth of the alachlor acre-treatments, while one-half were made for barnyardgrass control (Appendix Table 2). Cocklebur control accounted for 94 percent of the bentazon acre-treatments. Metribuzin acre-treatments totaled 37 percent for cocklebur control and 36 percent for morningglory control. Nearly one-third

Table 7. Usage patterns and quantities of specific pesticides applied to soybeans in Alabama, 1980 a/

Pesticides	: Acres <u>b/</u> : Acre- <u>c/</u> : Pounds of active ingredient		: treated : treatments: Total : Per treatment	
	----- Thousand -----			
HERBICIDES				
<u>Single materials</u>				
Alachlor	192	192	206	1.1
Bentazon	551	583	293	.5
Metribuzin	354	354	216	.6
Trifluralin	755	788	522	.7
Other	-	448	301	.7
Total	-	2,365	1,538	.7
<u>Tank-mix materials</u>				
Acifluorfen + bentazon	64	64	23+48	.4+ .8
Metribuzin + trifluralin	161	161	45+109	.3+ .7
Other	-	419	808	1.9
Total	-	644	1,033	1.6
Total herbicides	-	3,009	2,571	.9
INSECTICIDES				
<u>Single materials</u>				
Methomyl	232	264	138	.5
Parathion	96	161	161	1.0
Toxaphene	64	64	64	1.0
Other	-	91	62	.7
Total	-	580	425	.7
<u>Tank-mix materials</u>				
Methomyl + toxaphene	32	96	48+48	.5+ .5
Methyl parathion + toxaphene	32	129	177+177	1.4+1.4
Total	-	225	450	2.0
Total insecticides	-	805	875	1.1
NEMATICIDES				
Aldicarb	96	96	145	1.5
Other	-	64	160	2.5
Total	-	160	305	1.9
FUNGICIDES				
Total <u>d/</u>	-	96	24	.3
TOTAL PESTICIDES	-	4,070	3,775	.9

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Most farmers applied herbicides, insecticides, nematicides, and fungicides one time during the growing season. The average number of applications per season for each material can be determined by dividing acre-treatments (column 2) by acres treated (column 1).

d/ Specific materials not listed because of a limited number of observations.

of the trifluralin acre-treatments were made to control crabgrass infestations, while 37 percent were made for Johnsongrass control.

Methomyl accounted for 264,000 (46 percent) of the single material insecticide acre-treatments, while parathion and toxaphene acre-treatments totaled 161,000 (28 percent) and 64,000 (11 percent), respectively (Table 7). About 129,000 (57 percent) of the insecticide mix acre-treatments were made with methyl parathion plus toxaphene and 96,000 (43 percent) were methomyl plus toxaphene. Two-thirds of the methomyl acre-treatments were made for armyworm control and one-fourth were made to suppress corn earworm infestations (Appendix Table 3).

Aldicarb accounted for 96,000 (60 percent) of the nematicide acre-treatments (Table 7). Fungicide acre-treatments totaled 96,000 and were made to control pod and stem blight (Table 5).

GEORGIA

Acres planted to soybeans totaled 2.5 million in Georgia during 1980, of which 1.9 million were treated with herbicides, 1.5 million were treated with insecticides, and 71,000 were treated with fungicides (Table 2). A total of 6.2 million pounds (a.i.) of pesticides were applied to soybeans, which consisted of 1.9 million pounds of single material herbicides, 2 million pounds of herbicide mixes, 1.7 million pounds of single material insecticides, 558,000 pounds of insecticide mixes, and 36,000 pounds of fungicides (Table 8). Application rates for herbicides averaged 0.9 pound (a.i.) per acre-treatment for single materials and 3 pounds (a.i.) per acre-treatment for mixes. Rates for insecticides, applied alone and in mixes, averaged 0.9 and 1.3 pounds (a.i.) per acre-treatment, respectively. Fungicide rates averaged 0.3 pound (a.i.) per acre-treatment.

Pesticide acre-treatments totaled 5.4 million and were comprised of 2.2

Table 8. Usage patterns and quantities of specific pesticides applied to soybeans in Georgia, 1980 a/

Pesticides	: Acres <u>b/</u>	: Acre- <u>c/</u>	:Pounds of active ingredient	
	: treated	:treatments:	Total	Per treatment
----- <u>Thousand</u> -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	284	284	333	1.2
Bentazon	192	192	140	.7
Metribuzin	379	379	189	.5
Oryzalin	134	134	117	.9
Pendimethalin	142	142	160	1.1
Trifluralin	849	849	715	.8
Other	-	214	246	1.1
Total	-	2,194	1,900	.9
<u>Tank-mix materials</u>				
Dinoseb + naptalam	426	426	362+713	.9+1.7
Other	-	249	959	3.9
Total	-	675	2,034	3.0
Total herbicides	-	2,869	3,934	1.4
INSECTICIDES				
<u>Single materials</u>				
Carbaryl	71	107	96	.9
Methomyl	600	1,059	546	.5
Methyl parathion	142	142	142	1.0
Permethrin	178	178	18	.1
Toxaphene	278	420	824	2.0
Other	-	36	29	.8
Total	-	1,942	1,655	.9
<u>Tank-mix materials</u>				
Methyl parathion + toxaphene	71	124	142+142	1.1+1.1
Other	-	320	274	.9
Total	-	444	558	1.3
Total insecticides	-	2,386	2,213	.9
FUNGICIDES				
Benomyl	71	107	36	.3
TOTAL PESTICIDES	-	5,362	6,183	1.2

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Most farmers applied herbicides, insecticides, and fungicides one time during the growing season. The average number of applications per season for each material can be determined by dividing acre-treatments (column 2) by acres treated (column 1).

million with single material herbicides, 675,000 with herbicide mixes, 1.9 million with single material insecticides, 444,000 with insecticide mixes, and 107,000 with fungicides.

Of the 2.2 million single material herbicide acre-treatments, 849,000 (39 percent) were trifluralin, 379,000 (17 percent) were metribuzin, and 284,000 (13 percent) were alachlor. Nearly two-thirds (426,000) of the herbicide mix acre-treatments were dinoseb plus naptalam. Three-fourths of the alachlor and 62 percent of the trifluralin acre-treatments were made to control crabgrass infestations (Appendix Table 2). All of the bentazon acre-treatments and 56 percent of the metribuzin acre-treatments were made for cocklebur control.

Methomyl accounted for 1.1 million (55 percent) of the single material insecticide acre-treatments and toxaphene acre-treatments totaled 420,000 (22 percent) (Table 8). Methyl parathion plus toxaphene accounted for 124,000 (28 percent) of the insecticide mix acre-treatments. All of the carbaryl, 75 percent of the methyl parathion, and 20 percent of the methomyl acre-treatments were made for armyworm control (Appendix Table 3). Corn earworm control accounted for 57 percent of the methomyl acre-treatments.

Benomyl acre-treatments totaled 107,000 (Table 8). Two-thirds were made for pod and stem blight control and the remainder were made for leaf blight control (Appendix Table 4).

NORTH CAROLINA

About 2 million acres of soybeans were planted in North Carolina during the 1980 growing season (Table 2). Of these, 1.4 million were treated with herbicides, 821,000 were treated with insecticides, 87,000 were treated with nematicides, and 58,000 were treated with fungicides. A total of 4 million pounds (a.i.) of pesticides were applied to soybeans, consisting of 2 million

pounds of single material herbicides, 853,000 pounds of herbicide mixes, 893,000 pounds of insecticides, 107,000 pounds of nematocides, and 151,000 pounds of fungicides (Table 9). An estimated 1.5 pounds (a.i.) of single material herbicides and 2 pounds (a.i.) of herbicide mixes were applied per acre-treatment. Insecticides were applied at an average rate of 1 pound (a.i.) per acre-treatment. Nematicide and fungicide rates averaged 1.2 and 1.7 pounds (a.i.) per acre-treatment, respectively.

Pesticide acre-treatments totaled 2.9 million and consisted of 1.4 million with single material herbicides, 435,000 with herbicide mixes, 937,000 with insecticides, 87,000 with nematocides, and 87,000 with fungicides.

One-third (464,000) of the single material herbicide acre-treatments were alachlor, 174,000 (13 percent) were bentazon, and 232,000 (17 percent) were trifluralin. One-third (145,000) of the herbicide mix acre-treatments were made with alachlor plus linuron, while dinoseb plus naptalam and metribuzin plus trifluralin acre-treatments each totaled 58,000 (13 percent). Crabgrass and morningglory control each accounted for 19 percent of the alachlor acre-treatments, while 38 percent were made to reduce broadleaf signalgrass, cocklebur, and Johnsongrass infestations (Appendix Table 2). Cocklebur control accounted for two-thirds of the bentazon acre-treatments. Crabgrass, morningglory, pigweed, and ragweed control each accounted for 25 percent of the metribuzin acre-treatments. About 63 percent of the trifluralin acre-treatments were made to suppress crabgrass infestations.

One-half (464,000) of the insecticide acre-treatments were methomyl and 47 percent (444,000) were carbaryl (Table 9). Carbaryl acre-treatments totaled 35 percent for corn earworm control, 20 percent for armyworm control, 19 percent for green cloverworm control, and 26 percent for cabbage looper and cutworm control (Appendix Table 3). Corn earworm was the primary target pest for 38

Table 9. Usage patterns and quantities of specific pesticides applied to soybeans in North Carolina, 1980 a/

Pesticides	: Acres <u>b/</u>	: Acre- <u>c/</u>	:Pounds of active ingredient	
	: treated	:treatments:	Total	: Per treatment
----- <u>Thousand</u> -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	464	464	1,087	2.3
Bentazon	174	174	145	.8
Metribuzin	116	116	58	.5
Trifluralin	232	232	167	.7
Other	-	377	537	1.4
Total	-	1,363	1,994	1.5
<u>Tank-mix materials</u>				
Alachlor + linuron	145	145	262+80	1.8+ .6
Dinoseb + naptalam	58	58	23+43	.4+ .7
Metribuzin + trifluralin	58	58	36+44	.6+ .8
Other	-	174	365	2.1
Total	-	435	853	2.0
Total herbicides	-	1,798	2,847	1.6
INSECTICIDES				
Carbaryl	357	444	670	1.5
Methomyl	435	464	211	.5
Other	-	29	12	.4
Total	-	937	893	1.0
NEMATICIDES				
Carbofuran	58	58	61	1.1
Other	-	29	46	1.6
Total	-	87	107	1.2
FUNGICIDES				
Benomyl + other	-	87	151	1.7
TOTAL PESTICIDES	-	2,909	3,998	1.4

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Most farmers applied herbicides, insecticides, nematicides, and fungicides one time during the growing season. The average number of applications per season for each material can be determined by dividing acre-treatments (column 2) by acres treated (column 1).

percent of the methomyl acre-treatments, while 25 percent were made for cabbage looper control and 19 percent were made to suppress spider mite infestations.

Two-thirds (58,000) of the nematicide acre-treatments were made with carbofuran (Table 9). Benomyl was the primary fungicide that farmers reported using in 1980. It was applied in combination with other fungicides in 87,000 acre-treatments and was used for anthracnose control (Appendix Table 4).

SOUTH CAROLINA

Farmers planted 1.7 million acres to soybeans in South Carolina during 1980 and treated 1.3 million with herbicides, 1.1 million with insecticides, 283,000 with nematicides, and 47,000 with fungicides (Table 2). Approximately 4.1 million pounds (a.i.) of pesticides were applied to soybeans, of which 1 million were single material herbicides, 920,000 were herbicide mixes, 1.1 million were insecticides, 1 million were nematicides, and 24,000 were fungicides (Table 10). Herbicide application rates averaged 0.7 pound (a.i.) per acre-treatment for single materials and 2 pounds (a.i.) per acre-treatment for mixes. Insecticide application rates averaged 0.7 pound (a.i.) per acre-treatment, nematicide rates averaged 3.3 pounds (a.i.) per acre-treatment, and fungicide rates averaged 0.3 pound (a.i.) per acre-treatment.

Of the 4.1 million pesticide acre-treatments, 1.6 million were single material herbicides, 455,000 were herbicide mixes, 1.7 million were insecticides, 308,000 were nematicides, and 94,000 were fungicides.

About 900,000 (58 percent) of the single material herbicide acre-treatments were trifluralin, 227,000 (15 percent) were bentazon, and 142,000 (9 percent) were alachlor. One-fourth (118,000) of the herbicide mix acre-treatments were made with alachlor plus linuron, 17 percent (77,000) were made with dinoseb plus naptalam, and 16 percent (71,000) were made with metribuzin plus trifluralin.

Table 10. Usage patterns and quantities of specific pesticides applied to soybeans in South Carolina, 1980 a/

Pesticides	: Acres <u>b/</u> : treated	: Acre- <u>c/</u> : treatments:	:Pounds of active ingredient Total	: Per treatment
	----- Thousand -----			
HERBICIDES				
<u>Single materials</u>				
Alachlor	142	142	93	0.7
Bentazon	168	227	187	.8
Linuron	71	71	24	.3
Trifluralin	877	900	596	.7
Other	-	221	128	.6
Total	-	1,561	1,028	.7
<u>Tank-mix materials</u>				
Alachlor + linuron	118	118	331+142	2.8+1.2
Dinoseb + naptalam	77	77	35+67	.5+ .9
Metribuzin + trifluralin	71	71	27+65	.4+ .9
Other	-	189	253	1.3
Total	-	455	920	2.0
Total herbicides	-	2,016	1,948	1.0
INSECTICIDES				
Carbaryl	449	732	592	.8
Methomyl	449	756	303	.4
Other	-	188	233	1.2
Total	-	1,676	1,128	.7
NEMATICIDES				
Aldicarb	118	118	135	1.1
Ethylene dibromide	142	142	783	5.5
Other	-	48	95	2.0
Total	-	308	1,013	3.3
FUNGICIDES				
Benomyl	47	94	24	.3
TOTAL PESTICIDES	-	4,094	4,113	1.0

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ Data in this column for "other" and "total" were not reported because two or more materials may have been used on the same acre resulting in multiple counting.

c/ Most farmers applied herbicides, insecticides, nematicides, and fungicides one time during the growing season. The average number of applications per season for each material can be determined by dividing acre-treatments (column 2) by acres treated (column 1).

Crabgrass and panicum control each accounted for one-third of the alachlor acre-treatments (Appendix Table 2). The remaining third was made for Johnson-grass and nutsedge control. Cocklebur was the primary target pest for 90 percent of the bentazon, 50 percent of the metribuzin, and 29 percent of the trifluralin acre-treatments. One-half of the metribuzin acre-treatments were made to control sicklepod infestations and 52 percent of the trifluralin acre-treatments were made for crabgrass control.

Carbaryl accounted for 732,000 (44 percent) of the insecticide acre-treatments and methomyl acre-treatments totaled 756,000 (45 percent) (Table 10). One-third of the carbaryl acre-treatments and one-half of the methomyl acre-treatments were made to suppress corn earworm infestations (Appendix Table 3). Armyworm control accounted for 39 percent of the carbaryl and 13 percent of the methomyl acre-treatments. Velvetbean caterpillar was the primary target pest for one-half of the methyl parathion acre-treatments and one-sixth of the carbaryl acre-treatments.

Aldicarb and ethylene dibromide accounted for 118,000 (38 percent) and 142,000 (46 percent) of the nematicide acre-treatments, respectively (Table 10). Benomyl acre-treatments totaled 94,000 and were made for pod and stem blight control (Appendix Table 4).

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1. Delvo, Herman W., "1972 Soybean Objective Yield Survey", USDA, ERS, Farm Production Economics Division, 1972, (unpublished).
2. U.S. Department of Agriculture, "Agricultural Statistics, 1974".
3. USDA, ESS, Crop Reporting Board, "Crop Production-1980 Annual Summary", CrPr 2-1(81), January 14, 1981.
4. USDA, ESS, Crop Reporting Board, "Field Crops-Production, Disposition, Value 1979-80", CrPr 1(81), April 1981.

Appendix Table 1. Coefficients of variation for acres of soybeans treated with specific pesticides in the Southeast, 1980 a/ b/

Pesticides	:	:	:	North	:	South	:	Region
				Alabama		Georgia		Carolina
				----- Percent -----				
HERBICIDES								
<u>Single materials</u>								
Alachlor	39	33	22	39		16		
Bentazon	21	41	39	36		15		
Metribuzin	28	28	49	70		18		
Pendimethalin	57	49	-	<u>c/</u>		35		
Trifluralin	17	17	34	11		8		
<u>Tank-mix materials</u>								
Alachlor + linuron	-	-	43	43		31		
Dinoseb + naptalam	<u>c/</u>	26	70	53		22		
Metribuzin + trifluralin	43	-	70	57		31		
INSECTICIDES								
<u>Single materials</u>								
Carbaryl	-	70	25	20		15		
Methomyl	29	17	19	19		10		
Methyl parathion	71	49	-	70		35		
Parathion	57	-	-	70		45		
Toxaphene	53	32	-	-		28		
<u>Tank-mix materials</u>								
Methyl parathion + toxaphene	70	70	-	70		41		
NEMATICIDES								
Aldicarb	57	-	-	43		35		
Carbofuran	<u>c/</u>	-	70	<u>c/</u>		50		
Ethoprop	-	-	<u>c/</u>	<u>c/</u>		71		
Ethylene dibromide	-	-	-	39		39		
FUNGICIDES								
Benomyl	<u>c/</u>	70	-	70		45		

- None reported.

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ A coefficient of variation is the standard error of the estimate divided by acres treated times 100. A coefficient of variation describes the relative variation of the estimate. The lower the value of the coefficient, the more reliable the estimate.

c/ Use of this material at the State level was not significant and was reported in the "other" or "total" category.

Appendix Table 2. Percentage of soybean herbicide acre-treatments by primary weeds controlled as reported by farmers in the Southeast, 1980 a/

Herbicides, weeds	: North : South :					Region
	: Alabama	: Georgia	: Carolina	: Carolina		
	----- Percent -----					
<u>Alachlor</u>						
Grasses:						
Barnyardgrass	50	-	-	-		9
Broadleaf signalgrass	-	-	12	-		5
Crabgrass	17	75	19	33		35
Johnsongrass	-	-	13	17		8
Panicum	-	-	6	33		7
Other	-	-	6	-		2
Broadleaves:						
Cocklebur	17	13	13	-		12
Morningglory	-	-	19	-		8
Pigweed	-	12	6	-		6
Sicklepod	16	-	-	-		3
Nutsedge	-	-	6	17		5
<u>Bentazon</u>						
Broadleaves:						
Cocklebur	94	100	67	90		91
Ragweed	6	-	17	-		5
Sicklepod	-	-	-	10		2
Other	-	-	16	-		2
<u>Metribuzin</u>						
Grasses:						
Broadleaf signalgrass	-	9	-	-		4
Crabgrass	-	8	25	-		6
Other	9	-	-	-		3
Broadleaves:						
Cocklebur	37	56	-	50		41
Morningglory	36	-	25	-		18
Pigweed	-	-	25	-		3
Ragweed	-	-	25	-		3
Sicklepod	9	9	-	50		10
Other	9	18	-	-		12
<u>Trifluralin</u>						
Grasses:						
Broadleaf signalgrass	-	-	-	5		2
Crabgrass	31	62	63	52		50
Johnsongrass	37	8	13	3		15
Panicum	-	-	12	3		2
Other	4	8	-	2		5
Broadleaves:						
Cocklebur	12	4	12	29		15
Pigweed	12	13	-	3		8
Other	4	5	-	3		3

- None reported.

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

Appendix Table 3. Percentage of soybean insecticide acre-treatments by primary insects controlled as reported by farmers in the Southeast, 1980 a/

Insecticides, insects	Percent				
	Alabama	Georgia	North Carolina	South Carolina	Region
<u>Carbaryl</u>					
Armyworm	-	100	20	39	37
Bean leaf beetle	-	-	-	7	4
Cabbage looper	-	-	13	-	5
Corn earworm	-	-	35	32	30
Cutworm	-	-	13	-	5
Green cloverworm	-	-	19	-	7
Velvetbean caterpillar	-	-	-	16	9
Other	-	-	-	6	3
<u>Methomyl</u>					
Armyworm	64	20	12	13	21
Bean leaf beetle	-	-	-	6	2
Cabbage looper	-	10	25	6	11
Corn earworm	24	57	38	50	48
Cutworm	-	13	-	3	7
Spider mite	-	-	19	-	3
Velvetbean caterpillar	-	-	6	-	1
Other	12	-	-	22	7
<u>Methyl parathion</u>					
Armyworm	-	75	-	-	43
Velvetbean caterpillar	-	-	-	50	10
Other	100	25	-	50	47

- None reported.

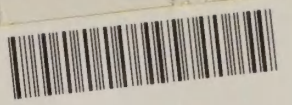
a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

Appendix Table 4. Percentage of soybean fungicide acre-treatments by primary diseases controlled as reported by farmers in the Southeast, 1980 a/

Fungicides, diseases	: North : South :				Region
	: Alabama	: Georgia	: Carolina	: Carolina	
----- Percent -----					
<u>Benomyl</u>					
Leaf blight	-	33	-	-	12
Pod and stem blight	100	67	-	100	88
<u>Benomyl + other</u>					
Anthracnose	-	-	100	-	100

- None reported.

a/ "1980 Soybean Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.



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