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STAFF REPORT

1980 PESTICIDE USE ON FIELD CORN
IN THE MAJOR PRODUCING STATES

by

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

February 1982

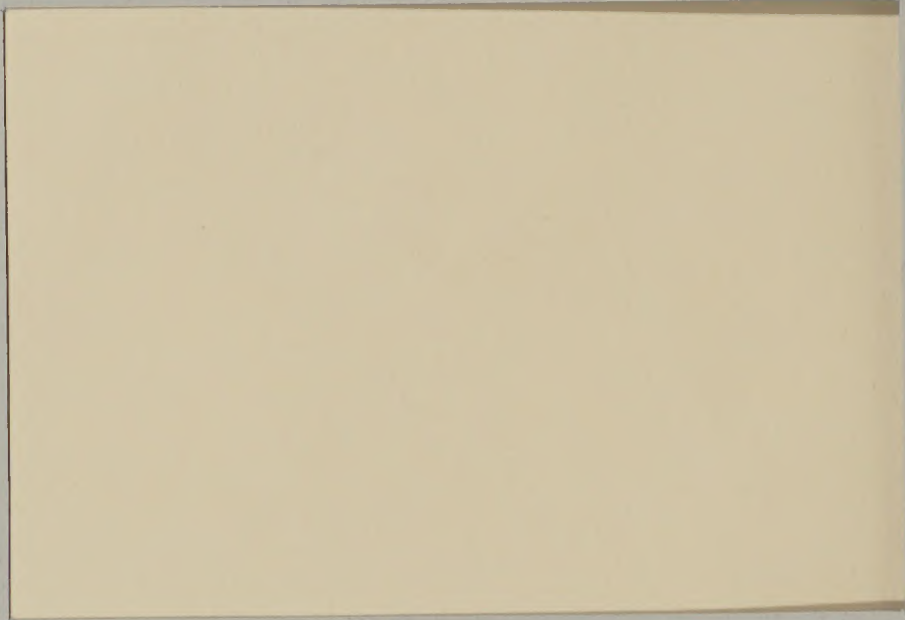
ERS Staff Report No. AGES820202

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1980 PESTICIDE USE ON FIELD CORN IN THE MAJOR PRODUCING STATES. by Michael Hanthorn, Robert McDowell, and Larry Roberson. Economic Research Service, U.S. Department of Agriculture, Washington, D.C. 20250. February 1982.

ERS Staff Report No. AGES820202

ABSTRACT

Expenditures reported for 1980 on field corn in the major producing States totaled 104.5 million pounds of insecticides, 77.8 million pounds of herbicides, and 1.4 million pounds of fungicides. The total value of pesticides used was \$1.4 billion. The major uses were for insecticides, herbicides, and fungicides. The major uses were for insecticides, herbicides, and fungicides.

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1980 PESTICIDE USE ON FIELD CORN IN THE MAJOR PRODUCING STATES. 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.

ERS Staff Report No. AGES820202

ABSTRACT

Farmers reported that 245.9 million pounds (a.i.) of pesticides were applied to field corn in the major producing States during 1980. This consisted of 209.5 million pounds (a.i.) of herbicides and 36.4 million pounds (a.i.) of insecticides. Pesticide acre-treatments totaled 135.4 million and consisted of 73.8 million with single material herbicides, 25.7 million with herbicide mixes, and 35.9 million with insecticides. The primary herbicides were alachlor, atrazine, and 2,4-D. The major insecticides were carbofuran, fonofos, and terbufos. Herbicides were applied primarily to control cocklebur and foxtail infestations. Insecticides were mainly applied to control corn borer and corn rootworm larvae infestations. Coefficients of variation were computed for acres of field corn treated with specific pesticide materials.

Key words: Pesticides, herbicides, insecticides, active ingredient, acres treated, acre-treatments, application rates, primary target pests, field corn, and major producing States.

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AUTHORS

Hanthorn, Osteen, and McDowell are with the Economic Research Service. Roberson is with the Statistical Reporting Service.

PREFACE

This report presents data at the national and regional level for pesticides applied to field corn in the major producing States during 1980. Pesticide use data for most of the individual major producing States are available in the following ERS Staff Reports:

- "1980 Pesticide Use on Field Corn in the Corn Belt"
- "1980 Pesticide Use on Field Corn in the Northern Plains"
- "1980 Pesticide Use on Field Corn in the Lake States".

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INTRODUCTION

This report presents pesticide use data for field corn grown in the major producing States during 1980. The data include usage patterns and quantities of specific herbicides and insecticides applied to field corn. 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 Corn Objective Yield Survey. A total of 2,870 farmers were personally interviewed by enumerators in the 16 major corn producing States. The sample size was as follows: Corn Belt, 1,210; Northern Plains, 560; Lake States, 515; Southeast, 240; Pennsylvania, 145; and Texas, 200.

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 field corn in 1980. Each field corn 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 regional and national 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, and insect species. 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 the estimated value ± 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.

MAJOR PRODUCING STATES

Description

The major producing States are located in the Corn Belt, Northern Plains, Lake States, and Southeast regions (Figure 1). Pennsylvania and Texas are also major producing States. The Corn Belt includes Illinois, Indiana, Iowa, Kentucky, Missouri, and Ohio. The Northern Plains comprises Kansas, Nebraska, and South Dakota. The Lake States are Michigan, Minnesota, and Wisconsin, while Georgia and North Carolina constitute the Southeast.

Approximately 89 percent of the U.S. field corn acreage (74.9 million acres) was planted in these States in 1980, from which 93 percent of the corn for grain (6.2 billion bushels) and 66 percent of the silage (72.8 million tons) were produced (Table 1). The farm value of grain grown in the major producing States totaled \$20.1 billion in 1980. About 48 percent (40.6 million acres) of the planted acreage was located in the Corn Belt during 1980. This acreage yielded 57 percent of the corn for grain (3.8 billion bushels) and 24 percent of the silage (21.8 million tons) grown in the United States during 1980.

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

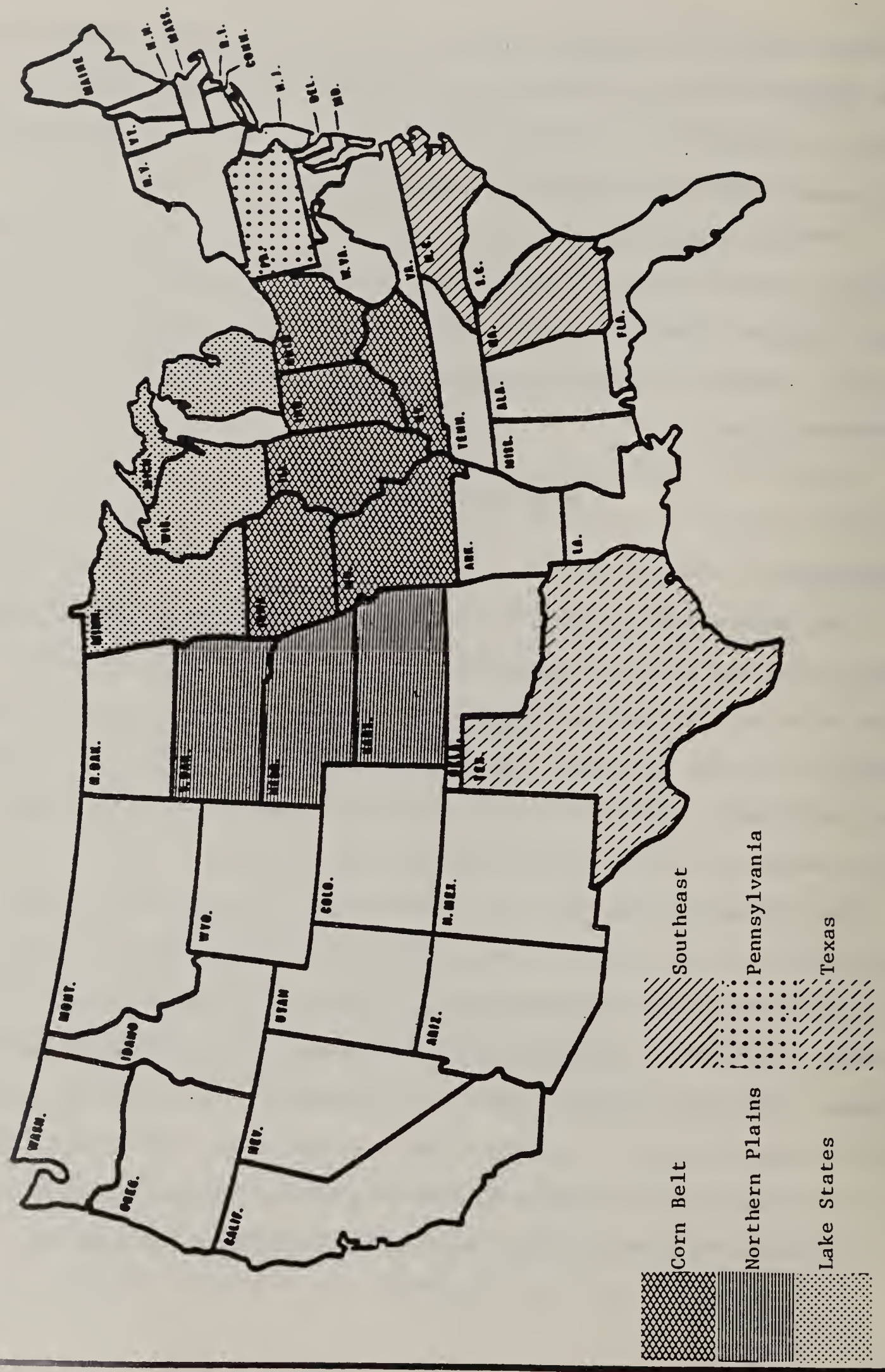


Table 1. Field corn acreage planted and harvested, production, and value in the major producing States, 1980

States	Total acres a/			Total production a/		Value
	Planted	Harvested	Grain	Bushels of grain	Tons of silage	of grain b/
						Million dollars
<u>Corn Belt</u>						
Illinois	11.7	11.4	0.2	1,066	2.9	3,517
Indiana	6.5	6.3	.1	603	1.9	1,990
Iowa	14.0	13.3	.7	1,463	9.5	4,608
Kentucky	1.6	1.5	.2	103	2.0	383
Missouri	2.6	2.1	.3	110	2.4	379
Ohio	4.2	3.9	.2	441	3.1	1,454
Region c/	40.6(48)	38.5(53)	1.7(18)	3,786(57)	21.8(24)	12,331(57)
<u>Northern Plains</u>						
Kansas	1.8	1.2	.4	117	3.8	396
Nebraska	7.8	7.1	.6	604	6.8	1,961
South Dakota	3.5	2.3	1.0	122	5.4	372
Region	13.1(16)	10.6(15)	2.0(22)	843(13)	16.0(14)	2,729(13)
<u>Lake States</u>						
Michigan	3.0	2.6	.3	247	4.4	790
Minnesota	7.2	6.3	.9	610	10.6	1,861
Wisconsin	4.2	3.3	.8	348	9.5	1,080
Region	14.4(17)	12.2(17)	2.0(22)	1,205(18)	24.5(22)	3,731(17)
<u>Southeast</u>						
Georgia	1.6	1.3	.1	55	.9	191
North Carolina	1.9	1.7	.1	104	1.6	379
Region	3.5(4)	3.0(4)	.2(2)	159(2)	2.5(2)	570(3)
Pennsylvania	1.8(2)	1.3(2)	.5(5)	96(1)	6.3(6)	370(2)
Texas	1.5(2)	1.3(2)	.1(1)	117(2)	1.7(2)	410(2)
TOTAL	74.9(89)	66.9(92)	6.5(70)	6,206(93)	72.8(66)	20,141(93)

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.

c/ Numbers in parentheses represent percentage of U.S. total.

Trends in Pesticide Use

There was a substantial increase in the number of acres planted to field corn and treated with pesticides in the major producing States between 1972 and 1980. Acres planted increased by 26 percent from 59.4 to 74.9 million (Table 2). Acres treated with herbicides increased 71 percent from 40.7 to 69.4 million, while acres treated with insecticides more than doubled from 15.4 to 31.9 million.

In 1980, 93 percent of the planted acreage in the major producing States was treated with herbicides and 43 percent was treated with insecticides. At least three-fourths of the planted acres in each region were treated with herbicides, whereas the proportion treated with insecticides fell in a range between 14 and 56 percent. Farmers reported applying insecticides on 77 percent of the planted acreage in Texas.

Pesticide Use

The major field corn weed and insect pests, as reported by farmers in the major producing States, are listed in Tables 3 and 4. 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 field corn.

In 1980, farmers reported that foxtail was the primary target pest for 35 percent of the herbicide acre-treatments (Table 3). Also, 13 percent were made to control cocklebur infestations, 8 percent were made to control velvetleaf infestations, 7 percent were made to suppress quackgrass infestations, and 6 percent were made for pigweed control. Corn rootworm larvae were the primary target pest for 69 percent of the insecticide acre-treatments and corn borer control accounted for 11 percent (Table 4).

Table 2. Field corn acreage planted and treated for weed and insect control in the major producing States, 1972 and 1980

States	Planted acres		Treated acres				Percent of planted acres treated			
	1972 a/	1980 b/	1972 c/	1980 d/	1972 c/	1980 d/	1972:	1980:	1972:	1980:
	Million		Million				Percent			
Corn Belt										
Illinois	9.5	11.7	7.8	11.2	4.4	5.5	82	96	46	47
Indiana	5.1	6.5	4.3	6.4	1.1	2.1	84	98	22	32
Iowa	11.3	14.0	8.7	13.9	3.6	6.1	77	99	32	44
Kentucky	1.1	1.6	.9	1.5	-	.3	78	94	-	19
Missouri	2.7	2.6	2.3	2.4	.5	.7	85	92	19	27
Ohio	3.3	4.2	2.6	4.2	.5	1.7	79	100	15	40
Region	33.0	40.6	26.6	39.6	10.1	16.4	81	98	31	40
Northern Plains										
Kansas	1.6	1.8	.9	1.7	.5	1.4	60	92	34	77
Nebraska	5.7	7.8	2.8	6.8	2.0	5.0	50	87	35	65
South Dakota	3.3	3.5	1.3	2.1	.6	.9	39	60	17	26
Region	10.5	13.1	5.0	10.6	3.1	7.3	48	81	29	56
Lake States										
Michigan	2.1	3.0	1.5	2.8	.04	1.4	69	93	2	48
Minnesota	5.6	7.2	4.2	6.9	1.0	1.7	74	95	18	24
Wisconsin	3.1	4.2	2.0	4.0	.9	2.6	65	96	31	62
Region	10.8	14.4	7.7	13.7	2.0	5.7	70	95	18	40
Southeast										
Georgia	1.6	1.6	.4	.9	-	.07	23	58	-	4
North										
Carolina	1.5	1.9	1.1	1.8	.06	.4	79	94	1	23
Region	3.1	3.5	1.5	2.7	.06	.5	50	78	2	14
Pennsylvania	1.4	1.8	.8	1.7	.1	.8	53	95	9	47
Texas	.6	1.5	e/	1.1	e/	1.2	e/	73	e/	77
TOTAL	59.4	74.9	40.7	69.4	15.4	31.9	69f/	93	26f/	43

- None reported.

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

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

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

d/ "1980 Corn Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

e/ Not surveyed in 1972.

f/ Computed excluding planted acres for Texas.

Table 3. Percentage of field corn herbicide acre-treatments by primary weeds controlled as reported by farmers in the major producing regions, 1980 a/

Pests	: Corn :Northern: Lake :South-:Pennsylv-: : : Belt : Plains :States: east : vania : Texas : Total						
	----- Percent -----						
<u>Grasses</u>							
Barnyardgrass	1	2	1	-	2	1	1
Broadleaf signalgrass	2	2	2	2	3	4	2
Crabgrass	1	4	1	18	1	-	2
Foxtail	42	32	28	-	16	-	35
Johnsongrass	2	3	1	2	3	24	2
Panicum	1	-	1	10	6	-	1
Quackgrass	2	1	27	-	13	-	7
Shattercane	1	6	-	-	-	-	1
Other	1	9	3	8	14	7	4
<u>Broadleaf weeds</u>							
Canada thistle	1	1	5	-	1	-	2
Cocklebur	13	9	11	38	1	6	13
Morningglory	3	1	1	5	4	-	2
Pigweed	5	12	5	1	1	31	6
Ragweed	4	1	4	6	14	25	4
Smartweed	5	3	1	1	1	-	3
Velvetleaf	11	5	6	-	1	-	8
Other	4	8	2	7	14	1	6
Nutsedge	1	1	1	2	5	1	1

- None reported.

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

Table 4. Percentage of field corn insecticide acre-treatments by primary insects controlled as reported by farmers in the major producing regions, 1980 a/

Pests	: Corn :Northern: Lake :South-:Pennsylv-: : : Belt : Plains :States: east : vania : Texas : Total						
	----- Percent -----						
<u>Insects</u>							
Armyworm	1	1	-	-	2	4	1
Banks grass mite	-	12	-	-	-	41	6
Corn borer <u>b/</u>	2	24	5	2	16	42	11
Corn rootworm larvae	84	51	92	3	64	5	69
Corn rootworm beetle	1	3	-	-	-	-	1
Cutworm	8	1	1	9	-	-	4
Grasshopper	-	3	-	-	-	-	1
Leaf aphid	1	-	-	-	-	-	1
Wireworm	3	1	1	39	-	2	3
Other	-	4	1	20 <u>c/</u>	18 <u>d/</u>	6	2
Nematode	-	-	-	27	-	-	1

- None reported.

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

b/ Represents the European corn borer in the Corn Belt, Lake States, and Southeast regions and Pennsylvania. Represents the Southwestern corn borer in Texas. Represents the European and Southwestern corn borer in the Northern Plains.

c/ Includes billbug, 12 percent, and corn earworm, 6 percent.

d/ Includes corn earworm, 4 percent; grub, 2 percent; and stalkborer, 6 percent.

About 245.9 million pounds (a.i.) of pesticides were applied to field corn in 1980 (Table 5). Of these, 127.2 million pounds were single material herbicides, 82.3 million pounds were herbicide mixes, and 36.4 million pounds were insecticides. Application rates for herbicides, applied alone and in mixes, averaged 1.7 and 3.2 pounds (a.i.) per acre-treatment, respectively. Insecticide rates averaged 1 pound (a.i.) per acre-treatment.

Farmers made 135.4 million pesticide acre-treatments, comprised of 73.8 million with single material herbicides, 25.7 million with herbicide mixes, and 35.9 million with insecticides.

One-third (23.7 million) of the single material herbicide acre-treatments were atrazine. Also, alachlor and 2,4-D acre-treatments totaled 13.9 and 10.2 million (19 and 14 percent), respectively. One-third (8.1 million) of the herbicide mix acre-treatments were atrazine plus alachlor and 15 percent (3.9 million) were atrazine plus butylate⁺. All of the butylate⁺ included in this report contained an additive to protect the corn seed from possible damage and was sold as Sutan⁺. Dicamba plus 2,4-D acre-treatments accounted for 2.3 million (9 percent) of the herbicide mix acre-treatments.

Foxtail was the primary target pest for 68 percent of the alachlor, 29 percent of the atrazine, and 70 percent of the butylate⁺ acre-treatments (Appendix Table 2). Also, quackgrass control accounted for 15 percent of the atrazine acre-treatments. Cocklebur and velvetleaf were the primary target pests for 41 and 20 percent, respectively, of the 2,4-D acre-treatments (Appendix Table 3).

Carbofuran, fonofos, and terbufos acre-treatments totaled 9.7, 6.1, and 8 million of the insecticide acre-treatments, respectively (Table 5). In total, these accounted for two-thirds of the insecticide acre-treatments. Corn rootworm larvae were the primary target pest for 66 percent of the carbofuran, 51 percent

Table 5. Usage patterns and quantities of specific pesticides applied to field corn in the major producing States, 1980 a/

Pesticides	: Acres <u>b/</u>	: Acre-	: Pounds of active ingredient	
	: treated	: treatments	: Total	: Per treatment
----- <u>Million</u> -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	13.9	13.9	29.3	2.1
Atrazine	23.1	23.7	37.3	1.6
Butylate ⁺	7.9	7.9	27.2	3.4
Cyanazine	6.1	6.1	10.6	1.7
Dicamba	4.2	4.2	1.5	.4
Metolachlor	3.1	3.1	5.5	1.8
2,4-D	9.6	10.2	5.0	.5
Other	-	4.7	10.8	2.3
Total	-	73.8	127.2	1.7
<u>Tank-mix materials</u>				
Atrazine + alachlor	7.9	8.1	11.1+14.3	1.4+1.8
Atrazine + butylate ⁺	3.8	3.9	4.9+11.7	1.3+3.0
Atrazine + cyanazine	1.5	1.5	1.7+1.9	1.1+1.3
Atrazine + metolachlor	2.0	2.0	3.1+3.5	1.5+1.7
Atrazine + simazine	1.0	1.0	1.2+1.2	1.1+1.2
Atrazine + other <u>d/</u>	-	2.9	3.3+6.6	1.1+2.3
Cyanazine + alachlor	1.2	1.3	2.2+2.4	1.7+1.8
Cyanazine + butylate ⁺	1.9	1.9	3.1+5.6	1.7+3.0
Cyanazine + other <u>e/</u>	-	.4	.7+ .8	1.8+2.0
Dicamba + 2,4-D	2.3	2.3	.8+1.0	.4+ .4
Dicamba + other <u>f/</u>	-	.1	.1+ .2	1.0+2.0
Other	-	.3	.3	3.0
Total	-	25.7	82.3	3.2
Total herbicides	-	99.5	209.5	2.1

-- continued

Table 5. Usage patterns and quantities of specific pesticides applied to field corn in the major producing States, 1980 a/ — continued

Pesticides	: Acres <u>b/</u>	: Acre- <u>c/</u>	:Pounds of active ingredient	
	: treated	: treatments	: Total	: Per treatment
----- <u>Million</u> -----				
INSECTICIDES				
Carbofuran <u>g/</u>	9.2	9.7	8.8	0.9
Chlorpyrifos	2.6	2.6	2.9	1.1
Fonofos	6.1	6.1	7.1	1.2
Phorate	3.7	3.7	3.6	1.0
Terbufos	7.9	8.0	9.3	1.2
Other	-	5.8	4.7	.8
Total	-	35.9	36.4	1.0
TOTAL PESTICIDES	-	135.4	245.9	1.8

a/ "1980 Corn 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 and insecticides 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/ Other includes bentazon, bifenox, dicamba, EPTC⁺, glyphosate, linuron, metribuzin, pendimethalin, propachlor, and 2,4-D.

e/ Other includes EPTC⁺, metolachlor, simazine, and 2,4-D.

f/ Other includes alachlor and metolachlor.

g/ Nematodes were the primary target pest for 3 percent (249,000) of the carbofuran acre-treatments.

of the chlorpyrifos, 95 percent of the fonofos, 90 percent of the phorate, and 94 percent of the terbufos acre-treatments (Appendix Table 4). One-fifth of the carbofuran acre-treatments were made for corn borer control and 45 percent of the chlorpyrifos acre-treatments were made for cutworm control. European corn borer is prevalent throughout most of the major producing States, excluding western Kansas and Texas where Southwestern corn borer infestations are common.

CORN BELT

Farmers in the Corn Belt planted 40.6 million acres of field corn in 1980 (Table 2). Of these, 39.6 million acres were treated with herbicides and 16.4 million acres were treated with insecticides. Approximately 144.8 million pounds (a.i.) of pesticides were applied to field corn, consisting of 75.3 million pounds of single material herbicides, 51.7 million pounds of herbicide mixes, and 17.8 million pounds of insecticides (Table 6). Application rates for herbicides, applied alone and in mixes, averaged 1.7 and 3.3 pounds (a.i.) per acre-treatment, respectively. Insecticide application rates averaged 1.1 pounds (a.i.) per acre-treatment.

Farmers made 75.5 million pesticide acre-treatments, comprised of 43.6 million with single material herbicides, 15.7 million with herbicide mixes, and 16.2 million with insecticides.

Atrazine acre-treatments totaled 13.1 million, or 30 percent of the single material herbicide acre-treatments. Alachlor, butylate⁺, and 2,4-D accounted for 19.8 million (45 percent) of these acre-treatments. Atrazine plus alachlor and atrazine plus butylate⁺ accounted for 7.4 million (47 percent) of the herbicide mix acre-treatments, while cyanazine plus butylate⁺ and dicamba plus 2,4-D acre-treatments totaled 3 million (19 percent). Foxtail was the primary target pest for three-fourths of both the alachlor and butylate⁺

Table 6. Usage patterns and quantities of specific pesticides applied to field corn in the Corn Belt, 1980 a/

Pesticides	: Acres <u>b/</u> :	Acres- <u>c/</u> :	Pounds of active ingredient	
	: treated	: treatments	Total	Per treatment
----- Million -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	7.7	7.7	16.3	2.1
Atrazine	12.9	13.1	20.0	1.5
Butylate ⁺	6.1	6.2	20.4	3.3
Cyanazine	3.7	3.7	6.6	1.8
Dicamba	2.7	2.7	1.0	.4
Metolachlor	2.3	2.3	4.1	1.8
2,4-D	5.8	5.9	2.8	.5
Other	-	2.0	4.1	2.0
Total	-	43.6	75.3	1.7
<u>Tank-mix materials</u>				
Atrazine + alachlor	4.2	4.3	5.6+7.6	1.3+1.8
Atrazine + butylate ⁺	3.1	3.1	3.8+9.3	1.2+3.0
Atrazine + cyanazine	.9	.9	1.0+1.2	1.2+1.4
Atrazine + metolachlor	1.2	1.2	1.8+2.1	1.5+1.7
Atrazine + simazine	.7	.7	.8+ .8	1.1+1.1
Atrazine + other <u>d/</u>	-	1.5	1.8+3.6	1.2+2.4
Cyanazine + alachlor	.5	.6	1.1+1.0	1.9+1.7
Cyanazine + butylate ⁺	1.7	1.7	2.9+5.1	1.7+3.0
Cyanazine + other <u>e/</u>	-	.2	.4+ .4	2.0+2.0
Dicamba + 2,4-D	1.3	1.3	.5+ .5	.4+ .4
Other	-	.2	.4	2.0
Total	-	15.7	51.7	3.3
Total herbicides	-	59.3	127.0	2.1
INSECTICIDES				
Carbofuran	4.0	4.1	3.9	.9
Chlorpyrifos	1.9	1.9	2.2	1.2
Fonofos	2.8	2.8	3.2	1.2
Phorate	1.7	1.7	1.4	.8
Terbufos	4.8	4.8	5.7	1.2
Other	-	.9	1.4	1.5
Total	-	16.2	17.8	1.1
TOTAL PESTICIDES	-	75.5	144.8	1.9

a/ "1980 Corn 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 and insecticides 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/ Other includes bentazon, bifenox, dicamba, EPTC⁺, metribuzin, paraquat, pendimethalin, propachlor, and 2,4-D.

e/ Other includes EPTC⁺, metolachlor, and 2,4-D.

acre-treatments (Appendix Table 2). Approximately 41 and 13 percent of the atrazine acre-treatments were made to control foxtail and cocklebur infestations, respectively (Appendix Tables 2 and 3). About 63 percent of the 2,4-D acre-treatments were made for cocklebur and velvetleaf control.

The two major field corn insecticides, carbofuran and terbufos, constituted 4.1 and 4.8 million (25 and 30 percent) of the insecticide acre-treatments, respectively (Table 6). About 6.4 million (39 percent) of the insecticide acre-treatments were made with chlorpyrifos, fonofos, and phorate. Between 92 and 100 percent of the carbofuran, fonofos, phorate, and terbufos acre-treatments were made for corn rootworm larvae control (Appendix Table 4). About 58 percent of the chlorpyrifos acre-treatments were made for cutworm control and 37 percent were made for corn rootworm larvae control.

NORTHERN PLAINS

In 1980, Northern Plains farmers planted 13.1 million acres of field corn and treated 10.6 million with herbicides and 7.3 million with insecticides (Table 2). About 33.3 million pounds (a.i.) of pesticides were applied to field corn (Table 7). This amount consisted of 14.6 million pounds (a.i.) of single material herbicides, 9 million pounds (a.i.) of herbicide mixes, and 9.6 million pounds (a.i.) of insecticides. Application rates for herbicides, applied alone and in mixes, averaged 1.6 and 2.5 pounds (a.i.) per acre-treatment, respectively. Insecticide applications averaged 0.9 pound (a.i.) per acre-treatment.

Pesticide acre-treatments totaled 23.1 million, consisting of 9 million with single material herbicides, 3.6 million with herbicide mixes, and 10.4 million with insecticides.

Atrazine acre-treatments amounted to 3.5 million, or 38 percent of those

Table 7. Usage patterns and quantities of specific pesticides applied to field corn in the Northern Plains, 1980 a/

Pesticides	: Acres <u>b/</u> : Acre-	<u>c/</u> :Pounds of active ingredient	Total	Per treatment
	: treated	: treatments		
----- <u>Thousand</u> -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	2,053	2,053	3,049	1.5
Atrazine	3,286	3,464	5,708	1.6
Butylate ⁺	567	567	2,199	3.9
EPTC ⁺	423	423	1,659	3.9
2,4-D	1,226	1,308	596	.5
Other	-	1,211	1,419	1.2
Total	-	9,026	14,630	1.6
<u>Tank-mix materials</u>				
Atrazine + alachlor	1,088	1,088	1,190+1,676	1.1+1.5
Atrazine + butylate ⁺	306	306	384+964	1.3+3.2
Atrazine + cyanazine	387	387	323+343	.8+ .9
Atrazine + propachlor	390	390	244+471	.6+1.2
Atrazine + other <u>d/</u>	-	624	681+1,184	1.1+1.9
Cyanazine + other <u>e/</u>	-	357	413+720	1.2+2.0
Dicamba + 2,4-D	405	405	187+197	.5+ .5
Other	-	41	72	1.8
Total	-	3,598	9,049	2.5
Total herbicides	-	12,624	23,679	1.9
INSECTICIDES				
Carbofuran	2,297	2,424	1,992	.8
Dimethoate	855	1,061	535	.5
Fonofos	1,713	1,759	2,120	1.2
Parathion	851	1,202	597	.5
Phorate	751	751	825	1.1
Terbufos	1,591	1,591	1,818	1.1
Other	-	1,660	1,710	1.0
Total	-	10,448	9,597	.9
TOTAL PESTICIDES	-	23,072	33,276	1.4

a/ "1980 Corn 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 and insecticides 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/ Other includes bentazon, fonofos, EPTC⁺, linuron, metolachlor, pendimethalin, simazine, and 2,4-D.

e/ Other includes alachlor, butylate⁺, and metolachlor.

made with single material herbicides. Alachlor and 2,4-D acre-treatments totaled 2.1 and 1.3 million, respectively, and represented approximately the same proportion of acre-treatments as atrazine. Atrazine plus alachlor totaled 1.1 million (30 percent) of the herbicide mix acre-treatments. Atrazine was also combined in separate mixes with butylate⁺, cyanazine, and propachlor. These mixes comprised 1.1 million (30 percent) of the herbicide mix acre-treatments.

Foxtail was the primary target pest for two-thirds of the alachlor acre-treatments (Appendix Table 2). Atrazine acre-treatments for foxtail and pigweed control totaled 29 and 23 percent, respectively (Appendix Tables 2 and 3). Cocklebur was the primary target pest for 46 percent of the 2,4-D acre-treatments and velvetleaf control accounted for 13 percent.

Three-fourths (8 million) of the insecticide acre-treatments were made with either carbofuran, dimethoate, fonofos, parathion, or terbufos (Table 7). Banks grass mite and Southwestern corn borer infestations were common in southwestern Kansas and accounted for a substantial proportion of the regional insecticide acre-treatments (Table 4). All of the chlorpyrifos, 95 percent of the fonofos, 97 percent of the terbufos, 76 percent of the phorate, and 42 percent of the carbofuran acre-treatments were made for corn rootworm larvae control (Appendix Table 4). Corn borer was the primary target pest for 49 percent of the carbofuran acre-treatments. One-fourth of the phorate acre-treatments were made for European corn borer control.

LAKE STATES

During the 1980 growing season, 14.4 million acres of field corn were planted in the Lake States (Table 2). Of these, 13.7 million acres were treated with herbicides and 5.7 million acres were treated with insecticides. Approximately 49.3 million pounds (a.i.) of pesticides were applied to field corn (Table 8).

Table 8. Usage patterns and quantities of specific pesticides applied to field corn in the Lake States, 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	3,574	3,574	8,614	2.4
Atrazine	4,341	4,471	7,236	1.6
Butylate ⁺	727	727	3,067	4.2
Cyanazine	1,783	1,808	3,105	1.7
Dicamba	1,030	1,030	327	.3
Propachlor	667	667	1,562	2.3
2,4-D	2,177	2,529	1,205	.5
Other	-	1,218	3,127	2.6
Total	-	16,024	28,243	1.8
<u>Tank-mix materials</u>				
Atrazine + alachlor	1,899	1,978	3,235+3,735	1.6+1.9
Atrazine + butylate ⁺	250	250	369+745	1.5+3.0
Atrazine + metolachlor	517	528	814+982	1.5+1.9
Atrazine + other <u>d/</u>	-	549	633+1,271	1.2+2.3
Cyanazine + alachlor	410	410	714+858	1.7+2.1
Cyanazine + other <u>e/</u>	-	226	408+537	1.8+2.4
Dicamba + 2,4-D	570	614	178+210	.3+ .3
Other	-	141	425	3.0
Total	-	4,696	15,114	3.2
Total herbicides	-	20,720	43,357	2.1
INSECTICIDES				
Carbofuran	1,368	1,393	1,265	.9
Fonofos	1,471	1,471	1,632	1.1
Phorate	1,150	1,150	1,301	1.1
Terbufos	1,201	1,201	1,328	1.1
Other	-	412	387	.9
Total	-	5,627	5,913	1.1
TOTAL PESTICIDES	-	26,347	49,270	1.9

a/ "1980 Corn 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 and insecticides 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/ Other includes cyanazine, dicamba, EPTC⁺, metolachlor, paraquat, pendimethalin, propachlor, simazine, and 2,4-D.

e/ Other includes butylate⁺, metolachlor, and simazine.

This amount consisted of 28.2 million pounds (a.i.) of single material herbicides, 15.1 million pounds (a.i.) of herbicide mixes, and 5.9 million pounds (a.i.) of insecticides. Application rates for herbicides, applied alone and in mixes, were 1.8 and 3.2 pounds (a.i.) per acre-treatment, respectively. Insecticide applications averaged 1.1 pounds (a.i.) per acre-treatment.

About 26.3 million acre-treatments were made on field corn, of which 16 million were single material herbicides, 4.7 million were herbicide mixes, and 5.6 million were insecticides.

Alachlor and atrazine acre-treatments totaled 3.6 and 4.5 million, respectively, and accounted for 50 percent of the single material herbicide acre-treatments. Cyanazine, dicamba, and 2,4-D acre-treatments totaled 1.8, 1, and 2.5 million, respectively, or one-third of the single material herbicide acre-treatments. About 2 million (42 percent) of the herbicide mix acre-treatments were atrazine plus alachlor.

Farmers reported that quackgrass was a primary target pest for a greater proportion of herbicide acre-treatments in the Lake States than in the other regions (Table 3). Quackgrass was the primary target pest for two-thirds of the atrazine acre-treatments and cocklebur was the major target pest for 60 percent of the 2,4-D acre-treatments (Appendix Tables 2 and 3). Two-thirds of the alachlor acre-treatments and 79 percent of the butylate⁺ acre-treatments were made to control foxtail infestations.

Approximately the same proportion of the insecticide acre-treatments was made with carbofuran, fonofos, phorate, and terbufos. These accounted for 5.2 million (93 percent) of the insecticide acre-treatments (Table 8). Between 83 and 92 percent of the carbofuran, chlorpyrifos, fonofos, and phorate acre-treatments and all of the terbufos acre-treatments were made for corn rootworm larvae control (Appendix Table 4). European corn borer was the major target

pest for 8 percent of the carbofuran and 10 percent of the phorate acre-treatments. About 17 percent of the chlorpyrifos acre-treatments were made for cutworm control.

SOUTHEAST

In 1980, Southeast farmers planted 3.5 million acres of field corn, of which 2.7 million were treated with herbicides and 500,000 were treated with insecticides (Table 2). About 9.9 million pounds (a.i.) of pesticides were applied to field corn (Table 9). This amount consisted of 5.2 million pounds (a.i.) of single material herbicides, 3.6 million pounds (a.i.) of herbicide mixes, and 1 million pounds (a.i.) of insecticides. Application rates for herbicides, applied alone and in mixes, averaged 1.9 and 3.5 pounds (a.i.) per acre-treatment, respectively. Insecticide applications averaged 1.1 pounds (a.i.) per acre-treatment.

Pesticide acre-treatments totaled 4.6 million and consisted of 2.7 million with single material herbicides, 1 million with herbicide mixes, and 911,000 with insecticides.

Atrazine acre-treatments amounted to 1.1 million (42 percent) of those made with single material herbicides, while alachlor acre-treatments totaled 494,000 (18 percent). Butylate⁺ acre-treatments amounted to 372,000 (14 percent) and 2,4-D acre-treatments totaled 377,000 (14 percent). Atrazine plus alachlor acre-treatments totaled 404,000, or 39 percent of the herbicide mix acre-treatments. Atrazine plus butylate⁺ acre-treatments accounted for 145,000 (14 percent) of the herbicide mix acre-treatments and atrazine plus simazine acre-treatments totaled 201,000 (19 percent).

Cocklebur and crabgrass control accounted for a larger proportion of the herbicide acre-treatments in the Southeast than in the other regions (Table 3).

Table 9. Usage patterns and quantities of specific pesticides applied to field corn 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	494	494	1,132	2.3
Atrazine	1,093	1,126	1,910	1.7
Butylate ⁺	360	372	1,304	3.5
2,4-D	330	377	311	.8
Other	-	329	569	1.7
Total	-	2,698	5,226	1.9
<u>Tank-mix materials</u>				
Atrazine + alachlor	389	404	523+707	1.3+1.7
Atrazine + butylate ⁺	128	145	285+594	2.0+4.1
Atrazine + simazine	201	201	258+257	1.3+1.3
Atrazine + other <u>d/</u>	-	175	301+291	1.7+1.7
Other	-	111	401	3.6
Total	-	1,036	3,617	3.5
Total herbicides	-	3,734	8,843	2.4
INSECTICIDES				
Carbofuran <u>e/</u>	542	542	614	1.1
Terbufos	234	249	334	1.3
Other	-	120	80	.7
Total	-	911	1,028	1.1
TOTAL PESTICIDES	-	4,645	9,871	2.1

a/ "1980 Corn 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 and insecticides 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/ Other includes cyanazine, glyphosate, linuron, and metolachlor.

e/ Nematodes were the primary target pest for 46 percent (249,000) of the carbofuran acre-treatments.

Alachlor acre-treatments for crabgrass and panicum control totaled 27 and 41 percent, respectively (Appendix Table 2). One-half of the atrazine acre-treatments were made to control cocklebur infestations and one-fifth were made for crabgrass control (Appendix Tables 2 and 3). Cocklebur infestations accounted for one-third of the butylate⁺ acre-treatments and 26 percent were made to control crabgrass, Johnsongrass, and sicklepod infestations. One-half of the 2,4-D acre-treatments were made for cocklebur control and one-fourth were made to control morningglory infestations.

Six-tenths (542,000) of the insecticide acre-treatments were made with carbofuran and 27 percent (249,000) were made with terbufos (Table 9). Nematodes were the primary target pest for 46 percent of the carbofuran acre-treatments and wireworm control accounted for 34 percent (Appendix Table 4). Terbufos acre-treatments totaled 56 percent for wireworm control, 25 percent for cutworm control, and 19 percent for billbug control. All of the phorate was used to reduce wireworm infestations.

PENNSYLVANIA

During the 1980 growing season, 1.8 million acres of field corn were planted in Pennsylvania, of which 1.7 million were treated with herbicides and 800,000 were treated with insecticides (Table 2). Approximately 5.5 million pounds (a.i.) of pesticides were applied to field corn, comprised of 2.3 million pounds of single material herbicides, 2.4 million pounds of herbicide mixes, and 725,000 pounds of insecticides (Table 10). Application rates for herbicides, applied alone and in mixes, averaged 1.5 and 3.4 pounds (a.i.) per acre-treatment, respectively. Insecticides were applied at an average rate of 1.1 pounds (a.i.) per acre-treatment.

Pesticide acre-treatments totaled 2.9 million and consisted of 1.5 million

Table 10. Usage patterns and quantities of specific pesticides applied to field corn in Pennsylvania, 1980 a/

Pesticides	: Acres <u>b/</u>	: Acre-	: Pounds of active ingredient	
	: treated	: treatments	: Total	: Per treatment
----- <u>Thousand</u> -----				
HERBICIDES				
<u>Single materials</u>				
Alachlor	140	140	239	1.7
Atrazine	793	820	1,319	1.6
Cyanazine	185	191	293	1.5
Dicamba	65	65	33	.5
Metolachlor	92	92	160	1.8
Paraquat	65	65	28	.4
Simazine	78	78	154	2.0
Other	-	85	112	1.3
Total	-	1,536	2,338	1.5
<u>Tank-mix materials</u>				
Atrazine + alachlor	288	288	410+508	1.4+1.8
Atrazine + butylate ⁺	33	33	52+116	1.6+3.5
Atrazine + cyanazine	131	131	212+194	1.6+1.5
Atrazine + metolachlor	52	52	78+86	1.5+1.6
Atrazine + simazine	39	39	52+63	1.3+1.6
Atrazine + other <u>d/</u>	-	120	161+352	1.3+2.9
Cyanazine + other <u>e/</u>	-	39	71+63	1.8+1.6
Total	-	702	2,418	3.4
Total herbicides	-	2,238	4,756	2.1
INSECTICIDES				
Carbofuran	435	435	448	1.0
Fonofos	118	118	147	1.3
Terbufos	39	39	45	1.2
Toxaphene	45	45	85	1.9
Total	-	637	725	1.1
TOTAL PESTICIDES	-	2,875	5,481	1.9

a/ "1980 Corn 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 and insecticides 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/ Other includes dicamba, linuron, paraquat, and 2,4-D.

e/ Other includes alachlor and metolachlor.

with single material herbicides, 702,000 with herbicide mixes, and 637,000 with insecticides.

Atrazine accounted for 820,000 (53 percent) of the single material herbicide acre-treatments. Alachlor and cyanazine acre-treatments totaled 140,000 (9 percent) and 191,000 (12 percent), respectively. Atrazine plus alachlor acre-treatments accounted for 288,000 (41 percent) of those made with herbicide mixes, while atrazine plus cyanazine acre-treatments totaled 131,000 (19 percent).

Farmers reported that quackgrass and ragweed control accounted for a greater proportion, and foxtail, cocklebur, and velvetleaf control a smaller proportion of the herbicide acre-treatments in Pennsylvania than in most of the regions (Table 3). Foxtail was the primary target pest for 24 percent of the alachlor acre-treatments and all of the butylate⁺ acre-treatments (Appendix Table 2). Quackgrass control accounted for 38 percent of the alachlor and 16 percent of the atrazine acre-treatments. One-fifth of the atrazine and one-fourth of the 2,4-D acre-treatments were made for ragweed control (Appendix Table 3). One-fourth of the 2,4-D acre-treatments were also made for morningglory control.

Two-thirds (435,000) of the insecticide acre-treatments were carbofuran and one-fifth (118,000) were fonofos (Table 10). Corn rootworm larvae were the primary target pest for 67 percent of the carbofuran, 56 percent of the fonofos, and all of the terbufos acre-treatments (Appendix Table 4).

TEXAS

Farmers planted 1.5 million acres of field corn in 1980 (Table 2). Of these, 1.1 million were treated with herbicides and 1.2 million were treated with insecticides. About 3.3 million pounds (a.i.) of pesticides were applied to field corn, consisting of 1.6 million pounds of single material herbicides,

263,000 pounds of herbicide mixes, 1.3 million pounds of single material insecticides, and 90,000 pounds of insecticide mixes (Table 11). Application rates for herbicides, applied alone and in mixes, averaged 1.6 and 2.2 pounds (a.i.) per acre-treatment. Insecticides were applied at an average rate of 0.7 pound (a.i.) per acre-treatment for single materials and 0.8 pound (a.i.) per acre-treatment for mixes.

Pesticide acre-treatments totaled 3.1 million and were comprised of 995,000 with single material herbicides, 120,000 with herbicide mixes, 1.9 million with single material insecticides, and 107,000 with insecticide mixes.

About 77 percent (762,000) of the single material herbicide acre-treatments were made with atrazine. Atrazine plus alachlor accounted for 43,000 (36 percent) of the herbicide mix acre-treatments and atrazine plus metolachlor acre-treatments totaled 69,000 (58 percent). Farmers reported that a greater proportion of herbicide acre-treatments were made for Johnsongrass, pigweed, and ragweed control in Texas than in the other regions (Table 3). Johnsongrass was the primary pest target for all of the butylate⁺ and 21 percent of the atrazine acre-treatments (Appendix Table 2). A major proportion of the atrazine acre-treatments was also made for pigweed and ragweed control (Appendix Table 3). All of the 2,4-D was used to control ragweed infestations.

Carbofuran accounted for 42 percent (786,000) of the single material insecticide acre-treatments (Table 11). Monocrotophos and dimethoate acre-treatments totaled 439,000 (24 percent) and 181,000 (10 percent), respectively. An emergency registration was granted in 1980 which allowed farmers in western Texas to apply monocrotophos on field corn to control Banks grass mite infestations. Dimethoate plus disulfoton acre-treatments accounted for 86 percent (92,000) of the insecticide mix acre-treatments.

Two insect pests, the Banks grass mite and Southwestern corn borer, were

Table 11. Usage patterns and quantities of specific pesticides applied to field corn in Texas, 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>				
Atrazine	738	762	1,186	1.6
Butylate ⁺	62	62	259	4.2
Cyanazine	23	23	44	1.9
Linuron	21	21	11	.5
Metolachlor	31	31	35	1.1
2,4-D	39	39	27	.7
Other	-	57	73	1.3
Total	-	995	1,635	1.6
<u>Tank-mix materials</u>				
Atrazine + alachlor	43	43	75+86	1.8+2.0
Atrazine + metolachlor	69	69	37+56	.5+ .8
Atrazine + 2,4-D	8	8	4+5	.6+ .7
Total	-	120	263	2.2
Total herbicides	-	1,115	1,898	1.7
INSECTICIDES				
<u>Single materials</u>				
Carbaryl	31	62	84	1.4
Carbofuran	560	786	599	.8
Dimethoate	127	181	80	.4
Disulfoton	15	31	19	.6
Monocrotophos	347	439	302	.7
Parathion	77	77	13	.2
Permethrin	62	123	25	.2
Phorate	54	54	53	1.0
Terbufos	54	54	40	.8
Other	-	49	61	1.2
Total	-	1,856	1,276	.7
<u>Tank-mix materials</u>				
Dimethoate + disulfoton	46	92	12+56	.3+1.2
Disulfoton + monocrotophos	15	15	12+10	.8+ .6
Total	-	107	90	.8
Total insecticides	-	1,963	1,366	.7
TOTAL PESTICIDES	-	3,078	3,264	1.1

a/ "1980 Corn 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 and insecticides 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).

the primary target pests for 83 percent of the insecticide acre-treatments (Table 4). Corn rootworm larvae control accounted for a much smaller proportion of the insecticide acre-treatments in Texas than in most of the other regions. About 58 percent of the carbofuran acre-treatments were made to suppress Southwestern corn borer infestations (Appendix Table 4). All of the phorate was used for Banks grass mite control and all of the terbufos was used for corn rootworm larvae control.

REFERENCES

1. Delvo, Herman W., "1972 Corn 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 field corn treated with specific pesticides in the major producing regions, 1980 a/ b/

Pesticides	: Corn :Northern: Lake :South-:Pennsylv-: : : Belt : Plains :States: east : vania : Texas : Total						
	<u>Percent</u>						
HERBICIDES							
<u>Single materials</u>							
Alachlor	7	12	9	17	29	-	5
Atrazine	5	9	7	10	9	5	3
Butylate ⁺	9	21	22	20	<u>c/</u>	34	7
Cyanazine	11	28	13	49	<u>49</u>	57	8
Dicamba	14	28	19	70	75	-	10
EPTC ⁺	24	19	29	<u>c/</u>	<u>c/</u>	-	14
Linuron	44	-	<u>c/</u>	<u>-</u>	<u>-</u>	49	37
Metolachlor	13	61	<u>27</u>	45	37	49	11
Paraquat	25	-	-	<u>c/</u>	44	-	21
Propachlor	34	35	24	<u>-</u>	-	-	18
Simazine	<u>c/</u>	-	<u>c/</u>	<u>c/</u>	40	-	35
2,4-D	<u>9</u>	16	<u>12</u>	<u>20</u>	49	44	6
<u>Tank-mix materials</u>							
Atrazine + alachlor	10	19	12	18	20	48	7
Atrazine + butylate ⁺	13	37	36	35	60	-	11
Atrazine + cyanazine	26	29	47	<u>c/</u>	31	-	17
Atrazine + metolachlor	18	71	23	37	49	37	13
Atrazine + propachlor	<u>c/</u>	31	<u>c/</u>	-	-	-	29
Atrazine + simazine	23	70	58	26	57	-	17
Cyanazine + alachlor	32	40	31	70	<u>c/</u>	-	19
Cyanazine + butylate ⁺	19	70	41	-	-	-	17
Dicamba + 2,4-D	21	31	27	-	-	-	15

-- continued

Appendix Table 1. Coefficients of variation for acres of field corn treated with specific pesticides in the major producing regions, 1980 a/ b/ -- continued

Pesticides	: Corn :Northern: Lake :South-:Pennsylv-: : : Belt : Plains :States: east : vania : Texas : Total						
	----- Percent -----						
INSECTICIDES							
<u>Single materials</u>							
Carbaryl	52	44	<u>c/</u>	-	-	49	31
Carbofuran	10	11	<u>14</u>	16	15	9	6
Chlorpyrifos	15	35	30	-	-	-	13
Dimethoate	<u>c/</u>	16	-	-	-	19	14
Disulfoton	-	<u>c/</u>	<u>c/</u>	-	-	49	48
Fonofos	14	<u>13</u>	<u>14</u>	-	32	-	8
Monocrotophos	-	-	-	-	-	12	12
Parathion	-	19	-	-	-	30	18
Permethrin	-	35	-	-	-	34	27
Phorate	19	21	15	<u>c/</u>	-	37	11
Terbufos	10	14	15	<u>23</u>	57	43	7
Toxaphene	<u>c/</u>	<u>c/</u>	-	<u>c/</u>	51	-	39
<u>Tank-mix materials</u>							
Dimethoate + disulfoton	-	-	-	-	-	28	28
Disulfoton + monocrotophos	-	-	-	-	-	70	70

- None reported.

a/ "1980 Corn 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 was not significant at the regional level and was reported in the "other" category.

Appendix Table 2. Percentage of field corn herbicide acre-treatments by primary grasses controlled as reported by farmers in the major producing regions, 1980 a/

Herbicides, grasses	: Corn : Belt	:Northern : Plains	: Lake : States	:South- : east	:Pennsylv- : vania	: : Texas	: : Total
----- Percent -----							
<u>Alachlor</u>							
Crabgrass	1	2	1	27	-	-	2
Foxtail	74	66	68	-	24	-	68
Panicum	2	-	2	41	-	-	3
Quackgrass	1	-	12	-	38	-	4
Other	7	19 <u>b/</u>	8	13	10	-	9
<u>Atrazine</u>							
Broadleaf							
signalgrass	3	1	1	3	2	6	3
Crabgrass	2	7	1	20	2	-	3
Foxtail	41	29	10	-	11	-	29
Johnsongrass	1	5	1	1	3	21	2
Quackgrass	4	1	67	-	16	-	15
Other	4	16 <u>c/</u>	5	8	30 <u>d/</u>	9	7
<u>Butylate⁺</u>							
Crabgrass	1	13	-	9	-	-	2
Foxtail	75	52	79	-	100	-	70
Johnsongrass	5	-	-	8	-	100	5
Panicum	1	-	4	4	-	-	2
Quackgrass	1	-	6	-	-	-	2
Shattercane	1	27	-	-	-	-	3
Other	3	8	-	22 <u>e/</u>	-	-	3

- None reported.

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

b/ Includes broadleaf signalgrass, 2 percent, and shattercane, 4 percent.

c/ Includes barnyardgrass, 3 percent, and shattercane, 3 percent.

d/ Includes barnyardgrass, 6 percent; nutsedge, 5 percent; and panicum, 3 percent.

e/ Includes nutsedge, 5 percent.

Appendix Table 3. Percentage of field corn herbicide acre-treatments by primary broadleaf weeds controlled as reported by farmers in the major producing regions, 1980 a/

Herbicides, broadleaf weeds	: Corn : Belt	: Northern : Plains	: Lake : States	: South- : east	: Pennsylv- : vania	: Texas	: Total
----- Percent -----							
<u>Alachlor</u>							
Cocklebur	4	3	1	9	-	-	3
Pigweed	1	3	1	-	-	-	2
Ragweed	2	-	1	3	9	-	2
Velvetleaf	3	5	2	-	-	-	3
Other	5	2	4	7	19	-	4
<u>Atrazine</u>							
Cocklebur	13	3	1	51	-	8	10
Pigweed	6	23	1	-	-	32	8
Ragweed	7	1	5	7	20	22	7
Smartweed	6	2	-	-	2	-	4
Velvetleaf	7	5	6	-	-	-	6
Other	6	7	2	10	14	2	6
<u>Butylate⁺</u>							
Cocklebur	3	-	4	32	-	-	4
Morningglory	2	-	-	-	-	-	1
Velvetleaf	4	-	4	-	-	-	4
Other	4	-	3	25 <u>b/</u>	-	-	4
<u>2,4-D</u>							
Canada thistle	3	3	14	-	-	-	5
Cocklebur	33	46	60	50	-	-	41
Morningglory	12	-	3	25	25	-	9
Pigweed	4	3	8	-	-	-	5
Ragweed	1	-	1	12	25	100	2
Smartweed	5	6	2	4	-	-	4
Velvetleaf	30	13	5	-	-	-	20
Other	12	29	7	9	50	-	14

- None reported.

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

b/ Includes ragweed, 5 percent, and sicklepod, 9 percent.

Appendix Table 4. Percentage of field corn insecticide acre-treatments by primary insects controlled as reported by farmers in the major producing regions, 1980 a/

Insecticides, insects	: Corn : Belt	:Northern : Plains	: Lake : States	:South- : east	:Pennsylv- : vania	: : Texas	: : Total
----- Percent -----							
<u>Carbofuran</u>							
Billbug	-	-	-	9	-	-	1
Corn borer <u>b/</u>	6	49	8	3	15	58	21
Nematode	-	-	-	46	-	-	3
Rootworm larvae	92	42	92	3	67	7	66
Rootworm beetle	-	1	-	-	6	-	1
Wireworm	2	-	-	34	-	4	3
Other	-	8	-	5	12	31 <u>c/</u>	5
<u>Chlorpyrifos</u>							
Cutworm	58	-	17	-	-	-	45
Rootworm larvae	37	100	83	-	-	-	51
Other	5	-	-	-	-	-	4
<u>Fonofos</u>							
European corn borer	-	5	3	-	11	-	2
Rootworm larvae	98	95	92	-	56	-	95
Stalk borer	-	-	-	-	11	-	.2
Wireworm	2	-	3	-	-	-	2
Other	-	-	2	-	22	-	.8
<u>Phorate</u>							
Banks grass mite	-	-	-	-	-	100	1
European corn borer	-	24	10	-	-	-	8
Rootworm larvae	100	76	88	-	-	-	90
Wireworm	-	-	2	100	-	-	1
<u>Terbufos</u>							
Billbug	-	-	-	19	-	-	1
Cutworm	-	-	-	25	-	-	1
Rootworm larvae	98	97	100	-	100	100	94
Wireworm	1	3	-	56	-	-	3
Other	1	-	-	-	-	-	1

- None reported.

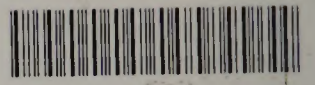
a/ "1980 Corn Pesticide Use Survey", USDA, ESS, Natural Resource Economics Division.

b/ This is the European corn borer in the Corn Belt, Lake States, and Southeast regions and in Pennsylvania. This is either the European or Southwestern corn borer in the Northern Plains and the Southwestern corn borer in Texas.

c/ Includes armyworm, 10 percent; chinch bug, 3 percent; and stalk borer, 8 percent.



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