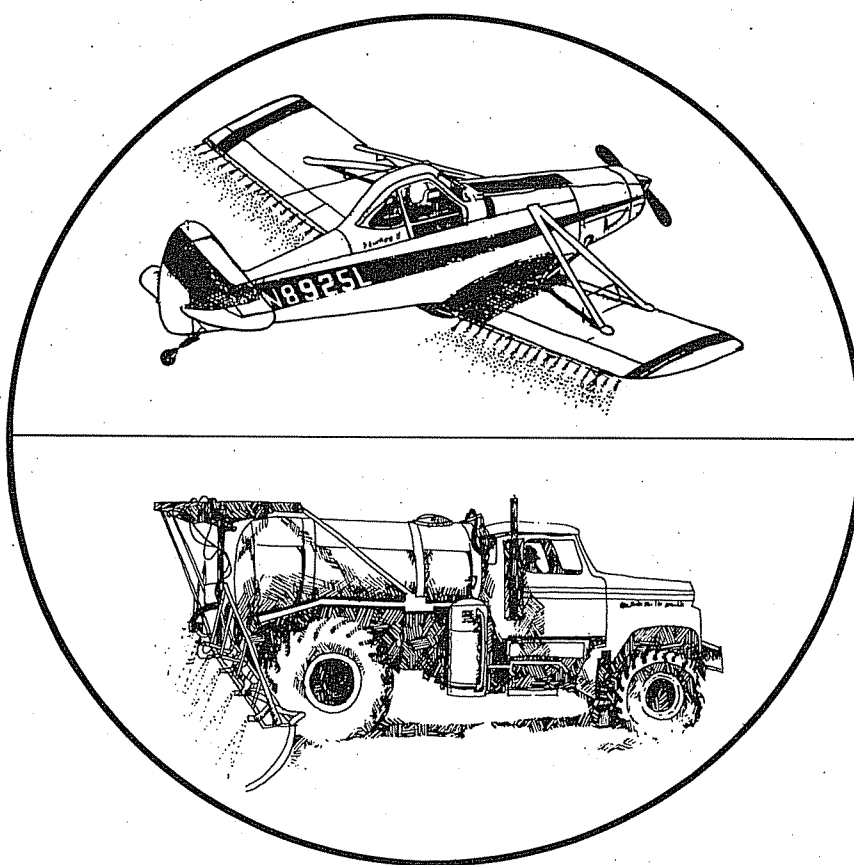


# PESTICIDE USE ON MAJOR CROPS IN NORTH DAKOTA 1984



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In Cooperation With  
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## INTRODUCTION

This report is the second major account of pesticide usage in North Dakota. The first comprehensive survey to assess pesticide usage on major crops in North Dakota was conducted on 1978 usage.<sup>1</sup> North Dakota ranked sixth in the nation in acreage of principal crops harvested and first in production of durum and hard red spring wheats, barley, flax, and sunflower in 1978.<sup>2</sup> The 1978 survey provided useful information for evaluating pesticide use patterns and the benefits and impacts from using these pesticides.

North Dakota ranked fourth in the nation in acreage of principal crops harvested in 1984 and remained first in production of durum and hard red spring wheats, barley, flax and sunflower.<sup>3</sup> Changes in agricultural production and pesticide development and regulation occurred between 1978 and 1984, and these may have significantly affected pesticide use. These changes include: 1) an increase in minimum and no-tillage systems; 2) substantial increases in acreages and/or regional shifts in production of winter wheat, dry beans, corn, soybean and sunflower; 3) shifts in pest populations; 4) new developments in pest control technology; 5) new regulations by government agencies of pesticides and their use; and 6) an economically depressed farm economy that may cause agricultural producers to change pesticide inputs.

A reassessment of pesticide use, benefits and impacts in North Dakota was made for 1984 because of these agriculture production changes and because of the six-year time span since the last pesticide use survey. The objectives of this survey were: 1) to determine acreages treated with each pesticide group and to identify the specific pesticides used; 2) to determine pesticide usage by state districts; 3) to determine the percentage of pesticides applied by farm operator or custom applicator and by air or ground equipment; and 4) to assess use of insecticide ear tags on cattle.

## METHODS

### Survey Instrument

The survey was a cooperative effort by the contributing authors of the agronomy and plant pathology departments of North Dakota State University and the North Dakota Crop and Livestock Reporting Service. The survey was developed to collect information on herbicides, insecticides,<sup>4</sup> fungicides,<sup>4</sup> and other pesticides used on wheat, barley, oats, flax, corn, sunflower, soybean, potatoes, sugarbeets, dry beans and alfalfa, plus other hay, summer fallow, rangeland and pasture (Appendix A). Emphasis was placed on acreage treated with specific pesticides for each crop or land use. Information on the number of applications, farm operator or custom application, and aerial or ground application, was also requested. Information on rates of application was not requested, as it had been in 1978.

<sup>1</sup>Nalewaja, J.D., A.G. Dexter, J. Buchli, W. Hamlin, and G. Kimmet. 1980. Pesticide Usage in Major North Dakota Crops. North Dakota State University in cooperation with North Dakota Crop and Livestock Reporting Service, Agronomy Report 1. 33 pp.

<sup>2</sup>North Dakota Crop and Livestock Statistics. 1979. North Dakota Crop and Livestock Reporting Service, Ag. Statistics No. 44. 87 pp.

<sup>3</sup>North Dakota Agricultural Statistics. 1985. North Dakota Crop and Livestock Reporting Service, Ag. Statistics No. 54. 132 pp.

<sup>4</sup>Use of insecticides and fungicides does not include seed treatment.

An additional question surveyed the use of ear tags on cattle and the number of cattle treated with ear tags in 1984.

The survey was announced through news releases in local newspapers.

### Sample

The questionnaire was mailed with return envelopes to 10,000 agricultural producers. The sample mailing list was randomly drawn from the North Dakota Crop and Livestock Reporting Service directory with extra samples for dry bean, sugarbeet and potato growers to assure adequate sampling for these crops. Non-respondents were randomly surveyed by telephone by trained interviewers until a total of 3,039 usable responses was obtained. Ninety percent of the respondents grew wheat, 55.8% grew barley, 38.6% oats, 15.4% flax, 26.0% corn, 36.5% sunflower, 13.5% soybean, 1.4% potatoes, 3.3% sugarbeets, 4.2% dry beans, 42.4% alfalfa, 35.3% other hay, and 76.8% had some summer fallow. Questionnaires which had missing information were completed by a telephone follow-up to the respondent. In several instances custom applicators who applied pesticides for the producers were contacted to determine the specific pesticide applied.

### Data Analysis

All pesticide acreages were weighted to provide statewide representation. Thus, values given in the tables are not straight averages but have been adjusted by multiplying the percentage of use times the total number of acres of a crop in the state or district.

All results reported in the questionnaire were included in the analysis and summary tables. Values in the tables which indicate only one or a few thousand acres might represent only one response, as values were interpolated to represent the total state acreages. Percentages were rounded off to the nearest tenth of a percent.

## RESULTS

### Total Acres Treated with Pesticides

Approximately 17.5, 2.5, and 0.5 million acres were treated with herbicides, insecticides, and fungicides, respectively, in 1984 (Table 1A). In 1978, approximately 14.1, 0.7 and 1.2 million acres were treated with herbicides, insecticides, and fungicides, respectively (Table 1B). Data from 1978 (Table 1B) included acres planted with pesticide treated seed, while 1984 data (Table 1A) did not. Herbicides were applied to approximately 43% of the acreage in crops, hay, pasture and rangeland, and summer fallow + PIK + ARP in 1984 while insecticides were applied to 6% and fungicides to 1% of this acreage (Table 1A). The total percentages in 1984 (Table 1A) should not be directly compared to the total percentages in 1978 (Table 1B) because summer fallow and acreage in government programs was not included for 1978. In both years, wheat accounted for the highest total number of acres treated, partly because of the large wheat acreage in North Dakota. Herbicides were applied to nearly all acres of sugarbeets, soybean, and wheat with 96.5, 96.3, and 90.9% of the acres treated, respectively, in 1984, compared to 93.4, 91.9 and 88.2%, respectively, in 1978.

Herbicide application to potato and oat acreage was less frequent than to other crops with 30.6 and 42.8% of the acres treated, respectively, in 1984, while 20.5 and 38.5% were treated, respectively, in 1978. Insecticide treatment was most frequent to potato, sunflower and sugarbeet acreage in 1984 with 96.9, 64.8 and 49.5% of the acres treated, respec-

tively. This contrasts with 1978, when only 5.6% of the sunflower acreage was treated with insecticides and insecticide treatment of potato and sugarbeets was 90.8 and 41.1%, respectively. The amount of corn acres treated with insecticides also increased from 4.2% in 1978 to 17.9% in 1984. Fungicides were most frequently applied to sugarbeet

and potatoes with 77.6 and 67.6% of the acreage treated in 1984, respectively. Fungicides were applied to 19.0% of the dry bean acreage in 1984. The fungicide usage on sugarbeets, potatoes and dry beans in 1978 was 7.5%, 54.5% and 16.0% of acres planted, respectively.

Table 1A. Acreage planted, acreage treated, and percentage of planted acreage treated with pesticides in crops, North Dakota, 1984.

Crop	Acres planted <sup>1</sup> (1000)	Pesticide treated acres <sup>2</sup>							
		Herbicide (1000)	Insecticide (1000)	Fungicide (1000)	Other <sup>3</sup> (1000)	Herbicide (%)	Insecticide (%)	Fungicide (%)	Other <sup>3</sup> (%)
Wheat	8820.0	8018.2	206.1	183.5	0.0	90.9	2.3	2.1	0.0
Barley	2950.0	2581.7	65.9	44.0	0.0	87.5	2.2	1.5	0.0
Oats	1150.0	492.6	13.9	0.0	0.0	42.8	1.2	0.0	0.0
Flax	400.0	265.2	11.4	0.0	0.0	66.3	2.9	0.0	0.0
Corn	970.0	735.3	173.8	2.2	0.0	75.8	17.9	0.2	0.0
Sunflower	2850.0	2521.4	1846.9	0.5	5.6	88.5	64.8	0.0	0.2
Soybean	750.0	722.4	15.7	2.7	0.4	96.3	2.1	0.4	0.0
Dry Beans	205.0	191.7	0.7	38.9	3.5	93.5	0.4	19.0	1.7
Potatoes	136.0	41.6	131.8	91.9	54.5	30.6	96.9	67.6	40.1
Sugarbeet	139.8	135.0	69.3	108.5	0.0	96.5	49.5	77.6	0.0
Alfalfa hay	1550.0	13.4	14.5	0.5	0.0	0.9	0.9	0.0	0.0
Other hay	1350.0	9.1	3.8	0.0	0.1	0.7	0.3	0.0	0.0
Pasture & range <sup>4</sup>	9754.7	116.0	27.7	0.0	0.0	1.2	0.3	0.0	0.0
Summer Fallow + PIK + ARP <sup>5</sup>	9908.0	1696.4	6.2	0.0	0.0	17.1	0.1	0.0	0.0
Other Crops <sup>6</sup>	—	—	—	—	—	52.9	8.5	0.0	0.0
<b>Total</b>	<b>40933.5</b>	<b>17539.8</b>	<b>2587.8</b>	<b>472.7</b>	<b>64.1</b>	<b>42.8</b>	<b>6.3</b>	<b>1.2</b>	<b>0.2</b>

<sup>1</sup>Preliminary estimates by the North Dakota Crop and Livestock Reporting Service. Exception: Pasture and range which are U.S. Census figures.

<sup>2</sup>Multiple applications to the same acreage were totaled as one application. Seed treatments not included.

<sup>3</sup>See Table 21 for other chemical usage in North Dakota. Desiccants were the main chemicals in the other category.

<sup>4</sup>Pasture and rangeland other than crop and woodland pastured.

<sup>5</sup>PIK and ARP are acres for the Payment in Kind and Acreage Reserve Program.

<sup>6</sup>Main crops in other category are rapeseed, mustard, millet, buckwheat, safflower.

Table 1B. Acreage planted, acreage treated, and percentage of planted acreage treated with pesticides in crops, North Dakota, 1978.

Crop	Acres planted <sup>1</sup> (1000)	Pesticide treated acres <sup>2</sup>							
		Herbicide (1000)	Insecticide (1000)	Fungicide (1000)	Other <sup>3</sup> (1000)	Herbicide (%)	Insecticide (%)	Fungicide (%)	Other <sup>3</sup> (%)
Wheat	9760.0	8612.2	307.4	774.0	0.0	88.2	3.2	7.9	0.0
Barley	2500.0	2163.0	77.5	210.5	0.0	86.5	3.1	8.4	0.0
Oats	1350.0	520.3	11.2	44.7	0.0	38.5	1.0	3.3	0.0
Flax	425.0	205.8	5.4	16.3	0.0	48.3	1.3	3.8	0.0
Corn	600.0	312.8	25.1	7.8	1.9	52.1	4.2	1.3	0.3
Sunflower	1890.0	1673.0	105.1	42.3	38.9	88.5	5.6	2.2	2.1
Potatoes	125.3 <sup>4</sup>	25.7	113.8	68.3	58.3	20.5	90.8	54.5	46.5
Sugarbeet	153.9 <sup>4</sup>	143.8	63.2	11.5	2.4	93.4	41.1	7.5	1.6
Soybean	175.0	160.8	10.9	3.5	0.0	91.9	6.2	2.0	0.0
Dry Beans	105.0 <sup>4</sup>	91.3	0.6	16.8	0.0	87.0	0.6	16.0	0.0
Alfalfa hay	1980.0	4.4	4.4	0.0	0.0	0.2	0.2	0.0	0.0
Other hay	1530.0	19.9	0.0	0.0	0.0	1.3	0.0	0.0	0.0
Pastureland, all types	11767.6	235.4	0.0	0.0	0.0	2.0	0.0	0.0	0.0
Other Crops <sup>5</sup>	—	—	—	—	—	16.0	2.0	0.1	0.1
<b>Total<sup>6</sup></b>	<b>32361.8</b>	<b>14168.4</b>	<b>724.6</b>	<b>1188.7</b>	<b>73.9</b>	<b>43.8</b>	<b>4.9</b>	<b>5.1</b>	<b>.4</b>

<sup>1</sup>Preliminary estimates as published in North Dakota Crop and Livestock Statistics (Ag. Statistics No. 44), May 1979; issued jointly by NDSU and the North Dakota Crop and Livestock Reporting Service.

<sup>2</sup>Multiple applications to the same acreage were totaled as one application. Seed treatments included.

<sup>3</sup>See tables on pesticide usage in sunflower and potatoes for listing of other category pesticides.

<sup>4</sup>Major producing counties, only.

<sup>5</sup>Main crops in other crops category are rapeseed, tame mustard and millet and millet with estimated planted acreages of 45,000, 100,000 and 75,000.

<sup>6</sup>Excludes summer fallow and government program acres, which were not surveyed.

Table 2. Acres of major crops, pasture, rangeland and summer fallow and number treated with pesticides according to crop reporting districts in North Dakota, 1984.

District	Acres planted <sup>1</sup> (1000)	Pesticide treated acres							
		Herbicide	Insecticide	Fungicide	Other	Herbicide	Insecticide	Fungicide	Other
		(1000)	(1000)	(1000)	(1000)	(1000)	(%)	(%)	(%)
Northwest	5390.2	2458.3	215.5	9.4	0	45.6	4.0	0.2	0
North Central	3916.3	1973.1	391.4	20.8	0	50.4	10.0	0.5	0
Northeast	5449.7	3296.7	573.5	298.0	54.6	60.5	10.5	5.5	1.0
West Central	4668.4	1042.9	84.4	0	0	22.3	1.8	0	0
Central	4217.9	2012.2	460.1	1.6	4.5	43.1	10.9	0.04	0
East Central	3507.8	2442.8	269.2	103.9	2.7	69.6	7.7	3.0	0.08
Southwest	4967.9	1141.6	107.6	0	0	23.0	2.2	0	0
South Central	4422.3	922.5	57.1	0	0	20.9	1.3	0	0
Southeast	4356.7	2245.7	462.1	37.0	0.9	51.6	10.6	0.9	0.02

<sup>1</sup>Total of preliminary estimated acres for major crop, hay, pasture, rangeland and summer fallow by the North Dakota Crop and Livestock Reporting Service.

### Acres Treated According to Crop Reporting Districts

North Dakota has nine crop reporting districts (Appendix B). Table 2 contains a summary of pesticide usage for each crop reporting district over all major crops, rangeland, pasture and summer fallow. Herbicide and fungicide usage as a percentage of acres treated was more frequent in the three eastern districts than the other six districts. Insecticide usage also was frequent in these three eastern districts and insecticide use in the Central and North Central districts was greater than in the other four districts.

Table 3 contains summaries of pesticide usage for each crop according to each crop reporting district. The largest acreage of wheat, 1,630,000 acres, was in the Northeast district and the highest percentage of wheat acreage treated with herbicides, 96.1%, also was in this district (Table 3). Insecticide usage on wheat was the greatest in the Northwest district with 5.2% of the acreage treated, most likely reflecting the greater grasshopper infestation in the Northwest. Fungicide application to wheat was most common in the Northeast and East Central districts, with 6.8 and 3.9% of the acreage treated, respectively.

Sunflower acreage was the greatest in the East Central district in 1978. However, in 1984 the greatest acreage of sunflower was in the Central district with 605,000 acres. Insecticides were applied to the most acres in the Central district with 516,400 acres treated, reflecting the high acreage of sunflower. The Southeast district had the largest acreage, 410,000 acres, planted to corn, and the largest percentage, 38.1, treated with insecticides.

### Pesticide Usage Information on Crops and Pasture Land in North Dakota, 1984

Tables 4 through 17 contain data on individual pesticide usage, number of applications, and application methods in major crops and pasture land. Pesticides are listed by common names only. Common and trade names of individual pesticides can be found in Appendix C.

**Wheat.** Formulations of 2,4-D were applied to 63.6% of the wheat acres in 1984, more than any other herbicide (Table 4). Formulations of MCPA were the second most commonly used herbicides on wheat, with 16.5% of the wheat treated. Triallate was applied to 12.0% and trifluralin to 11.6% of the wheat acreage in 1984. Herbicides were seldom applied more than once during the growing season. Only 0.6% of the treated wheat acreage was treated twice with the same herbicide. Only 15% of the herbicide-treated wheat

acreage was treated by custom applicators and only 11% was treated by aerial application. Each of the 13 insecticides reported for wheat were used on less than 1% of the acres. Parathion was used most frequently, on 0.6% of the wheat acres. Only 3.6% of the insecticide-treated wheat acreage was treated twice with the same insecticide. Of the insecticide-treated wheat acreage, 65.7% was treated by custom applicators and 63.3% was treated aerially.

Two percent of the wheat acres were reported treated with fungicide (Table 4). Mancozeb was the most frequently used fungicide on wheat with treatment to 1.2% of the wheat acres. Fungicides were frequently applied more than once during the growing season. Two applications were made to 62.5% and three applications to 5.9% of the treated wheat acreage. Of the fungicide-treated wheat acreage, 86.9% was treated by custom applicators and 85.4% was treated aerially.

**Barley.** Formulations of 2,4-D were applied to 51.6% of the barley acres and formulations of MCPA were applied to 22.0% of the barley acres (Table 5). Herbicides were generally applied once and were ground applied by the farm operator.

Nine insecticides were applied to barley, but each was applied to less than 1% of the acreage (Table 5). Parathion formulations were applied to 0.8% of the barley acres. Lindane was applied to 0.4% of the barley acres and this probably was a seed treatment. The survey did not request information on seed treatment but a few respondents apparently included seed treatments in their responses. Fenvalerate and formulations of parathion generally were custom and aerially applied while other insecticides were ground applied by the farm operator.

Mancozeb was used on 1.1% of the barley acreage and two applications were made to 49.3% of the treated acreage (Table 5). Fungicides generally were custom and aerially applied.

**Oats.** Formulations of 2,4-D were applied to 20.9% and formulations of MCPA were applied to 20.1% of the oats acreage (Table 6). Herbicides generally were applied once and were ground applied by the farm operator. Seven insecticides were applied to oats in 1984 (Table 6). Each was applied to less than 1% of the acreage. Carbofuran and chlorpyrifos were applied twice to 32.3% and 20.0% of the treated acres, respectively. Other insecticides were applied once. Insecticides were generally custom and aerially applied. No fungicides were reported used on oats.

**Flax.** Formulations of MCPA were used on 36.0% of the flax acres and trifluralin on 17.6% (Table 7). Herbicides generally were applied once by the farm operator with ground equipment. Seven insecticides were used on flax, each to less than 0.6% of the acreage (Table 7). No fungicides were reported used on flax.

**Corn.** EPTC plus Safener, atrazine, cyanazine, and alachlor were used on 23.7, 21.5, 21.1 and 17.1% of the corn acreage, respectively (Table 8). Herbicides generally were applied once by the farm operator with ground equipment. Fourteen insecticides were reported used on corn in 1984 (Table 8). Only five insecticides were reported in 1978. Carbofuran, phorate, and terbufos, were the most used insecticide treatments for corn in 1984. All insecticides were applied only once, except for malathion, which was applied twice on 41.1% of the treated acres. Most corn insecticides were farm operator applied with ground equipment. Triphenyl tin hydroxide was the only fungicide reported used for corn, on 0.2% of the acres.

**Sunflower.** Trifluralin was used on 79.2% of the sunflower acres in North Dakota (Table 9.) Herbicides generally were applied once by the farm operator with ground equipment.

Insecticide use on sunflower increased dramatically since 1978, with 64.8% of the planted acres treated in 1984 versus 5.6% in 1978 (Table 1A, 1B). Sunflower acreage shifted westward since 1978. The Northeast, East Central and Southeast districts contained 65.5% of the sunflower acres in 1978,<sup>1</sup> while only 38.1% of the sunflower acres were distributed in these three districts in 1984 (Table 3). Insecticide usage on sunflower also shifted westward in 1984 (Table 3) compared to 1978;<sup>1</sup> 427,000 acres were insecticide treated in the Central district in 1984 compared to 40,500 acres insecticide treated in 1978. Approximately 45% of the 1984 sunflower acres were treated with fenvalerate (Table 9), an insecticide treatment not reported on the 1978 survey.<sup>1</sup> Insecticides generally were applied once by custom applicator and aerial application.

No fungicides were reported on sunflower in 1984. A desiccant, paraquat, was applied to 6,400 acres for early dry-down (Table 9).

**Soybean.** Trifluralin was used on 73.7% of the acres of soybeans while 40.7% were treated with bentazon (Table 10). Metribuzin was the third most commonly used herbicide on soybeans with 20.4% of the acres treated. Herbicides generally were applied once by the farm operator using ground equipment.

Insecticides were used infrequently on soybeans with 1.6% of the acres treated (Table 10). Parathion was the most commonly used insecticide. Three applications of parathion were common and nearly all was custom and aerially applied.

Sulfur was used as a fungicide on 0.3% of the acres of soybeans (Table 10). Sulfur is used to control powdery mildew, generally an uncommon disease of soybeans in North Dakota.

**Potatoes.** EPTC was the herbicide used most often with application to 12.8% of the acres of potatoes (Table 11). Trifluralin was second with 6.9% of the acreage treated. Herbicides generally were applied by the farm operator using ground equipment.

Insecticides were used commonly on potatoes. Fenvalerate was applied to 78.4% and phosphamidon to 22.8% of the potato acres (Table 11). Three applications of some insecticides were common. Insecticides generally were applied by the farm operator with ground equipment.

Fungicides also were commonly applied to potatoes. From 11.8 to 27.5% of the potato acreage was treated with each of five fungicides (Table 11). Four applications of an individual fungicide were common.

Dinoseb was applied to 23.9% and diquat to 18.9% of the potato acreage to kill the potato vines late in the growing season.

**Sugarbeets.** Desmedipham plus phenmedipham was used on 50.7% of the sugarbeet acreage (Table 12). Other frequently used herbicides were diallate on 31.6% of the acres and EPTC on 26.5% of the acres. Desmedipham alone or in combination with phenmedipham was applied up to four times. Herbicides generally were applied by the farm operator using ground equipment.

Terbufos insecticide was used on 22.1% and chlorpyrifos on 21.6% of the sugarbeet acreage (Table 12). Insecticides generally were applied once by the farm operator using ground equipment.

Fungicide use on sugarbeets was almost 10 times greater in 1984 compared to 1978 (Table 1A, 1B). Triphenyl tin hydroxide was applied to 62% and mancozeb to 12.5% of the sugarbeet acreage in 1984 (Table 12). The tin fungicides were frequently applied three times and sometimes applied four or more times. Fungicides often were custom and aerially applied.

**Dry Bean.** Herbicide use on dry bean acres increased nearly three times since 1978 (Table 1A, 1B). Trifluralin was used to treat 60.1% of the bean acreage in 1984 (Table 13). Bentazon was applied to 29.7% and ethalfuralin to 22.0% of the dry bean acres. Herbicides generally were applied once by the farm operator using ground equipment.

Insecticides were used to treat 0.4% of the dry bean acres (Table 13). Parathion was used on 0.2% of the acreage.

Maneb plus zinc was the most frequently used of the five reported fungicides, with treatment to 13.3% of the dry bean acres (Table 13). Two applications of fungicides were common and applications generally were aerial by a custom applicator.

Sodium chlorate was used on 1.2% of the dry bean acreage as a desiccant (Table 13).

**Alfalfa.** Herbicides were used on 0.9% of the acres of alfalfa (Table 14). Parathion and carbaryl insecticides were both used to treat 0.3% of planted acres of alfalfa (Table 14). Malathion was used to treat 0.2% of the alfalfa acres. Treatments generally were applied once with almost equal levels of farm operator or custom treatment and usually with ground equipment. Sulfur and triadimefon fungicides were reported as treatments for alfalfa (Table 14).

**Other Hay.** Picloram and 2,4-D were the most commonly used herbicides on other forms of hay; each was applied to 0.4% of the total acres (Table 15).

Insecticides were seldom used on hay, with only 0.1% of the total acreage treated with a given insecticide (Table 15).

**Summer Fallow.** Formulations of 2,4-D were the most frequently used herbicides on summer fallow with 9.1% of summer fallow acres treated (Table 16). Glyphosate usage followed closely with treatment to 8.0% of the summer fallow acreage. The majority of the herbicide applications were made once by the farm operator using ground equipment.

<sup>1</sup>Nalewaja, J.D., A. G. Dexter, J. Buchli, W. Hamlin, and G. Kimmel. 1980. Pesticide usage in Major North Dakota Crops, North Dakota State University in cooperation with North Dakota Crop and Livestock Reporting Service, Agronomy Report 1. 31 pp.

Insecticides on summer fallow most likely were used to control grasshoppers. Acephate was most frequently used of the four insecticides reported, with treatment to less than 0.1% of the acres (Table 16).

**Pasture and Rangeland.** Picloram and formulations of 2,4-D were the most frequently used herbicides on pasture and rangeland, but each was used on only 0.7% of the acres (Table 17). Herbicides generally were applied by the farm operator using ground equipment.

Insecticides were used on 0.5% of the acres of pasture and rangeland (Table 17). Parathion and malathion were used on more acreage than the other five insecticides reported. Insecticides were applied most often by custom applicators and aerially.

#### Pesticide Summaries

Total cumulative acres treated in 1984 with each individual pesticide over all crops and crop reporting districts are given in Tables 18A through 21A. Tables 18B through 21B contain similar pesticide use summaries from the 1978 survey.

Fifty-seven herbicide formulations were reported in the 1984 survey (Table 18A) while 40 were reported in 1978 (Table 18B). Formulations of 2,4-D were applied to 8.6 million acres in 1984, accounting for 34.5% of acres treated with herbicide, compared to 9.3 million acres in 1978, accounting for 55.1% of acres treated with herbicide. The decline of wheat acreage from 9.8 million acres in 1978 (Table 1B) to 8.8 million acres in 1984 (Table 1A) may partially account for this reduction in use of 2,4-D.

Trifluralin was used on 4.5 million acres in 1984 (Table 18A), accounting for 18.3% of total acres treated with herbicides, compared to use on 2.0 million acres in 1978 (Table 18B), accounting for 12.1% of total acres treated with herbicides in 1978. Increased acreages of sunflower and soybeans in 1984 (Table 1A) compared to 1978 (Table 1B) and use of trifluralin on 1.0 million acres of wheat in 1984 (Table 4) compared to use on 0.4 million acres of wheat in 1978<sup>1</sup> account for much of this increase in use of trifluralin in 1984.

Formulations of MCPA were applied to 2.1 million acres in 1984 (Table 18A), accounting for 8.3% of all acres treated with herbicides, compared to 1.7 million acres in 1978 (Table 18B), accounting for 10.3% of all acres treated with herbicides in that year. Formulations of MCPA were used on 16.5% of the wheat acreage treated with herbicides in 1984 (Table 4) compared to use on 8.4% of the wheat acreage treated with herbicide in 1978.<sup>1</sup>

Diclofop was used to treat 650 thousand acres in 1984 (Table 18A) compared to use on 2 thousand acres in 1978 (Table 18B). Difenzoquat was used to treat 250 thousand acres in 1984 compared to use on 70 thousand acres in 1978. Triallate was used to treat 1.7 million acres in 1984 compared to treatment of 1.0 million acres in 1978. Thus, the total acres treated with these three wild oat herbicides increased from 1.1 million acres in 1978 to 2.6 million acres in 1984. Use of barban, another herbicide used for wild oat control, decreased from 620 thousand acres treated in 1978 to 180 thousand acres treated in 1984.

<sup>1</sup>Nalewaja, J. D., A. G. Dexter, J. Buchli, W. Hamlin, and G. Kimmert. 1980. Pesticide Usage on Major North Dakota Crops, North Dakota State University in cooperation with North Dakota Crop and Livestock Reporting Service, Agronomy Report 1. 31 pp.

Custom application of herbicides dropped from 24% in 1978 to 13.4% in 1984 (Table 18A, 18B).

The total cumulative acres treated with insecticides in 1984 was 2.9 million (Table 19A) compared to 370 thousand in 1978 (Table 19B). Fenvalerate was used to treat 1.4 million acres in 1984 (Table 19A), accounting for 49.1% of all acres treated with insecticides, while fenvalerate was not reported in the 1978 survey (Table 19B). Formulations of parathion were used to treat 520 thousand acres in 1984 (Table 19A) or 18.0% of acres treated with insecticides, compared to use on 20 thousand acres in 1978 (Table 19B) or 5.1% of acres treated. Carbofuran was used to treat 420 thousand acres in 1984 and 10 thousand acres in 1978. Much of the increased insecticide usage may have been due to large grasshopper infestations in 1984 and the greater sunflower acreage of 2.8 million acres in 1984 compared to 1.9 million acres in 1978 (Tables 1A, 1B).

Custom application of insecticides increased from 17.0% in 1978 (Table 19B) to 58.9% in 1984 (Table 19A). Aerial application increased from 21.0% in 1978 to 58.8% in 1984.

The total cumulative acres treated with fungicides in 1984 was 510 thousand acres (Table 20A) compared to 100 thousand acres in 1978 (Table 20B). Maneb compounds were used to treat 119 thousand acres in 1984, or 38.0% of all acres treated with fungicides, compared to 20 thousand acres in 1978, or 14.6% of all acres treated with fungicides. Mancozeb was used on 180 thousand acres in 1984 or 36.9% of all acres treated with fungicides, compared to use on 50 thousand acres in 1978, or 44.2% of all acres treated with fungicides. Triphenyl tin hydroxide was used to treat 110 thousand acres in 1984, or 22.5% of all acres treated with fungicides. Triphenyl tin hydroxide was not reported used in 1978.

Custom application of fungicides increased from 31.0% in 1978 (Table 20B) to 64.5% in 1984 (Table 20A). Aerial application of fungicides increased from 39% in 1978 to 64.1% in 1984.

Five other chemicals, primarily classified as desiccants or vine-killers, were used to treat a total cumulative acreage of 70 thousand acres in 1984 (Table 21A) compared to 120 thousand acres treated with seven compounds in 1978 (Table 21B). Paraquat was used to treat 9 thousand acres in 1984 compared to 51 thousand acres in 1978.

Over all pesticides used in 1984, 81% were farm operator applied and 19% were custom applied, while 84.6% were ground applied and 15.4% were aerially applied. Over all pesticides, 96% were applied only once.

#### Insecticide Ear Tag Usage

Statewide, 57% of all cattle operations used insecticide ear tags in 1984 (Table 22). The number of cattle treated was 940,700, which is 45.9% of the all cattle inventory as of January 1, 1985. Use of insecticide ear tags was fairly uniform across crop reporting districts, but the South Central district had the highest usage, with 64.8% of cattle operations using ear tags, while the Northwest district had the lowest usage with 48.6%.

#### Summary and Conclusions

Pesticides are an integral part of North Dakota agricultural production. Most agricultural producers use pesticides. Over 75% of the wheat, barley, corn, sunflower, soybean, dry bean, potato and sugarbeet acreages received at least one pesticide application in 1984.

Herbicides were used to treat more acres than other pesticides. Wheat was grown on the most acres in North Dakota and accounted for the largest quantities of herbicides used. Wheat also accounted for the largest acreage treated with fungicides. The major use of insecticides in North Dakota was sunflower.

Total pesticide use was the greatest in the East Central crop reporting district and the least in the South Central district.

Total acres treated with herbicides was 24.8 million, insecticides 2.9 million, fungicides 0.5 million, and others 70 thousand acres in 1984, counting multiple application to the same fields as cumulative acres (Tables 18A-21A). Total

acres treated with herbicides was 16.9 million, insecticides 0.4 million, fungicides 0.1 million, and others 0.1 million acres in 1978, counting multiple applications to the same fields as cumulative acres (Tables 18B-21B). The increase in pesticide use may represent a shift in crops grown, a shift in pest populations, changing tillage practices, shifts in government programs, and availability and development of specific pesticides.

Most of the individual pesticides were applied once by the individual farm operator using ground equipment.

Insecticide ear tags were used by a little over half of all 1984 cattle operations in North Dakota.

Table 3. Acreage planted, acreage treated, and percentage of planted acreage treated with pesticides in crop reporting districts of North Dakota, 1984.

Reporting Districts	Acres planted <sup>1</sup> (1000)	Pesticide treated acres <sup>2</sup>							
		Herbicide (1000)	Insecticide (1000)	Fungicide (1000)	Other (1000)	Herbicide (%)	Insecticide (%)	Fungicide (%)	Other (%)
<b>Wheat</b>									
Northwest	1360.0	1262.9	70.0	7.2	0.0	92.9	5.2	0.5	0.0
North Central	935.0	894.3	19.6	13.3	0.0	95.7	2.1	1.4	0.0
Northeast	1630.0	1566.4	7.3	111.0	0.0	96.1	0.5	6.8	0.0
West Central	670.0	564.9	10.3	0.0	0.0	84.3	1.5	0.0	0.0
Central	935.0	883.0	18.2	1.6	0.0	94.4	2.0	0.2	0.0
East Central	960.0	912.5	5.2	37.0	0.0	95.1	0.5	3.9	0.0
Southwest	770.0	654.0	16.5	0.0	0.0	84.9	2.1	0.0	0.0
South Central	610.0	462.8	25.7	0.0	0.0	75.9	4.2	0.0	0.0
Southeast	950.0	817.4	33.2	13.5	0.0	86.0	3.5	1.4	0.0
<b>Total</b>	<b>8820.0</b>	<b>8018.2</b>	<b>206.1</b>	<b>183.5</b>	<b>0.0</b>	<b>90.9</b>	<b>2.3</b>	<b>2.1</b>	<b>0.0</b>
<b>Barley</b>									
Northwest	413.3	355.6	22.8	2.2	0.0	86.1	5.5	0.5	0.0
North Central	345.5	317.9	12.4	7.5	0.0	92.0	3.6	2.2	0.0
Northeast	801.2	718.7	6.0	13.2	0.0	89.7	0.8	1.7	0.0
West Central	126.4	93.7	2.1	0.0	0.0	74.2	1.7	0.0	0.0
Central	201.5	179.9	1.8	0.0	0.0	89.3	0.9	0.0	0.0
East Central	548.4	520.9	7.8	20.2	0.0	95.0	1.4	3.7	0.0
Southwest	162.4	108.4	3.0	0.0	0.0	66.7	1.8	0.0	0.0
South Central	115.2	75.1	2.4	0.0	0.0	65.2	2.1	0.0	0.0
Southeast	236.1	211.5	7.6	0.9	0.0	89.6	3.2	0.4	0.0
<b>Total</b>	<b>2950.0</b>	<b>2581.7</b>	<b>65.9</b>	<b>44.0</b>	<b>0.0</b>	<b>87.5</b>	<b>2.2</b>	<b>1.5</b>	<b>0.0</b>
<b>Oats</b>									
Northwest	165.0	83.5	1.0	0.0	0.0	50.6	0.6	0.0	0.0
North Central	100.0	48.5	2.2	0.0	0.0	48.5	2.2	0.0	0.0
Northeast	40.0	24.2	0.0	0.0	0.0	60.4	0.0	0.0	0.0
West Central	170.0	49.2	1.2	0.0	0.0	28.9	0.7	0.0	0.0
Central	125.0	67.0	0.1	0.0	0.0	53.6	0.1	0.0	0.0
East Central	35.0	26.4	0.0	0.0	0.0	75.5	0.0	0.0	0.0
Southwest	155.0	51.4	1.5	0.0	0.0	33.2	1.0	0.0	0.0
South Central	210.0	65.7	4.8	0.0	0.0	31.3	2.3	0.0	0.0
Southeast	150.0	76.7	3.1	0.0	0.0	51.2	2.1	0.0	0.0
<b>Total</b>	<b>1150.0</b>	<b>492.6</b>	<b>13.9</b>	<b>0.0</b>	<b>0.0</b>	<b>42.8</b>	<b>1.2</b>	<b>0.0</b>	<b>0.0</b>



Table 3 continued.

Reporting Districts	Acres planted <sup>1</sup>	Pesticide treated acres <sup>2</sup>							
		Herbicide	Insecticide	Fungicide	Other	Herbicide	Insecticide	Fungicide	Other
	(1000)	(1000)	(1000)	(1000)	(1000)	(%)	(%)	(%)	(%)
<b>Flax</b>									
Northwest	30.0	20.2	3.6	0.0	0.0	67.4	12.0	0.0	0.0
North Central	65.0	35.8	4.7	0.0	0.0	55.1	7.2	0.0	0.0
Northeast	80.0	70.0	0.0	0.0	0.0	87.5	0.0	0.0	0.0
West Central	35.0	19.9	0.1	0.0	0.0	56.8	0.2	0.0	0.0
Central	65.0	45.6	0.3	0.0	0.0	70.2	0.4	0.0	0.0
East Central	25.0	17.9	0.0	0.0	0.0	71.6	0.0	0.0	0.0
Southwest	6.0	1.2	0.4	0.0	0.0	20.2	6.5	0.0	0.0
South Central	34.0	19.5	0.4	0.0	0.0	57.3	1.0	0.0	0.0
Southeast	60.0	35.1	2.1	0.0	0.0	58.5	3.5	0.0	0.0
Total	400.0	265.2	11.4	0.0	0.0	66.3	2.9	0.0	0.0
<b>Corn</b>									
Northwest	11.0	7.3	0.2	0.0	0.0	66.3	1.6	0.0	0.0
North Central	42.0	28.6	0.6	0.0	0.0	68.2	1.4	0.0	0.0
Northeast	56.0	44.3	4.2	0.0	0.0	79.1	7.4	0.0	0.0
West Central	52.0	15.6	0.3	0.0	0.0	30.0	0.5	0.0	0.0
Central	97.0	65.9	0.0	0.0	0.0	67.9	0.0	0.0	0.0
East Central	145.0	136.3	9.2	0.0	0.0	94.0	6.3	0.0	0.0
Southwest	42.0	22.8	0.2	0.0	0.0	54.4	0.5	0.0	0.0
South Central	115.0	40.8	2.9	0.0	0.0	35.5	2.5	0.0	0.0
Southeast	410.0	373.7	156.3	2.2	0.0	91.2	38.1	0.5	0.0
Total	970.0	735.3	173.8	2.2	0.0	75.8	17.9	0.2	0.0
<b>Sunflower</b>									
Northwest	280.0	253.0	107.2	0.0	0.0	90.4	38.3	0.0	0.0
North Central	420.0	374.5	338.2	0.5	0.0	89.2	80.5	0.1	0.0
Northeast	435.0	373.8	367.4	0.0	0.0	85.9	84.5	0.0	0.0
West Central	175.0	162.8	63.0	0.0	0.0	93.0	36.0	0.0	0.0
Central	605.0	516.4	427.6	0.0	4.5	85.4	70.7	0.0	0.8
East Central	300.0	290.2	215.3	0.0	0.4	96.7	71.8	0.0	0.1
Southwest	160.0	146.2	66.3	0.0	0.0	91.4	41.5	0.0	0.0
South Central	125.0	85.7	19.1	0.0	0.0	68.6	15.3	0.0	0.0
Southeast	350.0	318.9	242.9	0.0	0.7	91.1	69.4	0.0	0.2
Total	2850.0	2521.4	1846.9	0.5	5.6	88.5	64.8	0	0.2
<b>Soybean<sup>3</sup></b>									
North Central	2.9	2.0	0.0	0.0	0.0	70.2	0.0	0.0	0.0
Northeast	135.0	125.4	0.0	2.7	0.0	92.9	0.0	2.0	0.0
Central	14.5	14.5	0.0	0.0	0.0	100.0	0.0	0.0	0.0
East Central	365.0	360.1	11.4	0.0	0.4	98.7	3.1	0.0	0.1
Southwest	0.9	0.9	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Southeast	230.0	217.7	4.3	0.0	0.0	94.7	1.9	0.0	0.0
Other Counties	1.7	1.7	0.0	0.0	0.0	100.0	0.0	0.0	0.0
Total	750.0	722.4	15.7	2.7	0.4	96.3	2.1	0.4	0
<b>Dry Bean</b>									
Northwest	0.4	0.4	0.0	0.0	0.0	100.0	0.0	0.0	0.0
North Central	1.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Northeast	99.0	94.6	0.0	31.7	1.6	95.5	0.0	32.1	1.6
West Central	2.2	1.0	0.0	0.0	0.0	47.0	0.0	0.0	0.0
Central	6.9	6.9	0.0	0.0	0.0	100.0	0.0	0.0	0.0
East Central	77.0	72.5	0.3	6.7	1.9	94.2	0.4	8.7	2.5
Southwest	1.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
South Central	1.8	1.2	0.5	0.0	0.0	64.3	25.0	0.0	0.0
Southeast	15.4	15.1	0.0	0.4	0.0	98.0	0.0	2.9	0.0
Total	205.0	191.7	0.7	38.9	3.5	93.5	0.4	19.0	1.7
<b>Potatoes<sup>3</sup></b>									
Northeast	128.4	34.6	125.7	87.3	53.0	27.0	97.9	68.0	41.3
East Central	5.0	4.5	4.1	3.2	0.0	89.0	82.2	64.4	0.0
Other Counties	2.6	2.6	2.0	1.5	1.5	99.0	75.8	56.4	56.4
Total	136.0	41.6	131.8	91.9	54.5	30.6	96.9	67.6	40.1

Table 3 continued.

Reporting Districts	Acres planted <sup>1</sup> (1000)	Pesticide treated acres <sup>2</sup>							
		Herbicide	Insecticide	Fungicide	Other	Herbicide	Insecticide	Fungicide	Other
		(1000)	(1000)	(1000)	(1000)	(1000)	(%)	(%)	(%)
<b>Sugarbeet<sup>3</sup></b>									
Northwest	4.0	2.6	1.4	0.0	0.0	64.8	35.4	0.0	0.0
Northeast	64.2	62.5	39.2	52.1	0.0	97.4	61.1	81.2	0.0
West Central	8.2	7.9	2.6	0.0	0.0	96.5	31.4	0.0	0.0
East Central	41.5	40.1	14.9	36.8	0.0	96.5	35.9	88.7	0.0
Southeast	21.9	21.9	11.2	19.5	0.0	100.0	51.0	89.1	0.0
<b>Total</b>	<b>139.8</b>	<b>135.0</b>	<b>69.3</b>	<b>108.5</b>	<b>0.0</b>	<b>96.5</b>	<b>49.5</b>	<b>77.6</b>	<b>0.0</b>
<b>Alfalfa Hay<sup>3</sup></b>									
Northwest	110.0	0.3	3.7	0.0	0.0	0.3	3.4	0.0	0.0
North Central	150.0	0.2	1.7	0.0	0.0	0.1	1.2	0.0	0.0
Northeast	45.0	0.4	0.4	0.0	0.0	0.8	0.8	0.0	0.0
West Central	245.0	5.5	3.9	0.0	0.0	2.3	1.6	0.0	0.0
Central	205.0	1.7	0.0	0.0	0.0	0.8	0.0	0.0	0.0
East Central	50.0	0.2	1.0	0.0	0.0	0.4	2.0	0.0	0.0
Southwest	275.0	1.8	1.5	0.0	0.0	0.7	0.5	0.0	0.0
South Central	280.0	0.1	1.3	0.0	0.0	.0	0.5	0.0	0.0
Southeast	190.0	3.3	1.1	0.5	0.0	1.7	0.6	0.3	0.0
<b>Total</b>	<b>1550.0</b>	<b>13.4</b>	<b>14.5</b>	<b>0.5</b>	<b>0.0</b>	<b>0.9</b>	<b>0.9</b>	<b>0.0</b>	<b>0.0</b>
<b>Other Hay</b>									
Northwest	145.0	0.4	2.8	0.0	0.0	0.3	2.0	0.0	0.0
North Central	215.0	2.7	0.2	0.0	0.0	1.3	0.1	0.0	0.0
Northeast	90.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
West Central	160.0	0.2	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Central	200.0	1.8	0.7	0.0	0.0	0.9	0.3	0.0	0.0
East Central	40.0	0.2	0.0	0.0	0.0	0.5	0.0	0.0	0.0
Southwest	115.0	1.9	0.0	0.0	0.0	1.7	0.0	0.0	0.0
South Central	200.0	0.1	0.0	0.0	0.0	0.1	0.0	0.0	0.0
Southeast	185.0	1.6	0.1	0.0	0.1	0.9	.0	0.0	0.1
<b>Total</b>	<b>1350.0</b>	<b>9.1</b>	<b>3.8</b>	<b>0.0</b>	<b>0.1</b>	<b>0.7</b>	<b>0.3</b>	<b>0.0</b>	<b>0.0</b>
<b>Pasture &amp; Range</b>									
Northwest	989.5	12.9	2.8	0.0	0.0	1.3	0.3	0.0	0.0
North Central	559.7	18.1	7.3	0.0	0.0	3.2	1.3	0.0	0.0
Northeast	156.9	5.0	0.0	0.0	0.0	3.2	0.0	0.0	0.0
West Central	2138.6	6.8	0.9	0.0	0.0	0.3	0.0	0.0	0.0
Central	790.0	21.2	0.0	0.0	0.0	2.7	0.0	0.0	0.0
East Central	149.9	5.5	0.0	0.0	0.0	3.6	0.0	0.0	0.0
Southwest	2183.5	17.0	16.6	0.0	0.0	0.8	0.8	0.0	0.0
South Central	2068.3	7.7	0.0	0.0	0.0	0.4	0.0	0.0	0.0
Southeast	718.3	21.8	0.2	0.0	0.0	3.0	0.0	0.0	0.0
<b>Total</b>	<b>9754.7</b>	<b>116.0</b>	<b>27.7</b>	<b>0.0</b>	<b>0.0</b>	<b>1.2</b>	<b>0.3</b>	<b>0.0</b>	<b>0.0</b>
<b>Summer Fallow</b>									
Northwest	1882.0	459.2	0.0	0.0	0.0	24.4	0.0	0.0	0.0
North Central	1080.0	250.5	4.5	0.0	0.0	23.2	0.4	0.0	0.0
Northeast	1689.0	176.8	0.0	0.0	0.0	10.5	0.0	0.0	0.0
West Central	918.0	115.1	0.0	0.0	0.0	12.5	0.0	0.0	0.0
Central	973.0	208.3	0.0	0.0	0.0	21.4	0.0	0.0	0.0
East Central	766.0	55.5	0.0	0.0	0.0	7.3	0.0	0.0	0.0
Southwest	1097.0	136.0	1.6	0.0	0.0	12.4	0.2	0.0	0.0
South Central	663.0	163.8	0.0	0.0	0.0	24.7	0.0	0.0	0.0
Southeast	840.0	131.0	0.0	0.0	0.0	15.6	0.0	0.0	0.0
<b>Total</b>	<b>9908.0</b>	<b>1696.4</b>	<b>6.2</b>	<b>0.0</b>	<b>0.0</b>	<b>17.1</b>	<b>0.1</b>	<b>0.0</b>	<b>0.0</b>

<sup>1</sup>Preliminary estimates by the North Dakota Crop and Livestock Reporting Service.

<sup>2</sup>Multiple applications to the same acreage were totaled as one application.

<sup>3</sup>Crop reporting districts not listed did not contain significant amounts of the crop.

Table 4. WHEAT: Herbicide, insecticide and fungicide usage and application methods, North Dakota, 1984.

Pesticides	Acres of wheat treated <sup>2</sup>		Applications				Applicator		Method of Application	
							Farm	Custom	Aerial	Ground
	(1000)	(%)	1	2	3	4 or more	operator	(%)	(%)	(%)
<b>HERBICIDES<sup>1</sup></b>										
Alachlor	2.1	.0	100.0	0.0	0.0	0.0	80.0	20.0	0.0	100.0
Barban	112.5	1.3	96.2	3.8	0.0	0.0	78.0	22.0	17.7	82.3
Bromoxynil	152.5	1.7	100.0	0.0	0.0	0.0	87.5	12.5	10.7	89.3
Bromoxynil & MCPA	508.9	5.8	99.7	0.3	0.0	0.0	80.0	20.0	19.4	80.6
Chloramben	12.7	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Chlorosulfuron	187.2	2.1	100.0	0.0	0.0	0.0	68.6	31.4	23.8	76.2
Cyanazine	5.4	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Dalapon	2.7	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Dicamba	848.8	9.6	100.0	0.0	0.0	0.0	88.7	11.3	6.6	93.4
Diclofop	476.1	5.4	97.8	2.2	0.0	0.0	81.3	18.7	15.9	84.1
Difenzoquat	155.5	1.8	100.0	0.0	0.0	0.0	87.1	12.9	9.8	90.2
Dinoseb	2.8	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Diallate	10.7	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
EPTC	0.5	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Fluazifop	0.2	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Glyphosate	28.6	0.3	100.0	0.0	0.0	0.0	74.0	26.0	25.0	75.0
Linuron	1.6	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
MCPA	388.2	4.4	100.0	0.0	0.0	0.0	86.6	13.4	15.6	84.4
MCPA amine	754.9	8.6	99.6	0.4	0.0	0.0	79.9	20.1	16.2	83.8
MCPA ester	308.6	3.5	99.9	0.1	0.0	0.0	90.8	9.2	6.7	93.3
Naptalam & 2,4-DB	0.8	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Picloram	71.3	0.8	95.1	4.9	0.0	0.0	69.0	31.0	13.4	86.6
Propachlor	0.2	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Propanil	12.0	0.1	100.0	0.0	0.0	0.0	87.9	12.1	0.0	100.0
Triallate	1054.5	12.0	99.3	0.7	0.0	0.0	94.4	5.6	2.8	97.2
Trifluralin	1022.8	11.6	99.1	0.9	0.0	0.0	95.7	4.3	2.9	97.1
2,4-D	350.4	4.0	98.4	1.6	0.0	0.0	75.9	24.1	17.1	82.9
2,4-D amine	3389.1	38.4	99.6	0.4	0.0	0.0	81.9	18.1	12.9	87.1
2,4-D ester	1871.7	21.2	99.2	0.8	0.0	0.0	85.3	14.7	9.4	90.6
All Herbicides	11733.5	133.0	99.4	0.6	0.0	0.0	85.0	15.0	11.0	89.0
<b>INSECTICIDES</b>										
Acephate	9.3	0.1	80.7	19.3	0.0	0.0	51.7	48.3	48.3	51.7
Aldicarb	3.3	.0	100.0	0.0	0.0	0.0	27.8	72.2	0.0	100.0
Carbaryl	21.9	0.2	98.5	1.5	0.0	0.0	51.2	48.8	50.9	49.1
Carbofuran	17.2	0.2	100.0	0.0	0.0	0.0	28.4	71.6	76.9	23.1
Chlorpyrifos	0.4	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Fenvalerate	13.5	0.2	98.0	2.0	0.0	0.0	2.0	98.0	98.0	2.0
Lindane	14.9	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Malathion	35.6	0.4	95.3	4.7	0.0	0.0	18.0	82.0	82.5	17.5
Methoxychlor	0.4	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Methyl Parathion	3.5	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Parathion	48.7	0.6	94.5	5.5	0.0	0.0	8.7	91.3	83.6	16.4
Phorate	13.0	0.1	100.0	0.0	0.0	0.0	89.6	10.4	10.4	89.6
Toxaphene	4.1	.0	100.0	0.0	0.0	0.0	100.0	0.0	100.0	100.0
All Insecticides	185.7	2.1	96.4	3.6	0.0	0.0	34.3	65.7	63.3	36.7
<b>FUNGICIDES</b>										
Mancozeb	103.7	1.2	28.7	61.5	9.9	0.0	4.2	95.8	93.2	6.8
Maneb	12.5	0.1	76.3	23.7	0.0	0.0	0.0	100.0	100.0	0.0
Maneb & Zinc	57.4	0.7	26.8	73.2	0.0	0.0	32.2	67.8	67.8	32.2
All Fungicides	173.6	2.0	31.6	62.5	5.9	0.0	13.1	86.9	85.4	14.6

<sup>1</sup>Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.

<sup>2</sup>Multiple applications to the same acreage were totaled the same as individual applications to separate acreages. Thus, acres treated can exceed 100% of planted acres.

Table 5. BARLEY: Herbicide, insecticide and fungicide usage and application methods, North Dakota, 1984.

Pesticides	Acres of barley treated <sup>2</sup>		Applications				Applicator		Method of Application	
							Farm	Custom	Aerial	Ground
	(1000)	(%)	1	2	3	4 or more	operator	(%)	(%)	(%)
<b>HERBICIDES<sup>1</sup></b>										
AC 222,293	0.2	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Barban	44.0	1.5	97.9	2.1	0.0	0.0	86.9	13.1	13.2	86.8
Bromoxynil	53.1	1.8	99.5	0.5	0.0	0.0	91.2	8.8	7.8	92.2
Bromoxynil & MCPA	178.2	6.0	100.0	0.0	0.0	0.0	92.6	7.4	12.0	88.0
Butylate & Safener	0.4	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Chloramben	1.7	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Chlorsulfuron	43.6	1.5	100.0	0.0	0.0	0.0	77.9	22.1	11.6	88.4
Cyanazine	1.2	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Diallate	0.9	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Dicamba	107.2	3.6	100.0	0.0	0.0	0.0	88.7	11.3	11.0	89.0
Diclofop	130.7	4.4	100.0	0.0	0.0	0.0	83.9	16.1	8.0	92.0
Difenzoquat	87.2	3.0	100.0	0.0	0.0	0.0	78.7	21.3	18.3	81.7
Glyphosate	7.6	0.3	90.8	9.2	0.0	0.0	89.6	10.4	10.4	89.6
Linuron	0.8	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
MCPA	180.3	6.1	100.0	0.0	0.0	0.0	86.2	13.8	22.8	77.2
MCPA amine	317.0	10.7	100.0	0.0	0.0	0.0	86.3	13.7	12.4	87.6
MCPA ester	154.0	5.2	100.0	0.0	0.0	0.0	91.5	8.5	8.2	91.8
Metribuzin	1.6	0.1	100.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0
Picloram	21.0	0.7	100.0	0.0	0.0	0.0	83.1	16.9	4.7	95.3
Propanil	3.7	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Triallate	321.7	10.9	98.7	1.3	0.0	0.0	95.5	4.5	2.4	97.6
Trifluralin	312.2	10.6	98.7	1.3	0.0	0.0	97.2	2.8	4.1	95.9
2,4-D	87.6	3.0	95.1	4.9	0.0	0.0	84.4	15.6	16.4	83.6
2,4-D amine	1080.4	36.6	99.9	0.1	0.0	0.0	84.7	15.3	13.4	86.6
2,4-D ester	458.8	15.6	100.0	0.0	0.0	0.0	90.3	9.7	5.5	94.5
All Herbicides	3594.8	121.9	99.6	0.4	0.0	0.0	88.4	11.6	10.5	89.5
<b>INSECTICIDES</b>										
Acephate	1.6	0.1	100.0	0.0	0.0	0.0	66.7	33.3	33.3	66.7
Carbaryl	11.1	0.4	89.4	10.6	0.0	0.0	58.9	41.1	41.1	58.9
Carbofuran	4.4	0.1	100.0	0.0	0.0	0.0	94.8	5.2	5.2	94.8
Fenvalerate	3.7	0.1	100.0	0.0	0.0	0.0	18.1	81.9	81.9	18.1
Lindane	11.2	0.4	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Malathion	3.0	0.1	96.4	0.0	3.6	0.0	53.1	46.9	49.8	50.2
Methyl Parathion	7.7	0.3	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Naled	0.3	.0	0.0	100.0	0.0	0.0	100.0	0.0	0.0	100.0
Parathion	15.8	0.5	90.3	9.7	0.0	0.0	4.0	96.0	96.6	3.4
All Insecticides	58.7	2.0	95.0	4.9	0.2	0.0	43.5	56.5	56.8	43.2
<b>FUNGICIDES</b>										
Mancozeb	32.8	1.1	50.5	49.5	0.0	0.0	6.0	94.0	94.0	6.0
Maneb & Zinc	6.5	0.2	52.1	47.9	0.0	0.0	52.1	47.9	47.9	52.1
All Fungicides	39.3	1.3	50.7	49.3	0.0	0.0	13.7	86.3	86.3	13.7

<sup>1</sup>Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.

<sup>2</sup>Multiple applications to the same acreage were totaled the same as individual applications to separate acreages. Thus, acres treated can exceed 100% of planted acres.

Table 6. OATS: Herbicide, insecticide and fungicide usage and application methods, North Dakota, 1984.

Pesticides	Acres of oats treated <sup>2</sup>		Applications				Applicator		Method of Application	
			1	2	3	4 or more	Farm operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<b>HERBICIDES<sup>1</sup></b>										
Alachlor	0.4	.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
Bromoxynil	0.9	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Bromoxynil & MCPA	3.2	0.3	100.0	0.0	0.0	0.0	100.0	0.0	7.3	92.7
Chloramben	0.7	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Chlorsulfuron	3.9	0.3	100.0	0.0	0.0	0.0	78.7	21.3	0.0	100.0
Dicamba	40.8	3.5	98.0	2.0	0.0	0.0	85.8	14.2	0.0	100.0
Difenzoquat	0.1	.0	100.0	0.0	0.0	0.0	22.2	77.8	77.8	22.2
EPTC	0.2	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Glyphosate	0.6	.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
MCPA	62.4	5.4	100.0	0.0	0.0	0.0	82.3	17.7	6.3	93.7
MCPA amine	145.6	12.7	99.5	0.5	0.0	0.0	75.0	25.0	16.3	83.7
MCPA ester	22.7	2.0	100.0	0.0	0.0	0.0	95.6	4.4	4.4	95.6
Picloram	1.4	0.1	77.9	22.1	0.0	0.0	100.0	0.0	0.0	100.0
Trifluralin	3.4	0.3	100.0	0.0	0.0	0.0	50.9	49.1	0.0	100.0
2,4-D	9.4	0.8	100.0	0.0	0.0	0.0	80.5	19.5	19.5	80.5
2,4-D amine	190.3	16.5	99.9	0.1	0.0	0.0	85.9	14.1	4.3	95.7
2,4-D ester	41.9	3.6	99.3	0.7	0.0	0.0	79.8	20.2	3.7	96.3
All Herbicides	527.7	45.9	99.5	0.5	0.0	0.0	81.9	18.1	7.7	92.3
<b>INSECTICIDES</b>										
Acephate	0.6	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Carbaryl	1.0	0.1	100.0	0.0	0.0	0.0	11.1	88.9	88.9	11.1
Carbofuran	0.7	0.1	67.7	32.3	0.0	0.0	100.0	0.0	0.0	100.0
Chlorpyrifos	0.6	0.1	80.0	20.0	0.0	0.0	20.0	80.0	0.0	100.0
Fenvalerate	0.3	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Malathion	1.9	0.2	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Parathion	9.1	0.8	100.0	0.0	0.0	0.0	0.0	100.0	76.2	23.8
All Insecticides	14.2	1.2	97.4	2.6	0.0	0.0	11.3	88.7	69.9	30.1

<sup>1</sup>Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.

<sup>2</sup>Multiple applications to the same acreage were totaled the same as individual applications to separate acreages. Thus, acres treated can exceed 100% of planted acres.

Table 7. FLAX: Herbicide, insecticide and fungicide usage and application methods, North Dakota, 1984.

Pesticides	Acres of flax treated <sup>2</sup>		Applications				Applicator		Method of Application	
			1	2	3	4 or more	Farm operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
<b>HERBICIDES<sup>1</sup></b>										
Asulam	0.7	0.2	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
Barban	3.6	0.9	100.0	0.0	0.0	0.0	95.7	4.3	0.0	100.0
Bromoxynil	5.2	1.3	100.0	0.0	0.0	0.0	77.9	22.1	29.1	70.9
Bromoxynil & MCPA	13.0	3.3	100.0	0.0	0.0	0.0	90.0	10.0	13.4	86.6
Butylate & Safener	2.8	0.7	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Chlorsulfuron	1.1	0.3	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Cyanazine	0.2	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Dalapon	25.2	6.3	95.7	4.3	0.0	0.0	89.0	11.0	3.3	96.7
Diallate	0.9	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Dicamba	2.6	0.7	100.0	0.0	0.0	0.0	81.3	18.8	0.0	100.0
Diclofop	12.5	3.1	100.0	0.0	0.0	0.0	63.9	36.1	27.2	72.8
Difenzoquat	0.5	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
EPTC	28.6	7.2	100.0	0.0	0.0	0.0	95.2	4.8	0.0	100.0
Glyphosate	3.3	0.8	88.2	11.8	0.0	0.0	100.0	0.0	0.0	100.0
MCPA	38.9	9.7	100.0	0.0	0.0	0.0	82.1	17.9	1.4	98.6
MCPA amine	90.1	22.5	100.0	0.0	0.0	0.0	88.2	11.8	7.2	92.8
MCPA ester	15.2	3.8	100.0	0.0	0.0	0.0	91.0	9.0	19.2	80.8
Picloram	6.5	1.6	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Sethoxydim	8.2	2.1	100.0	0.0	0.0	0.0	95.4	4.6	0.0	100.0
Triallate	21.5	5.4	100.0	0.0	0.0	0.0	93.8	6.2	2.2	97.8
Trifluralin	70.5	17.6	100.0	0.0	0.0	0.0	92.0	8.0	0.5	99.5
2,4-D	4.1	1.0	100.0	0.0	0.0	0.0	74.8	25.2	54.5	45.5
2,4-D amine	27.8	7.0	100.0	0.0	0.0	0.0	82.2	17.8	6.3	93.7
2,4-D ester	4.2	1.0	100.0	0.0	0.0	0.0	74.4	25.6	18.3	81.7
All Herbicides	387.3	96.8	99.3	0.0	0.0	0.0	88.2	11.8	6.0	94.0
<b>INSECTICIDES</b>										
Acephate	2.2	0.6	16.7	83.3	0.0	0.0	100.0	0.0	0.0	100.0
Carbaryl	2.2	0.5	100.0	0.0	0.0	0.0	58.3	41.7	41.7	58.3
Endosulfan	0.9	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Fenvalerate	2.1	0.5	100.0	0.0	0.0	0.0	4.3	95.7	87.0	13.0
Malathion	1.4	0.4	70.4	29.6	0.0	0.0	66.7	33.3	33.3	66.7
Parathion	2.1	0.5	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Toxaphene	1.6	0.4	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
All Insecticides	12.5	3.1	80.7	19.3	0.0	0.0	44.4	55.6	54.0	46.0

<sup>1</sup>Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.

<sup>2</sup>Multiple applications to the same acreage were totaled the same as individual applications to separate acreages. Thus, acres treated can exceed 100% of planted acres.

Table 8. CORN: Herbicide, insecticide and fungicide usage and application methods, North Dakota, 1984.

Pesticides	Acres of corn treated <sup>2</sup>		Applications				Applicator		Method of Application	
							Farm	Custom	Aerial	Ground
	(1000)	(%)	1	2	3	4 or more	operator	(%)	(%)	(%)
<b>HERBICIDES<sup>1</sup></b>										
Acifluorfen	2.4	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Alachlor	165.7	17.1	100.0	0.0	0.0	0.0	88.3	11.7	8.8	91.2
Atrazine	208.7	21.5	97.4	2.6	0.0	0.0	78.4	21.6	12.4	87.6
Atrazine & Metolachlor	10.0	1.0	100.0	0.0	0.0	0.0	88.4	11.6	0.0	100.0
Bentazon	0.3	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Bromoxynil	6.3	0.6	100.0	0.0	0.0	0.0	78.3	21.7	21.7	78.3
Bromoxynil & MCPA	3.1	0.3	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Butylate & Safener	6.4	0.7	100.0	0.0	0.0	0.0	93.3	6.7	3.0	97.0
Cyanazine	204.4	21.1	95.7	4.3	0.0	0.0	80.2	19.8	12.4	87.6
Desmedipham & Phenmed.	1.3	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Diallate	1.1	0.1	100.0	0.0	0.0	0.0	38.5	61.5	61.5	38.5
Dicamba	127.9	13.2	100.0	0.0	0.0	0.0	85.0	15.0	5.4	94.6
Dinoseb amine salt	0.4	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
EPTC plus Safener	230.0	23.7	100.0	0.0	0.0	0.0	89.9	10.1	4.9	95.1
Glyphosate	8.4	0.9	100.0	0.0	0.0	0.0	73.1	26.9	22.8	77.2
MCPA	0.5	0.1	100.0	0.0	0.0	0.0	58.3	41.7	0.0	100.0
MCPA amine	0.7	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
MCPA ester	1.6	0.2	100.0	0.0	0.0	0.0	55.6	44.4	44.4	55.6
Metolachlor	19.2	2.0	84.6	15.4	0.0	0.0	69.3	30.7	12.8	87.2
Pendimethalin	6.5	0.7	100.0	0.0	0.0	0.0	79.8	20.2	0.0	100.0
Propachlor	0.1	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Triallate	0.3	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Trifluralin	1.6	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
2,4-D	5.0	0.5	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
2,4-D amine	56.2	5.8	100.0	0.0	0.0	0.0	74.6	25.4	12.2	87.8
2,4-D ester	11.4	1.2	100.0	0.0	0.0	0.0	72.3	27.7	18.1	81.9
All Herbicides	1079.6	111.3	98.3	1.7	0.0	0.0	83.4	16.6	9.3	90.7
<b>INSECTICIDES</b>										
Aldicarb	0.7	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Carbaryl	13.6	1.4	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Carbofuran	64.1	6.6	100.0	0.0	0.0	0.0	53.4	46.6	37.0	63.0
Chlorpyrifos	9.1	0.9	100.0	0.0	0.0	0.0	99.2	0.8	1.7	98.3
Diazinon	3.3	0.3	100.0	0.0	0.0	0.0	11.5	88.5	88.5	11.5
Fenvalerate	4.2	0.4	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Fonofos	0.4	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Lindane	1.6	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Malathion	1.7	0.2	58.9	41.1	0.0	0.0	53.8	46.2	58.9	41.1
Methyl Parathion	2.0	0.2	100.0	0.0	0.0	0.0	13.0	87.0	87.0	13.0
Parathion	1.8	0.2	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Permethrin	1.4	0.1	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Phorate	35.6	3.7	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Terbufos	43.7	4.5	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
All Insecticides	183.2	18.9	99.7	0.3	0.0	0.0	77.6	22.4	19.0	81.0
<b>FUNGICIDES</b>										
Triphenyl Tin Hydroxides	2.2	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
All Fungicides	2.2	0.2	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0

<sup>1</sup>Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.

<sup>2</sup>Multiple applications to the same acreage were totaled the same as individual applications to separate acreages. Thus, acres treated can exceed 100% of planted acres.

Table 9. SUNFLOWER: Herbicide, insecticide and fungicide usage and application methods, North Dakota, 1984.

Pesticides	Acres of sunflower treated <sup>2</sup>		Applications				Applicator		Method of Application	
							Farm	Custom	Aerial	Ground
	(1000)	(%)	1 (%)	2 (%)	3 (%)	4 or more (%)	operator (%)	(%)	(%)	(%)
<b>HERBICIDES<sup>1</sup></b>										
Acifluorfen	50.6	1.8	100.0	0.0	0.0	0.0	95.3	4.7	10.7	89.3
Alachlor	10.9	0.4	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Atrazine	2.3	0.1	100.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0
Barban	8.4	0.3	100.0	0.0	0.0	0.0	92.7	7.3	5.2	94.8
Bentazon	0.7	.0	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
Butylate & Safener	16.6	0.6	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Chloramben	4.9	0.2	100.0	0.0	0.0	0.0	100.0	0.0	12.4	87.6
Cyanazine	1.1	.0	100.0	0.0	0.0	0.0	100.0	0.0	100.0	0.0
Desmedipham	0.7	.0	100.0	0.0	0.0	0.0	100.0	0.0	51.6	48.4
Diallate	1.4	.0	100.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Dicamba	1.8	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Diclofop	6.3	0.2	100.0	0.0	0.0	0.0	95.5	4.5	4.5	95.5
Difenzoquat	0.3	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Dinoseb amine salt	0.9	.0	100.0	0.0	0.0	0.0	100.0	100.0	100.0	0.0
EPTC	65.1	2.3	92.6	7.4	0.0	0.0	90.5	9.5	9.0	91.0
EPTC plus Safener	0.6	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Ethalfuralin	33.1	1.2	100.0	0.0	0.0	0.0	91.9	8.1	0.0	100.0
Fluazifop	3.5	0.1	100.0	0.0	0.0	0.0	79.7	20.3	0.0	100.0
Glyphosate	29.2	1.0	100.0	0.0	0.0	0.0	97.0	3.0	2.4	97.6
MCPA	1.0	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Pendimethalin	200.3	7.0	97.4	2.6	0.0	0.0	88.8	11.2	6.3	93.7
Picloram	1.6	0.1	100.0	0.0	0.0	0.0	0.0	100.0	0.0	100.0
Sethoxydim	7.4	0.3	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Triallate	123.7	4.3	100.0	0.0	0.0	0.0	96.1	3.9	7.7	92.3
Trifluralin	2258.1	79.2	98.3	1.7	0.1	0.0	90.3	9.7	4.4	95.6
2,4-D	0.2	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
2,4-D amine	8.2	0.3	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
2,4-D ester	0.3	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
All Herbicides	2839.9	99.7	98.3	1.7	0.0	0.0	90.6	9.4	5.1	94.9
<b>INSECTICIDES</b>										
Acephate	3.8	0.1	54.3	45.7	0.0	0.0	34.8	65.2	65.2	34.8
Carbaryl	12.5	0.4	100.0	0.0	0.0	0.0	66.6	33.4	35.4	64.6
Carbofuran	327.7	11.5	94.3	5.6	0.1	0.0	58.2	41.8	43.3	56.7
Chlorpyrifos	0.1	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Diazinon	1.6	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Dimethoate	0.4	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Dioxathion	1.1	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Fenvalerate	1276.7	44.8	96.7	2.9	0.5	0.0	34.7	65.3	66.9	33.1
Fonofos	0.7	.0	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Malathion	35.0	1.2	86.7	13.3	0.0	0.0	18.1	81.9	90.7	9.3
Methidathion	6.0	0.2	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
Parathion	398.7	14.0	86.9	11.7	1.4	0.0	4.4	95.6	92.7	7.3
Phorate	0.8	.0	100.0	0.0	0.0	0.0	100.0	0.0	0.0	100.0
Toxaphene	2.6	0.1	100.0	0.0	0.0	0.0	0.0	100.0	100.0	0.0
All Insecticides	2067.7	72.6	94.1	5.3	0.6	0.0	32.2	67.8	98.6	31.4
<b>OTHER CHEMICALS</b>										
Paraquat	6.4	0.2	90.8	9.2	0.0	0.0	54.6	45.4	93.8	6.2
All Other Chemicals	6.4	0.2	90.8	9.2	0.0	0.0	54.6	45.4	93.8	6.2

<sup>1</sup>Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.

<sup>2</sup>Multiple applications to the same acreage were totaled the same as individual applications to separate acreages. Thus, acres treated can exceed 100% of planted acres.