Pesticide Use and Pest Management Practices for Major Crops in North Dakota - 2000

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NOTE: This report summarizes the information on pesticide use as reported by the farmers surveyed. The data do not imply endorsement of any particular product or practice. Also, some responses may have misreported use of pesticides due to similar sounding chemical or trade names. In some cases, pesticides are approved for use before planting or after harvest, but not to a crop. The mention of an unregistered pesticide applied to a crop does not imply applications are legal or advocated by the authors. It is of the utmost importance that pesticide users READ, UNDERSTAND, and FOLLOW all label directions and precautions.

INTRODUCTION

This is the sixth major account of pesticide usage in North Dakota and describes pesticide usage on agricultural land in 2000. The information is derived from a comprehensive survey of North Dakota farm operators. The first five comprehensive surveys to assess pesticide usage on major crops in North Dakota were conducted on 1978[1], 1984[2], 1989[3], 1992[4], and 1996[5] pesticide applications.

Total acres treated with herbicides, insecticides and fungicides were 16,081,700 in 1978, 20,600,300 in 1984, 19,527,400 in 1989, 19,034,200 in 1992, 20,668,100 in 1996, and 19,087,900 in 2000. Changes in pesticide treated acres may be due to pest outbreaks, changes in pest populations, tillage practices, substitution of non-chemical for chemical methods, shifts in acreage of major crops, or new developments in pest control technology.

The survey of pesticide usage during 2000 in North Dakota was conducted because regular assessment of pesticide usage is an important indicator of changes in farming practices and farmer attitudes toward pesticides, as well as an indicator of the relative severity of various pests in the state.

The specific objectives of the survey were:

1. identify acreage of crops treated with each pesticide group, and identify specific pesticides used;
2. determine pesticide usage by state districts;
3. determine the percentage of pesticides applied by farm operator or custom applicator by air or ground equipment; and
4. determine extent of use of several non-chemical pest control methods.

METHODOLOGY

North Dakota State University, North Dakota Agricultural Statistics Service (NDASS), and the North Dakota Department of Agriculture designed the survey instrument. As in previous surveys, pesticide use data for wheat, barley, oat, flax, corn, sunflower, soybean, dry bean, canola, potato, sugarbeet, alfalfa hay, other hay, pasture, summer-fallow, and CRP was requested for the 2000 crop year. Crops added to the survey included crambe, safflower, dry mustard, and field pea.

NDASS was responsible for implementing the survey. The survey was conducted as a phone survey. NDASS selected a sample population of 7,000 farm operators to represent each crop at the district level. The target for useable surveys was 3,500 responses, stratified across NDASS's reporting districts. After selection of the sample population, a pre-survey letter was mailed to alert selected growers of the survey effort and content. Interviews were conducted from late-February through March 2001.

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[1] 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. 33p.

[2] McMullen, M.P., A.G. Dexter, J.D. Nalewaja, W. Hamlin, and K. Davison. 1985. Pesticide Use on Major Crops in North Dakota, 1984. North Dakota State University in cooperation with North Dakota Crop and Livestock Reporting Service, Agronomy Report 3. 31p.

[3] McMullen, M.P., A.G. Dexter, J.D. Nalewaja, and G. Dahl. 1989. Pesticide Use on Major Crops in North Dakota, 1989. North Dakota State University in cooperation with North Dakota Crop and Livestock Reporting Service, Extension Report 1. 50p.

[4] Zollinger, R.K., M.P. McMullen, G. Dahl, A.G. Dexter, J.D. Nalewaja, W.G. Hamlin, and D.G. Becker. 1992. Pesticide Use and Pest Management Practices for Major Crops in North Dakota, 1992. North Dakota State University in cooperation with North Dakota Agricultural Statistics Service, Extension Report 15. 67p.

[5] Zollinger, R.K., G. Dahl, M.P. McMullen, P. Glogoza, A.G. Dexter, S.C. Fitterer, G.E. Waldhaus, and K. Ignaszewski. 1998. Pesticide Use and Pest Management Practices for Major Crops in North Dakota, 1996. North Dakota State University in cooperation with North Dakota Agricultural Statistics Service, Extension Report 43. 79p.

The Questionnaire
The questionnaire was designed to collect pesticide data for major and minor crops, summer fallow, CRP and pasture in North Dakota for the 2000 crop year. The questionnaire was similar to the one used for the 1992 and 1996 surveys. Modifications included the addition of questions regarding the use of genetically modified (GM) crops, revised questions querying pest management practices, and questions regarding pesticide drift issues.

Information on individual crop total acres seeded, acres seeded with any treated seed and acres seeded with farm-treated seed was obtained. Acres treated by crop were determined for the general pesticide categories of herbicides, insecticides, fungicides and desiccants.

Pesticide usage data included the active ingredient used, acres treated, number of applications, type of applicator and method of application for each major crop or land use identified by respondents in Section 1 of the questionnaire. The type of applicator meant the chemical was self-applied by the farm operator or custom applied. The method of application referred to aerial or ground applications.

Farmers were asked about their use of the GM crops of corn, soybean, canola and potato. They were asked the number of acres planted using this technology in one section; later they were asked if they plan to increase or decrease the use of GM crops.

Respondents were asked to identify crop and pest problems that did not have a pesticide available to adequately manage the problem. This was a new section added to the survey with the objective of identifying possible pesticide priorities.

For the pest management decisions and practices, questions were developed to query whether respondents scouted for pests, information they used to make treatment decisions, whether they used non-chemical methods of pest control, their intended GM crop usage, and internet use as an information resource. Finally, a series of questions about spray drift incidence and management was included to establish some baseline information regarding this pesticide issue.

The Sample
A sample of 7,000 farm operators was selected at random from the North Dakota Agricultural Statistics Service (NDASS) list of farm operators. Samples were not adjusted to increase representation for the regional crops of sugarbeet and potato. Potato and sugarbeet have been included in previous statewide pesticide surveys. Due to NASS Agricultural Resource Management Surveys (ARMS) implemented on these crops in 1999 and 2000, the additional respondents needed to adequately address these crops at the district level were not selected out of concern for respondent fatigue. The ARMS surveys are extensive interviews that obtain significant amounts of information at the field and enterprise level. To document pesticide use on these crops in this comprehensive effort, survey results from the NASS surveys pertaining to pesticides are being cited.

Data Collection and Editing
Telephone interviews were conducted from February to March 2001. A total of 3,580 usable surveys were obtained.

Of the producers surveyed for 2000, 53% grew wheat, 26% barley, 21% oat, 8% flax, 14% corn, 14% sunflower, 11% soybean, 1.8% field pea, 0.8% lentil, 4.3% dry bean, 11% canola, 0.2% crambe, 0.4% safflower, 0.2% mustard, and 0.8% sugarbeet. Forty-one percent reported having alfalfa hay, 36% other hay, 37% CRP, 25% reported having summer fallow, and 59% pastureland.

The data review process looked at completeness and reasonableness of data within each section of the questionnaire and across sections. For example, the acreage treated with herbicides reported in the first section of the questionnaire was compared to the total herbicide treated acreage reported in Section III for each crop.

The Summary
All state level percentages shown in the summary tables are weighted averages of the districts. Data were summarized by obtaining a percent of total acres treated for the general pesticide category, as well as for specific chemicals, by crop, and by crop reporting districts. These percentage of total acres treated were multiplied by the NDASS estimate of total acres planted to each crop in the district. State acres were obtained by the addition of these data with state percentages derived to obtain the weighted figures.

All results from the questionnaire were included in the summary tables. Items designated “NS” were not sufficient to estimate district or state level projections. Where responses represented one respondent, “NS” was used to maintain confidentiality.

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STATEWIDE USAGE IN NORTH DAKOTA

The reported pesticide treated acres in Tables 1, 2, and 3 indicate acres that received one or more applications of a pesticide. The treated acres in pesticide usage Tables 4 through 40 include multiple applications to the same acreage as separate values in the total, and pesticides applied as a tank mixture were totaled separately unless a commercial premix was used. Thus, acres treated in pesticide Tables 4 through 40 can exceed 100% of the planted acres. See list of tables.

Herbicides, insecticides, and fungicides were applied one or more times to 18.1, 0.3, and 0.7 million acres, respectively, in 2000 (Table 1), compared to 18.7, 1.3, and 0.6 million acres, respectively in 1996 [5]; 17.6, 0.9, and 0.6 million acres, respectively, in 1992 [4]; 17.4, 1.8, and 0.4 million acres, respectively, in 1989 [3]; and 17.5, 2.5, and 0.5 million acres, respectively, in 1984 [2]. In 2000, herbicides were applied to approximately 47.3% of all crop, pasture, hay, CRP, and summer fallow land, insecticides to 0.8%, and fungicides to 1.9%. In 1996, herbicides were applied to approximately 47.3% of all crop, pasture, hay, CRP, and summer fallow land, insecticides to 3.2%, and fungicides to 1.6%. In 1992, herbicides were applied to approximately 43.1% of all crop, pasture, hay, CRP, and summer fallow land, insecticides to 2.1%, and fungicides to 1.4%.

Of surveyed crops, acres planted to treated seed totaled 7.8 million, 63.2% of dry bean, 73.4% of corn, 78.9% of sunflower, 81.6% of canola, 39.6% of barley, 33.5% of wheat, and 17.9% of soybean acreage planted with treated seed (Table 1). These values compare to seed treated acres of 9.8 million, 84.3%, 79.4%, 76.5%, 76.2%, 50.9%, 45.3%, and 9.5%, respectively, for 1996[5]. Acres planted to on-farm treated seed totaled 3.9 million in 2000 (Table 1), indicating that a slight majority of treated seed planted is treated on the farm. On-farm treatment is most common for seed of wheat and barley. Seed of corn, sunflower, canola, and dry bean is generally purchased already treated (Table 1).

Total acres of surveyed crops treated at least once with herbicides was 18,076,000 in 2000 (Table 1), compared to 18,765,000 in 1996, 17,573,200 in 1992, 17,368,600 in 1989, and 17,539,800 in 1984. If estimated treated acres for potato (NASS 1999) and sugarbeet (NASS 2000) are added to the 2000 figure, total herbicide treated acres would be 18,434,430, a total similar to 1996.

When multiple herbicide applications were totaled as multiple acres, herbicide treated acres were 30,112,300 in 2000 (Table 37) compared to 24,819,300 in 1984, 27,674,700 in 1989, 28,777,400 in 1992, and 33,691,700 in 1996. Herbicide treated acres increase to 31,480,330 if estimated acres for potato (NASS 1999) and sugarbeet (NASS 2000) are included.

The percentage of acres treated at least once with herbicides in 2000 was over 90% for wheat, barley, and soybean; acres treated at least once was over 80% for flax, corn, sunflower, lentils, dry bean, and canola (Table 1). Acres treated were less than 2% for alfalfa hay, other hay, and pasture. CRP herbicide treated acres were 7.9%. Nineteen percent of summer fallow acres were treated. Crops with increases in herbicide treated acres were flax (86.2% vs 68.8% in 1996) and canola (88.8% vs 75.8% in 1996).

Insecticides were used on 0.28 million acres of the surveyed crops. If potato (NASS 1999) and sugarbeet (NASS 2000) are added, the estimated acres treated with insecticides increases to 0.6 million. This is significantly less than the 1.26 million acres treated in 1996 [5]. Most of the reduction was due to reduced treating of wheat for managing the wheat midge. Only 0.8% of the surveyed crop acres were treated with an insecticide. Sunflower was the most frequently treated survey crop with 10.2% of the acres receiving at least one insecticide treatment. Potato and sugarbeet were frequently treated with insecticides and NASS summaries indicate 95% and 81% of these acres were treated with insecticides, respectively. Though frequently treated with insecticides, these crops represent only 0.9% of North Dakota agricultural acres.

Total acreage treated with fungicide, exclusive of seed treatment, remained relatively constant with 1.9% of the surveyed acres treated, compared to 1.6% in 1996 and 1.4% in 1992 of total cropland treated at least once. The most frequently treated surveyed crop was wheat with 6.2% of the acres, or 0.6 million acres receiving at least one treatment. Potato and sugarbeet are frequently treated with fungicides. The NASS surveys estimate the crop acres treated were 99% in 1999 and 96% in 2000, respectively.

TABLE 1. Acreage planted, acreage treated and percentage of planted acreage treated with pesticides in surveyed crops, North Dakota, 2000

		Pesticide Treated Acres [2]											
Crop	Acres Planted [1]	Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Wheat	10170.0	3409.7	33.5	3065.7	30.1	9496.6	93.4	93.0	0.9	633.5	6.2	---	---
Barley	1900.0	751.7	39.6	682.2	35.9	1726.6	90.9	1.0	0.1	33.0	1.7	---	---
Oats	600.0	15.9	2.6	9.9	1.7	227.8	38.0	---	---	---	---	---	---
Flax	490.0	13.1	2.7	5.0	1.0	422.6	86.2	---	---	---	---	---	---
Corn	1080.0	793.1	73.4	23.7	2.2	933.4	86.4	21.0	1.9	2.3	0.2	---	---
Sunflower	1340.0	1057.6	78.9	56.3	4.2	1105.6	82.5	136.3	10.2	---	---	1.1	0.1
Soybean	1900.0	340.9	17.9	81.3	4.3	1791.3	94.3	2.4	0.1	1.9	0.1	0.6	0.0
Field Pea	67.1	6.3	9.4	---	---	47.1	70.2	---	---	---	---	1.0	1.5
Lentils	44.4	4.0	8.9	---	---	38.8	87.2	---	---	---	---	0.9	2.0
Beans	610.0	385.2	63.2	31.3	5.1	537.5	88.1	1.7	0.3	23.5	3.9	8.3	1.4
Canola	1270.0	1036.3	81.6	3.2	0.3	1127.3	88.8	29.5	2.3	18.1	1.4	---	---
Alfalfa	1350.0	2.8	0.2	---	---	12.2	0.9	2.9	0.2	---	---	---	---
Other Hay	1100.0	0.5	0.0	---	---	16.9	1.5	---	---	---	---	---	---
CRP [3]	3174.7	0.8	0.0	---	---	251.3	7.9	---	---	---	---	---	---
Fallow	1165.0	---	---	---	---	225.8	19.4	---	---	---	---	---	---
Pasture	11947.2	---	---	---	---	115.6	1.0	---	---	---	---	---	---
Total	38208.4	7817.8	20.5	3958.7	10.4	18076.3	47.3	287.7	0.8	712.2	1.9	12.0	0.0

[1] Preliminary estimates by the North Dakota Agricultural Statistics Service.
[2] Multiple applications to the same acreage were totaled as one application within a pesticide group.
[3] CRP represents acres in the Conservation Reserve Program.

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ACRES TREATED BY NORTH DAKOTA AGRICULTURAL STATISTICS DISTRICTS

North Dakota has nine agricultural statistics crop reporting districts (Appendix B). Summaries of pesticide usage by district are provided in Table 2. The greatest percentages of acreage planted to treated seed were the northeast and east central districts. These same two districts rank one and two for acres treated for all pesticide categories.

Summaries of pesticide usage per crop by district are provided in Table 3.

Herbicide usage on **wheat** ranged from 88% of the acreage in the central to 97% in the north central. Insecticide usage on wheat ranged from none reported in five of the districts to a high of 2.3% in the northeast. Fungicide usage on wheat ranged from none reported in the southwest and south central to highs of 13% in the north central and northeast and 15% in the east central. These regions have had the highest risk and incidence of fusarium head blight, also known as head scab.

Herbicide usage on **barley** ranged from 66% of the acreage in the southwest to 97% in the north central, northeast, and east central districts. Acres treated with herbicides were over 90% in five of the nine districts. Insecticide usage on barley was less than 1% in the west central district, the only district recording insecticide usage. Fungicide usage on barley ranged from none reported in western districts to a high of 5% in the central district.

Herbicide usage on **oat** was less than on wheat and barley in all districts. Usage ranged from 27% of the acreage in the west central to 79% in the east central district. Six of the nine districts had less than 50% of the oat acres treated with herbicides. No insecticide or fungicide treated oat acres were reported.

Herbicide usage on **flax** varied from 51% in the east central to 98% in the northeast district. No insecticide or fungicide treatments were reported.

Herbicide usage on **corn** ranged from 83 to 97% of the acreage in the three east districts where 76% of the North Dakota corn acres are located. In the remainder of the state, the range of herbicide treated acres was a low of 49% in the south central district to a high of 82% in both the north central and central districts. Insecticide usage on corn was reported from only four of the nine districts with a total estimated treated acres of only 1.9%. Most of the treated acres were located in the east central and southeast districts, representing 86% of the total insecticide treated acres. Fungicide use was reported from only the east central district and was only 1.1%.
Eighty-seven percent of the **sunflower** acres were planted in the central and eastern districts. Slightly more than 82% of the sunflower acres were treated with herbicides statewide. The nine districts averaged 84% of the acres treated with herbicide, ranging from 73% to 91%. Statewide, 10.2% of the sunflower acres were treated with insecticide. An average of 7.9% of the acres were treated by district, with a range of 0.9 to 20.3%. No fungicide treatments were reported.

More than 94% of the **soybean** acres were treated with herbicides in all districts that had a significant soybean acreage. Treated acres ranged from 73% in the south central to 98% in the central districts. Insecticide usage on soybean normally is a small percentage. Only 0.1% of the acres were treated with insecticide, all from the southeast district.

New, small acreage crops for North Dakota include **field pea and lentil** at 67,100 and 44,400 acres, respectively. District level estimates are not available for these crops. The only pesticide group reported was herbicide with an estimated 70% of the pea acres and 87% of the lentil acres treated statewide.

Dry edible bean acres were primarily in the northeast, east central, and central districts, representing 84% of the state acres. Eighty-eight percent of the dry bean acres were treated with herbicide in all districts that had a significant dry bean acreage. Insecticides were applied on only 0.3% of the acres statewide. Fungicides were used on 3.9% of the total dry bean acres, with 5.4% and 1.7% in the northeast and east central districts and 4.9% of all other districts combined.

The northern and central districts grew 88% of the **canola** acres. Eighty-nine percent of the canola acres were treated statewide with herbicides. The range of treatment was from 81% in the north central to 100% in the south central districts. Insecticides were applied to 2.3%, with the acres ranging from none reported from four districts to a high of 8.1% in the northwest district. Fungicides were used on 1.4% of the canola acres. This was the first year a registered fungicide was available, though it was issued too late for some producers. A significant amount of seed treatments was used in canola to manage diseases and insects. Treated seed was used on 81.6% of the canola acres.

Herbicide use on **alfalfa** and **other hay** was very small, ranging from zero to 5.8% of the acreage across the districts and totaled only 1.2% statewide. Total insecticide treated alfalfa acres was only 0.2% of the 1.3 million acres. No insecticide treatments were reported on other hay acres. No fungicides were reported on either alfalfa or other hay.

Herbicides were used on 1 to 17% of the **CRP** acreage across districts. Greatest herbicide usage was reported by the north central, central, and east central districts, locations where perennial weed infestations were of greater concern. No insecticide or fungicide use was reported on CRP acreage.

Herbicides were applied to 19.4% of the statewide **summer fallow**. Acres treated ranged from 10% in the central district to 28% in the southwest district. No insecticide or fungicide use was reported on summer fallow.

Herbicide usage on **pasture** ranged from a low of 0.4% in the northwest and southwest districts to a high of 3.5% in the east central district. Statewide usage was only 1%. No acres of pasture were reported to have been treated with insecticide or fungicide.

Potato was included in the ARMS survey conducted for the 1999 production year [6]. Forty-nine producers from North Dakota were interviewed. Herbicides were used on 83% of the potato acreage. Ninety-five percent of the potato acreage was estimated to have been treated with insecticide. Fungicide applications were estimated to have been applied to 99% of the acres.

Sugarbeet was included in the ARMS survey conducted for the 2000 production year [7]. There were 152 producers from North Dakota interviewed. Herbicides were used on 100% of the sugarbeet acres. For the North Dakota sugarbeet acres, 81% were estimated to have been treated with insecticide. Fungicide treatments were estimated for 96% of the acres.

[6] USDA, NASS. 2000. Agricultural Chemical Usage, 1999 Field Crops Summary. Ag Ch 1(00) a. May 2000.

[7] USDA, NASS. 2001. Agricultural Chemical Usage, 2000 Field Crops Summary. Ag Ch 1(01) b. May 2001.

TABLE 2. Acreage planted, acreage treated, and percentage of planted acreage treated with pesticides for surveyed crops from crop reporting districts of North Dakota, 2000

		Pesticide Treated Acres [2]											
District	Acres Planted [1]	Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Northwest	4863.2	994.2	20.4	679.6	14.0	2660.9	54.7	47.7	1.0	53.5	1.1	1.9	0.0
North Central	3715.2	980.4	26.4	551.7	14.9	1917.0	51.6	27.8	0.7	135.7	3.7	0.0	0.0
Northeast	4564.9	1670.6	36.6	821.8	18.0	3401.9	74.5	76.8	1.7	291.2	6.4	4.0	0.1
West Central	4334.8	433.9	10.0	265.3	6.1	1235.1	28.5	3.8	0.1	7.4	0.2	---	---
Central	3925.5	778.9	19.8	317.7	8.1	1813.9	46.2	51.4	1.3	59.9	1.5	1.1	0.0
East Central	3184.8	1226.3	38.5	623.2	19.6	2490.2	78.2	41.4	1.3	157.3	4.9	4.9	0.2
Southwest	4846.9	564.9	11.7	394.4	8.1	1219.4	25.2	4.6	0.1	---	---	---	---
South Central	4577.9	316.2	6.9	61.9	1.4	979.8	21.4	8.1	0.2	---	---	---	---
Southeast	4195.2	852.5	20.3	243.1	5.8	2358.0	56.2	26.1	0.6	7.1	0.2	0.0	0.0
Total	38208.4	7817.8	20.5	3958.7	10.4	18076.3	47.3	287.7	0.8	712.2	1.9	12.0	0.0

[1] Preliminary estimates by the North Dakota Agricultural Statistics Service.
[2] Multiple applications to the same acreage were totaled as one application within a pesticide group.

TABLE 3. Acreage planted, acreage treated, and percentage of planted acreage treated with pesticides, by crop, from crop reporting districts of North Dakota, 2000

		Pesticide Treated Acres [2]											
District	Acres Planted [1]	Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Wheat													
Northwest	2054.0	610.2	29.7	574.4	28.0	1910.6	93.0	25.7	1.2	47.7	2.3	---	---
North Central	957.0	367.0	38.4	351.3	36.7	930.4	97.2	---	---	130.0	13.6	---	---
Northeast	1941.0	806.2	41.5	665.3	34.3	1864.3	96.0	44.0	2.3	254.7	13.1	---	---
West Central	939.0	230.9	24.6	216.0	23.0	853.5	90.9	2.0	0.2	4.9	0.5	---	---
Central	857.0	230.3	26.9	223.5	26.1	758.7	88.5	---	---	41.9	4.9	---	---
East Central	994.0	533.8	53.7	461.0	46.4	926.7	93.2	21.4	2.2	149.0	15.0	---	---
Southwest	1006.0	387.8	38.5	364.2	36.2	927.5	92.2	---	---	---	---	---	---
South Central	651.0	54.1	8.3	33.7	5.2	586.7	90.1	---	---	---	---	---	---
Southeast	771.0	189.4	24.6	176.1	22.8	738.1	95.7	---	---	5.3	0.7	---	---
TOTAL	10170.0	3409.7	33.5	3065.7	30.1	9496.6	93.4	93.0	0.9	633.5	6.2	---	---
Barley													
Northwest	255.0	113.0	44.3	103.8	40.7	239.2	93.8	---	---	3.4	1.3	---	---
North Central	345.0	166.5	48.3	163.5	47.4	334.4	96.9	---	---	1.9	0.5	---	---
Northeast	380.0	155.6	40.9	130.7	34.4	367.3	96.6	---	---	9.6	2.5	---	---
West Central	140.0	37.0	26.4	31.8	22.7	108.6	77.5	1.0	0.7	---	---	---	---
Central	280.0	68.1	24.3	64.9	23.2	246.2	87.9	---	---	14.5	5.2	---	---
East Central	215.0	130.2	60.6	109.4	50.9	209.5	97.4	---	---	3.6	1.7	---	---
Southwest	71.0	31.1	43.8	29.8	42.0	47.1	66.4	---	---	---	---	---	---
South Central	105.0	25.0	23.8	24.0	22.8	75.1	71.5	---	---	---	---	---	---
Southeast	109.0	25.2	23.1	24.3	22.2	99.2	91.0	---	---	---	---	---	---
TOTAL	1900.0	751.7	39.6	682.2	35.9	1726.6	90.9	1.0	0.1	33.0	1.7	---	---
Oat													
Northwest	41.0	0.7	1.8	0.4	1.0	20.2	49.4	---	---	---	---	---	---
North Central	50.0	0.6	1.3	0.6	1.3	18.0	36.0	---	---	---	---	---	---
Northeast	14.0	1.4	10.3	1.4	10.3	7.6	54.6	---	---	---	---	---	---
West Central	110.0	2.4	2.2	0.9	0.8	30.1	27.4	---	---	---	---	---	---
Central	62.0	0.8	1.4	---	---	24.8	40.0	---	---	---	---	---	---
East Central	9.0	2.0	21.9	2.0	21.9	7.1	79.1	---	---	---	---	---	---
Southwest	96.0	1.5	1.6	0.3	0.4	33.1	34.5	---	---	---	---	---	---
South Central	160.0	6.3	3.9	4.2	2.6	56.8	35.5	---	---	---	---	---	---
Southeast	58.0	---	---	---	---	29.9	51.6	---	---	---	---	---	---
TOTAL	600.0	15.9	2.6	9.9	1.7	227.8	38.0	---	---	---	---	---	---

Table 3. ***Continued***

District	Acres Planted [1]	Pesticide Treated Acres [2]											
		Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Flax													
Northwest	87.0	1.0	1.1	---	---	78.8	90.6	---	---	---	---	---	---
North Central	70.0	---	---	---	---	60.4	86.3	---	---	---	---	---	---
Northeast	105.0	2.7	2.6	1.1	1.0	103.2	98.3	---	---	---	---	---	---
West Central	30.0	4.2	14.1	4.0	13.2	21.2	70.7	---	---	---	---	---	---
Central	95.0	2.0	2.1	---	---	78.7	82.8	---	---	---	---	---	---
East Central	14.0	3.3	23.4	---	---	7.2	51.5	---	---	---	---	---	---
Southwest	27.0	---	---	---	---	23.5	87.1	---	---	---	---	---	---
South Central	20.0	---	---	---	---	11.8	59.2	---	---	---	---	---	---
Southeast	42.0	---	---	---	---	7.9	90.2	---	---	---	---	---	---
TOTAL	490.0	13.1	2.7	5.0	1.0	422.6	86.2	---	---	---	---	---	---
Corn													
Northwest	5.5	2.3	41.1	---	---	4.2	76.1	---	---	---	---	---	---
North Central	33.5	27.8	83.0	4.8	14.3	27.5	82.1	1.3	4.0	---	---	---	---
Northeast	93.0	82.6	88.8	---	---	77.5	83.4	---	---	---	---	---	---
West Central	31.0	19.9	64.3	---	---	19.5	63.0	---	---	---	---	---	---
Central	65.5	47.8	73.0	2.4	3.7	54.0	82.4	---	---	---	---	---	---
East Central	216.0	177.1	82.0	---	---	209.7	97.1	13.5	6.3	2.3	1.1	---	---
Southwest	39.5	32.8	83.2	---	---	26.0	65.8	---	---	---	---	---	---
South Central	86.0	65.7	76.3	---	---	42.2	49.1	1.5	1.8	---	---	---	---
Southeast	510.0	337.0	66.1	16.5	3.2	472.7	92.7	4.6	0.9	---	---	---	---
TOTAL	1080.0	793.1	73.4	23.7	2.2	933.4	86.4	21.0	1.9	2.3	0.2	---	---
Sunflower													
Northwest	78.6	62.1	79.0	0.9	1.1	68.4	87.0	0.9	1.2	---	---	---	---
North Central	218.0	173.1	79.4	29.4	13.5	164.5	75.4	17.4	8.0	---	---	---	---
Northeast	162.0	126.6	78.1	11.8	7.3	136.2	84.0	32.8	20.3	---	---	---	---
West Central	42.5	39.5	92.8	4.3	10.2	38.8	91.2	0.4	0.9	---	---	---	---
Central	305.0	242.8	79.6	5.8	1.9	258.5	84.7	51.4	16.9	---	---	1.1	0.4
East Central	132.0	97.8	74.1	4.1	3.1	96.4	73.0	4.3	3.3	---	---	---	---
Southwest	53.4	47.6	89.2	---	---	47.7	89.3	3.5	6.5	---	---	---	---
South Central	170.0	139.3	82.0	---	---	134.3	79.0	6.5	3.8	---	---	---	---
Southeast	178.5	128.8	72.1	---	---	161.0	90.2	19.0	10.7	---	---	---	---
TOTAL	1340.0	1057.6	78.9	56.3	4.2	1105.6	82.5	136.3	10.2	---	---	1.1	0.1

Table 3. ***Continued***

District	Acres Planted [1]	Pesticide Treated Acres [2]											
		Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Soybean													
North Central	7.7	2.9	38.0	---	---	6.7	87.3	---	---	---	---	---	---
Northeast	200.0	34.7	17.3	11.4	5.7	183.8	91.9	---	---	---	---	---	---
Central	100.0	6.3	6.3	---	---	97.6	97.6	---	---	---	---	---	---
East Central	850.0	143.1	16.8	43.7	5.1	809.5	95.2	---	---	---	---	0.6	0.1
South Central	20.0	10.7	53.4	---	---	14.5	72.6	---	---	---	---	---	---
Southeast	715.0	142.4	19.9	26.2	3.7	673.7	94.2	2.4	0.3	1.9	0.3	---	---
Other	7.3	0.7	9.9	---	---	5.5	76.0	---	---	---	---	---	---
TOTAL	1900.0	340.8	17.9	81.3	4.3	1791.3	94.3	2.4	0.1	1.9	0.1	0.6	0.0
Field pea													
TOTAL	67.1	6.3	9.4	---	---	47.1	70.2	---	---	---	---	1.0	1.5
Lentil													
TOTAL	44.4	4.0	8.9	---	---	38.8	87.3	---	---	---	---	0.9	2.0
Dry Edible Bean													
Northeast	303.0	161.7	53.4	---	---	267.5	88.3	---	---	16.2	5.4	4.0	1.3
Central	71.0	53.5	75.3	21.1	29.8	48.2	67.8	---	---	---	---	---	---
East Central	136.0	111.5	82.0	3.0	2.2	131.9	96.9	1.7	1.2	2.4	1.7	4.3	3.1
Others	100.0	58.5	58.5	7.2	7.2	90.0	90.0	---	---	4.9	4.9	---	---
TOTAL	610.0	385.2	63.2	31.3	5.1	537.6	88.1	1.7	0.3	23.5	3.9	8.3	1.4
Canola													
Northwest	232.0	201.1	86.7	---	---	219.6	94.7	18.7	8.1	---	---	---	---
North Central	275.0	228.8	83.2	2.1	0.8	223.8	81.4	9.0	3.3	3.8	1.4	---	---
Northeast	367.0	298.8	81.4	---	---	320.4	87.3	---	---	10.7	2.9	---	---
West Central	103.0	77.4	75.2	1.1	1.1	93.4	90.7	---	---	---	---	---	---
Central	145.0	126.0	86.9	---	---	130.3	89.9	---	---	3.6	2.5	---	---
East Central	32.0	27.5	86.0	---	---	28.0	87.4	0.5	1.6	---	---	---	---
Southwest	72.0	52.5	72.9	---	---	68.7	95.5	1.1	1.5	---	---	---	---
South Central	27.0	14.4	53.3	---	---	27.0	100.0	---	---	---	---	---	---
Southeast	17.0	9.9	58.5	---	---	16.0	94.4	0.1	0.8	---	---	---	---
TOTAL	1270.0	1036.3	81.6	3.2	0.3	1127.3	88.8	29.5	2.3	18.1	1.4	---	---

Table 3. ***Continued***

District	Acres Planted [1]	Pesticide Treated Acres [2]											
		Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Alfalfa													
Northwest	116.0	0.5	0.4	---	---	1.0	0.8	2.4	2.0	---	---	---	---
North Central	135.0	0.1	0.0	---	---	4.0	2.9	0.0	0.0	---	---	---	---
Northeast	39.0	---	---	---	---	1.5	3.9	---	---	---	---	---	---
West Central	197.0	0.6	0.3	---	---	0.6	0.3	0.5	0.2	---	---	---	---
Central	173.0	0.5	0.3	---	---	0.1	0.1	---	---	---	---	---	---
East Central	35.0	---	---	---	---	0.9	2.5	---	---	---	---	---	---
Southwest	228.0	---	---	---	---	0.4	0.2	0.0	0.0	---	---	---	---
South Central	297.0	0.2	0.1	---	---	1.3	0.4	---	---	---	---	---	---
Southeast	130.0	0.9	0.7	---	---	2.5	1.9	---	---	---	---	---	---
TOTAL	1350.0	2.8	0.2	---	---	12.2	0.9	2.9	0.2	---	---	---	---
Other Hay													
Northwest	102.0	---	---	---	---	0.4	0.4	---	---	---	---	---	---
North Central	221.0	---	---	---	---	4.6	2.1	---	---	---	---	---	---
Northeast	35.0	---	---	---	---	0.3	0.7	---	---	---	---	---	---
West Central	151.0	0.0	0.0	---	---	1.5	1.0	---	---	---	---	---	---
Central	136.0	---	---	---	---	1.7	1.3	---	---	---	---	---	---
East Central	24.0	---	---	---	---	0.2	0.7	---	---	---	---	---	---
Southwest	141.0	---	---	---	---	0.5	0.4	---	---	---	---	---	---
South Central	183.0	---	---	---	---	1.9	1.0	---	---	---	---	---	---
Southeast	107.0	0.4	0.4	---	---	5.8	5.4	---	---	---	---	---	---
TOTAL	1100.0	0.5	0.0	---	---	16.9	1.5	---	---	---	---	---	---
CRP													
Northwest	273.2	0.1	0.0	---	---	5.6	2.1	---	---	---	---	---	---
North Central	419.1	---	---	---	---	69.7	16.6	---	---	---	---	---	---
Northeast	532.1	0.3	0.1	---	---	28.2	5.3	---	---	---	---	---	---
West Central	134.2	---	---	---	---	8.2	6.1	---	---	---	---	---	---
Central	513.3	0.4	0.1	---	---	72.8	14.2	---	---	---	---	---	---
East Central	232.0	---	---	---	---	37.9	16.3	---	---	---	---	---	---
Southwest	409.6	---	---	---	---	5.8	1.4	---	---	---	---	---	---
South Central	265.0	---	---	---	---	2.6	1.0	---	---	---	---	---	---
Southeast	396.2	---	---	---	---	20.4	5.1	---	---	---	---	---	---
TOTAL	3174.7	0.8	0.0	---	---	251.3	7.9	---	---	---	---	---	---

Table 3. ***Continued***

District	Acres Planted [1]	Pesticide Treated Acres [2]											
		Total Treated Seed		On-farm Treated Seed		Herbicide		Insecticide		Fungicide		Desiccants	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Fallow													
Northwest	302.5	---	---	---	---	57.7	19.1	---	---	---	---	---	---
North Central	130.8	---	---	---	---	34.1	26.0	---	---	---	---	---	---
Northeast	137.4	---	---	---	---	33.4	24.3	---	---	---	---	---	---
West Central	39.3	---	---	---	---	7.4	18.8	---	---	---	---	---	---
Central	154.7	---	---	---	---	15.0	9.7	---	---	---	---	---	---
East Central	94.0	---	---	---	---	16.5	17.5	---	---	---	---	---	---
Southwest	51.9	---	---	---	---	14.5	27.9	---	---	---	---	---	---
South Central	29.2	---	---	---	---	6.4	21.9	---	---	---	---	---	---
Southeast	225.2	---	---	---	---	40.8	18.1	---	---	---	---	---	---
TOTAL	1165.0	---	---	---	---	225.8	19.4	---	---	---	---	---	---
Pasture													
Northwest	1254.4	---	---	---	---	4.5	0.4	---	---	---	---	---	---
North Central	832.9	---	---	---	---	22.8	2.7	---	---	---	---	---	---
Northeast	251.1	---	---	---	---	5.9	2.3	---	---	---	---	---	---
West Central	2371.9	---	---	---	---	11.1	0.5	---	---	---	---	---	---
Central	959.7	---	---	---	---	20.7	2.2	---	---	---	---	---	---
East Central	198.3	---	---	---	---	6.9	3.5	---	---	---	---	---	---
Southwest	2633.6	---	---	---	---	9.4	0.4	---	---	---	---	---	---
South Central	2555.0	---	---	---	---	16.2	0.6	---	---	---	---	---	---
Southeast	890.3	---	---	---	---	18.1	2.0	---	---	---	---	---	---
TOTAL	11947.2	---	---	---	---	115.6	1.0	---	---	---	---	---	---
Potato	*(USDA, NASS. 2000)*												
TOTAL	121.0	---	---	---	---	100.4	83.0	114.9	95.0	119.8	99.0	---	---
Sugarbeet	*(USDA, NASS, 2001)*												
TOTAL	258.0	---	---	---	---	258.0	100.0	209.0	81.0	247.7	96.0	---	---

Pesticide Use and Pest Management Practices for Major Crops in North Dakota - 2000

ER-79
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ON-FARM SEED TREATMENT, BY CROP

Table 1 provides information on acres planted with treated seed, regardless if treatment was with a single, multiple, or a mixture of products. Data in Table 4 indicate acreage of individual crops planted to seed that was treated on-farm with single, several, or combinations of products.

For **wheat**, 31.9% of the acreage was planted to seed treated on-farm, with maneb + lindane as the individual seed treatment product used on the most acres at 7.8% of the acreage treated (Table 4). Carboxin was used on 6.9% of the acreage and carboxin + thiram on 4.2% of the acreage (Table 4). The grain auger method was used to treat 67.5% of the on-farm treated wheat. Insecticide seed treatments were used on 35% of the seed treated acres. Lindane was the seed treatment insecticide used on 99+% of the seed treated acres.

Barley seed was treated on-farm for 37.8% of the acres (Table 4). The most frequently used treatments were products containing carboxin, with 11.2% of the acreage planted to seed treated with carboxin alone, and 24.4% planted with carboxin + other pesticides. Maneb + lindane was used on seed treated for 7.1% of the barley acreage (Table 4). The grain auger method was used for 64.8% of the on-farm seed treatment of barley. Lindane was the most common insecticide used to treat barley seed. It was used on 31.7% of the seed treated barley acres, and 11.9% of the total barley acres.

On-farm seed treatment was used for only 1.7% of the **oat** acreage, non-significant levels of the **flax** acreage, and 6.4% of the **soybean** acreage (Table 4). Carboxin alone and maneb + lindane were the only measurable products for oats. Maneb + lindane was the only treatment mentioned for flax. Carboxin was the only measurable product for soybean on-farm treatment.

Canola seed is frequently treated for disease and insect control. Canola acres seeded with treated seed were 81.7% of the total acres (Table 4). The most frequently used fungicide was benomyl at 21.3% of the seed treated acres. The insecticide imidacloprid was used on 58% of the acres to manage crucifer flea beetles. Thiamethoxam, a new insecticide seed treatment registered as a Section 18 on a limited number of acres in 2000, was used on only 2.3% (Table 4). These seed treatment products were only available as a commercial seed treatment.

Over all the crops treated on-farm, 0.95 million acres were planted with seed treated with maneb fungicide + lindane insecticide; 0.95 million acres had seed treated with carboxin fungicide alone, and another 0.52 million acres had seed treated with carboxin + thiram fungicide (Table 5). Carboxin alone or in combination was used on seed planted to 1.9 million acres (compared to 3.74 and 3.05 million in 1996 and 1992, respectively), and maneb alone or in combination was used on seed planted to 1.1 million acres (compared to 2.30 and 2.38 million in 1996 and 1992, respectively). Seed treatment also included use of insecticide products such as diazinon, imidacloprid, lindane, and thiamethoxam either alone or in combination with fungicides.

TABLE 4. ON-FARM SEED TREATMENT BY CROP: Acres treated, percent of crop, and method of application for North Dakota, 2000

TREATMENT	Acres Seeded [1]	Acres Seeded	Treatment Method		
			Drill Box	Auger	Other
	(1000)	(%)	(%)	(%)	(%)
Wheat					
Bacillus subtilis	NS	NS	NS	NS	NS
Captan + Diazinon	NS	NS	NS	NS	NS
Captan + PCNB + Thiabendazole	26.6	0.3	11.2	88.8	---
Carboxin	699.9	6.9	26.6	68.5	4.9
Carboxin + Imazalil + Thiabendazole	118.1	1.2	---	100.0	---
Carboxin + Maneb + Lindane	104.0	1.0	33.8	66.2	---
Carboxin + Thiram	430.3	4.2	21.8	72.2	6.0
Carboxin + Thiram + Lindane	124.2	1.2	60.2	23.9	15.9
Difenoconazole	267.6	2.6	18.0	74.2	7.8
Formaldehyde	NS	NS	NS	NS	NS
Imazalil	49.3	0.5	53.5	46.5	---
Lindane	121.1	1.2	11.2	75.4	13.4
Mancozeb	NS	NS	NS	NS	NS
Maneb + Lindane	791.0	7.8	37.4	61.1	1.4
Metalaxyl	NS	NS	NS	NS	NS
Tebuconazole	317.7	3.1	12.6	67.1	20.3
Thiram	123.9	1.2	18.4	67.7	13.8
TOTAL	3243.2	31.9	26.0	67.5	6.5
Barley					
Captan	NS	NS	NS	NS	NS
Captan + Diazinon	NS	NS	NS	NS	NS
Carboxin	212.5	11.2	21.6	73.2	5.2
Carboxin + Imazalil + Thiabendazole	22.9	1.2	---	100.0	---
Carboxin + Maneb + Lindane	31.9	1.7	32.0	68.0	---
Carboxin + Thiram	89.9	4.7	19.9	64.8	15.3
Carboxin + Thiram + Lindane	30.4	1.6	75.9	17.4	6.8
Difenoconazole	12.9	0.7	24.1	62.6	13.3
Formaldehyde	NS	NS	NS	NS	NS
Imazalil	10.9	0.6	---	100.0	---
Lindane	29.2	1.5	25.5	55.4	19.1
Maneb + Lindane	135.6	7.1	45.7	53.2	1.1
Tebuconazole	97.2	5.1	21.5	62.3	16.1
Thiram	37.0	1.9	20.8	75.1	4.2
TOTAL	717.5	37.8	27.8	64.8	7.4

Table 4. ***Continued***

TREATMENT	Acres Seeded [1]	Acres Seeded	Treatment Method		
			Drill Box	Auger	Other
	(1000)	(%)	(%)	(%)	(%)
Oat					
Carboxin	4.2	0.7	39.8	60.2	---
Carboxin + Thiram	NS	NS	NS	NS	NS
Carboxin + Thiram + Lindane	NS	NS	NS	NS	NS
Lindane	NS	NS	NS	NS	NS
Maneb + Lindane	3.0	0.5	88.0	12.0	---
Metiram	NS	NS	NS	NS	NS
TOTAL	9.9	1.7	52.3	47.7	---
Flax					
Maneb + Lindane	NS	NS	NS	NS	NS
TOTAL	NS	NS	NS	NS	NS
Canola					
Benomyl	270.9	21.3	---	---	100.0
Captan	NS	NS	NS	NS	NS
Carboxin	NS	NS	NS	NS	NS
Imazalil	NS	NS	NS	NS	NS
Imidacloprid	738.3	58.1	---	---	100.0
Thiamethoxam + Metalaxyl + Fludioxonil + Difenoconazole	29.4	2.3	---	---	100.0
Thiram	NS	NS	NS	NS	NS
TOTAL	1068.4	81.7	---	---	100.0
Soybean					
Carboxin	30.0	1.6	---	100.0	---
Carboxin + Imazalil + Thiabendazole	NS	NS	NS	NS	NS
Carboxin + Thiram	NS	NS	NS	NS	NS
Carboxin + Thiram + Metalaxyl	NS	NS	NS	NS	NS
Fludioxonil	NS	NS	NS	NS	NS
Maneb + Lindane	NS	NS	NS	NS	NS
Metalaxyl	NS	NS	NS	NS	NS
Tebuconazole	NS	NS	NS	NS	NS
TOTAL	81.3	6.4	---	98.2	1.8

[1] Acres reported seeded with treated seed include multiple applications to the same seed and seed treatment products applied as a tank mixture were totaled separately unless applied as a commercial premix.
NS - not sufficient to estimate state projections.

TABLE 5. ON-FARM SEED TREATMENT BY ACTIVE INGREDIENT: Total acres treated, percent of selected crops, and method of application for North Dakota, 2000

TREATMENT	Acres Seeded		Treatment Method		
			Drill Box	Auger	Other
	(1000)	(%)	(%)	(%)	(%)
Bacillus subtilis	NS	NS	NS	NS	NS
Benomyl	270.9	21.3	2.6	2.8	94.5
Captan	14.3	0.5	9.0	---	91.0
Captan + Diazinon	NS	NS	NS	NS	NS
Captan + PCNB + Thiabendazole	26.6	0.3	11.2	88.8	---
Carboxin	956.3	6.0	24.4	69.8	5.8
Carboxin + Imazalil + Thiabendazole	148.4	1.1	---	100.0	---
Carboxin + Maneb + Lindane	135.9	1.1	33.4	66.6	---
Carboxin + Thiram	522.0	3.6	21.4	71.0	7.5
Carboxin + Thiram + Lindane	155.2	1.2	63.0	22.9	14.1
Carboxin + Thiram + Metalaxyl	NS	NS	NS	NS	NS
Difenoconazole	280.5	2.3	18.3	73.7	8.0
Fludioxonil	NS	NS	NS	NS	NS
Formaldehyde	NS	NS	NS	NS	NS
Imazalil	61.7	0.5	42.8	54.8	2.4
Imidacloprid	738.3	58.1	2.8	1.3	95.9
Lindane	150.3	1.2	14.0	71.5	14.5
Mancozeb	NS	NS	NS	NS	NS
Maneb + Lindane	950.4	6.3	38.4	60.3	1.4
Metalaxyl	14.0	0.1	2.3	97.7	---
Metiram	NS	NS	NS	NS	NS
Tebuconazole	417.8	3.0	14.6	65.9	19.6
Thiamethoxam + Apron + Maxim + Dividend	29.4	2.3	---	---	100.0
Thiram	166.5	1.2	18.3	67.1	14.6
TOTAL	5125.4	31.4	21.1	53.8	25.1

NS - not sufficient to estimate state projections.

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PESTICIDE USAGE ON CROPS, PASTURE, SUMMER FALLOW, AND CRP IN NORTH DAKOTA, 2000

Acres treated values for individual crops in pesticide usage Tables 7 through 21often exceed the acres treated by crop as reported in Table 1. The increase is due to the separate reporting of multiple pesticide applications to the same acreage within a pesticide grouping. Table 1 reports total treated acres as those that received at least one application for the tabulated pesticide group. However, separate acreage values are not reported in tables when pesticides were applied on the same acre as a commercially available premix formulation. Knowing the usage of these premixes provides insight into the possible rates and pounds of active that were applied.

The following pesticide use by crop tables contain data on individual pesticides and premixes used, number of applications, and application methods on the major crops, pasture land, summer fallow, and CRP for 2000. Pesticides are listed by their common chemical name only. Many of the common and trade names of the individual pesticides are provided in Appendix C.

North Dakota crop production statistics provided throughout this report are made available from summaries published in the North Dakota Agricultural Statistics 2001. NDASS. Ag Statistics No. 71, June 2001.

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PESTICIDE USE FOR WHEAT

Wheat has the greatest number of acres of any crop grown in North Dakota. The state grows primarily hard red spring and durum wheats; limited acres of winter wheat are produced. Production statistics for **ALL WHEAT** in North Dakota are summarized in Table 6.

The most frequently applied herbicide was 2,4-D which was used on 51.3% of the wheat acres in 2000 (Table 7), compared to 50% in 1996, 52% in 1992, 55% in 1989, and 64% in 1984. The next most frequent was fenoxaprop-p, applied to 23.9%; followed by dicamba at 20.7%, and MCPA at 16.7%. The top five herbicide active ingredients reported from the past three pesticide use surveys are summarized in Figure 1. The greatest increase in the use of an active ingredient was with fenoxaprop-p. Wheat acreage treated with sulfonylurea type herbicides (chlorsulfuron, metsulfuron, thifensulfuron, triasulfuron, and tribenuron) was 44% in 2000, an increase from 32% in 1996, and 21% in 1992 and 1989. The farm operator applied 87% of the herbicides to wheat, and 95% of the applications were applied with ground equipment.

Insecticides were applied on only 1% of the wheat acreage in 2000 (Table 7). In the past, insecticide usage on wheat acres has been strongly influenced by regional outbreaks of grasshoppers. In 1996, the orange wheat blossom midge, *Sitodiplosis mosellana*, had a significant influence on insecticide usage when 3.6% of the acres were treated with chlorpyrifos (Figure 1). Insecticide applications were applied 54% of the time by air.

Fungicides were applied to 6.7% of the wheat acres (Table 7). The most frequently applied fungicide was tebuconazole on 4.9% of the acres. Tebuconazole was first made available for use on wheat in 1997 under a Section 18 Emergency Exemption label for management of fusarium head blight, or head scab.

TABLE 6. Production summary for ALL WHEAT, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Bu.)*	*(000 Bu.)*	*($/Bu.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	12,680	12,515	31.6	395,130	4.19	1,638,379	130.91	17	1
1997	11,625	11,095	24.3	269,290	3.82	1,019,426	91.88	11	2
1998	9,770	9,610	32.0	307,700	3.03	930,897	96.87	12	2
1999	9,410	8,657	28.0	242,280	2.77	670,237	77.42	11	2
2000	10,170	9,413	33.3	313,785	2.71	857,369	91.08	14	2

TABLE 7. WHEAT: Herbicide, Insecticide, and Fungicide usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 x	2 x	3 x	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	4778.6	47.0	99.2	0.8	---	85.8	14.2	6.4	93.6
2,4-D + Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acetochlor + Safener + Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acifluorfen	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acifluorfen + Bentazon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ametryn	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 7. ***Continued***

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 x	2 x	3 x	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil	91.6	0.9	100.0	---	---	84.1	15.9	---	100.0
Bromoxynil + MCPA	1266.1	12.4	95.9	4.1	---	93.0	7.0	2.59	97.5
Clodinafop	64.6	0.6	100.0	---	---	80.3	19.7	9.6	90.4
Clopyralid	21.1	0.2	100.0	---	---	84.9	15.1	---	100.0
Clopyralid + 2,4-D	225.0	2.2	100.0	---	---	77.3	22.7	8.5	91.5
Clopyralid + MCPA	41.3	0.4	100.0	---	---	72.6	27.4	18.2	81.8
Dicamba	2104.1	20.7	100.0	---	---	87.8	12.2	4.4	95.6
Dicamba + Primisulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Diclofop	NS	NS	NS	NS	NS	NS	NS	NS	NS
Difenzoquat	26.1	0.3	100.0	---	---	69.7	30.3	30.3	69.7
Fenoxaprop + 2,4-D + MCPA	181.3	1.8	81.2	18.8	---	77.0	23.0	15.9	84.1
Fenoxaprop + MCPA	190.9	1.9	100.0	---	---	82.5	17.5	6.4	93.6
Fenoxaprop+MCPA+ Thifensulfuron +Tribenuron	419.3	4.1	100.0	---	---	67.6	32.4	4.2	95.8
Fenoxaprop-P + Safener	2426.7	23.9	98.7	1.3	---	89.4	10.6	3.6	96.4
Fenoxaprop-P-ethyl +MCPA + Isooctylester+Thifensulfuron	21.7	0.2	100.0	---	---	58.1	41.9	16.2	83.8
Fluroxypyr	226.5	2.2	98.8	1.2	---	94.4	5.6	2.0	98.0
Fluroxypyr + 2,4-D Ester	32.9	0.3	100.0	---	---	92.7	7.3	---	100.0
Fluroxypyr + MCPA Ester	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	425.0	4.2	86.8	13.2	---	80.4	19.6	7.7	92.3
Glyphosate + Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazamethabenz	182.2	1.8	100.0	---	---	85.9	14.1	14.1	85.9
Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
MCPA	1698.1	16.7	99.6	0.4	---	88.3	11.7	2.3	97.7
Metsulfuron	80.3	0.8	100.0	---	---	91.0	9.0	3.9	96.1
Metsulfuron + Chlorsulfuron	23.0	0.2	100.0	---	---	86.6	13.4	---	100.0
Oxadiazon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pendimethalin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	20.3	0.2	100.0	---	---	74.2	25.8	---	100.0
Quizalofop-P	5.6	0.1	100.0	---	---	84.8	15.2	---	100.0
Sethoxydim	12.3	0.1	100.0	---	---	100.0	---	---	100.0
Thifensulfuron	248.9	2.4	100.0	---	---	83.9	16.1	6.6	93.4
Thifensulfuron + Tribenuron	286.5	2.8	97.8	---	---	86.0	14.0	8.5	91.5
Tralkoxydim	244.5	2.4	100.0	---	---	82.2	17.8	0.7	99.3
Triallate	105.9	1.0	100.0	---	---	83.9	16.1	4.4	95.6
Triallate + Trifluralin	132.6	1.3	100.0	---	---	81.1	18.9	---	100.0
Triasulfuron	63.3	0.6	100.0	---	---	91.6	8.4	8.4	91.6
Tribenuron	1207.0	11.9	97.4	2.6	---	86.7	13.3	3.4	96.6
Trifluralin	385.9	3.8	100.0	---	---		10.7	---	100.0
All Herbicides	17333.2	170.4	98.3	1.7	---	86.6	13.4	4.7	95.3
Insecticide									
Chlorpyrifos	66.0	0.6	100.0	---	---	62.4	37.6	31.8	68.2
Dimethoate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Encapsulated Methyl Parathion	14.7	0.1	100.0	---	---	---	100.0	100.0	---
Esfenvalerate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ethyl Parathion	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lambda-cyhalothrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	101.0	1.0	84.3	15.7	---	57.4	42.6	54.5	45.5

Table 7. ***Continued***

	Acres Treated [2] (1000)	Acres Treated (%)	Applications 1 x (%)	Applications 2 x (%)	Applications 3 x (%)	Applicator Farm Operator (%)	Applicator Custom (%)	Method of Application Aerial (%)	Method of Application Ground (%)
Fungicide									
Benlate	26.6	0.3	100.0	---	---	78.9	21.1	50.4	49.6
Chlorothalonil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Mancozeb	36.7	0.4	100.0	---	---	28.8	71.2	71.2	28.8
Propiconazole	119.3	1.2	99.5	0.5	---	64.3	35.7	32.9	67.1
Tebuconazole	494.2	4.9	96.5	3.5	---	47.1	52.9	51.3	48.7
All Fungicides	678.5	6.7	97.3	2.7	---	50.3	49.7	49.2	50.8

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

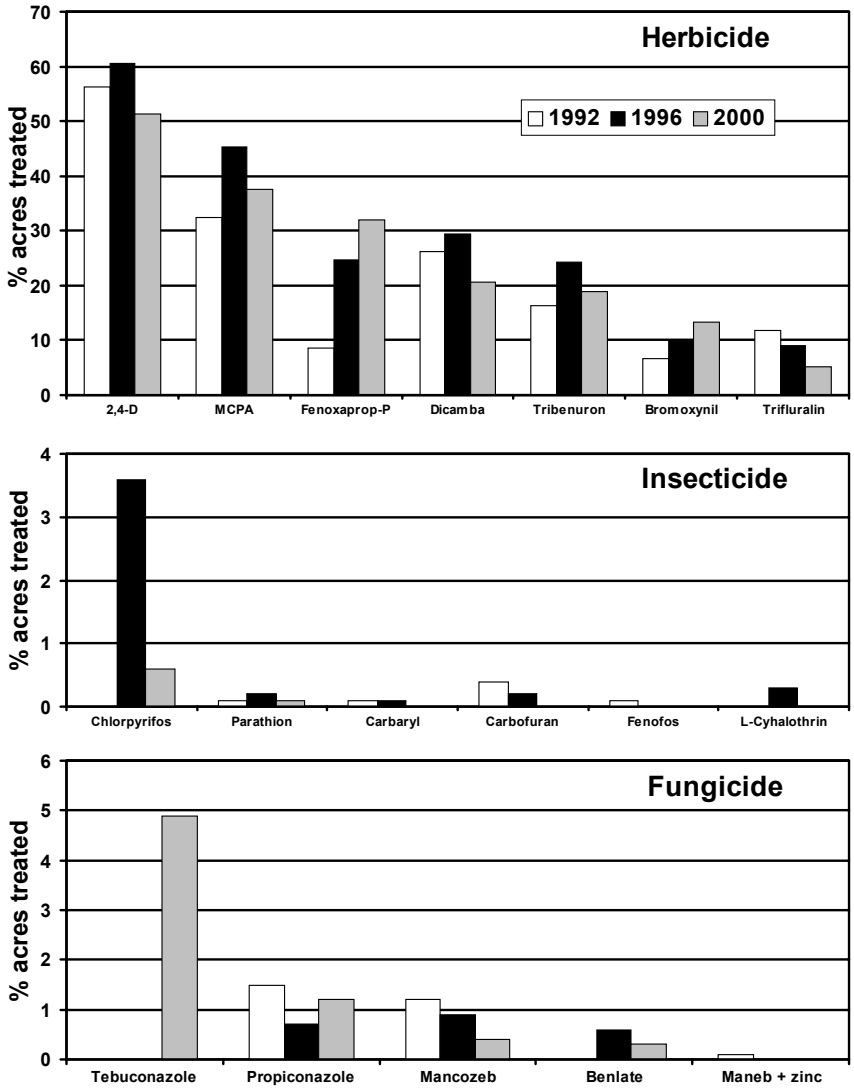

Figure 1. Percent of North Dakota wheat acres treated with the top five active ingredients from the herbicide, insecticide, and fungicide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR BARLEY

North Dakota ranks first in the United States for barley production, producing 31% of the total United States barley crop in 2000 (Table 8). Barley is grown in all 53 counties of North Dakota. Approximately 23% of the state's barley crop is grown in the northeastern area of the state. Though barley acres are largely seeded to malting types, only 33% of the North Dakota crop is used for malt annually.

The most frequently applied herbicides were 2,4-D and MCPA, applied to 40.6% and 39.7% of the barley acres, respectively, either alone or in a premix (Table 9). 2,4-D usage continued the downward trend from 45% in 1996 and 50% in 1992 (Figure 2). The largest increase in percent acres treated was for fenoxaprop-p, applied to 21.5% of the acres, alone or as a premix. Sulfonylurea herbicides were applied to 18% of the barley acreage. The farm operator with ground equipment applied over 95% of herbicides on barley.

Insecticide usage on barley was not sufficient to estimate.

Fungicides were used on only 2% of the barley acres. The most frequently used product was tebuconazole, applied to 1.3% of the acres. Tebuconazole was made available through the Section 18 Emergency Exemption process for the management of fusarium head blight, or head scab.

TABLE 8. Production summary for BARLEY, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Bu.)*	*(000 Bu.)*	*($/Bu.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	2,650	2,600	55.0	143,000	2.42	346,060	133.10	1	36
1997	2,400	2,250	45.0	101,250	1.96	198,450	88.20	1	27
1998	2,000	1,930	55.0	106,150	1.67	177,271	91.85	1	30
1999	1,350	1,240	48.0	59,520	1.91	113,683	91.68	1	21
2000	1,900	1,770	55.0	97,350	1.63	158,681	89.65	1	31

TABLE 9 . BARLEY: Herbicide, Insecticide, and Fungicide usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	694.1	36.5	98.9	1.1	---	88.1	11.9	4.6	95.4
Acetochlor + Safener + Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS
Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil + MCPA	324.4	17.1	100.0	---	---	93.6	6.4	1.8	98.2
Bromoxynil + MCPA + Fenoxaprop-p	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bronate+agsco 400	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 9. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
Clodinafop	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clopyralid + 2,4-D	43.7	2.3	100.0	---	---	68.8	31.2	19.4	80.6
Clopyralid + MCPA	8.3	0.4	100.0	---	---	54.9	45.1	---	100.0
Dicamba	99.1	5.2	100.0	---	---	92.5	7.5	5.4	94.6
Diclofop	NS	NS	NS	NS	NS	NS	NS	NS	NS
Difenzoquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fenoxaprop + 2,4-D + MCPA	34.4	1.8	100.0	---	---	84.6	15.4	2.6	97.4
Fenoxaprop + MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fenoxaprop+MCPA+ Thifensulfuron+Tribenuron	5.2	0.3	100.0	---	---	---	100.0	---	100.0
Fenoxaprop-P + Safener	366.3	19.3	100.0	---	---	88.0	12.0	6.2	93.8
Fluroxypyr	40.1	2.1	100.0	---	---	81.0	19.0	7.0	93.0
Glyphosate	34.5	1.8	93.6	6.4	---	95.1	4.9	---	100.0
Imazamethabenz	40.1	2.1	100.0	---	---	92.8	7.2	---	100.0
Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
MCPA	381.0	20.1	99.4	0.6	---	90.5	9.5	5.0	95.0
Metsulfuron	5.7	0.3	100.0	---	---	100.0	---	---	100.0
Nicosulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	34.1	1.8	100.0	---	---	84.1	15.9	12.9	87.1
Sethoxydim	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thifensulfuron	39.8	2.1	100.0	---	---	84.8	15.2	9.3	90.7
Thifensulfuron + Tribenuron	54.3	2.9	100.0	---	---	89.3	10.7	6.3	93.7
Tralkoxydim	27.0	1.4	100.0	---	---	75.8	24.2	3.4	96.6
Triallate	12.2	0.6	100.0	---	---	69.4	30.6	---	100.0
Triallate + Trifluralin	28.6	1.5	100.0	---	---	77.8	22.2	---	100.0
Triasulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tribenuron	239.5	12.6	100.0	---	---	90.7	9.3	2.0	98.0
Trifluralin	75.3	4.0	100.0	---	---	92.4	7.6	---	100.0
All Herbicides	2626.0	138.2	99.5	0.5	---	88.3	11.7	4.5	95.5
Insecticide									
Dimethoate	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fungicide									
Mancozeb	NS	NS	NS	NS	NS	NS	NS	NS	NS
Propiconazole	9.7	0.5	100.0	---	---	83.0	17.0	17.0	83.0
Tebuconazole	24.9	1.3	100.0	---	---	58.1	41.9	41.9	58.1
All Fungicides	38.2	2.0	100.0	---	---	58.9	41.1	41.1	58.9

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

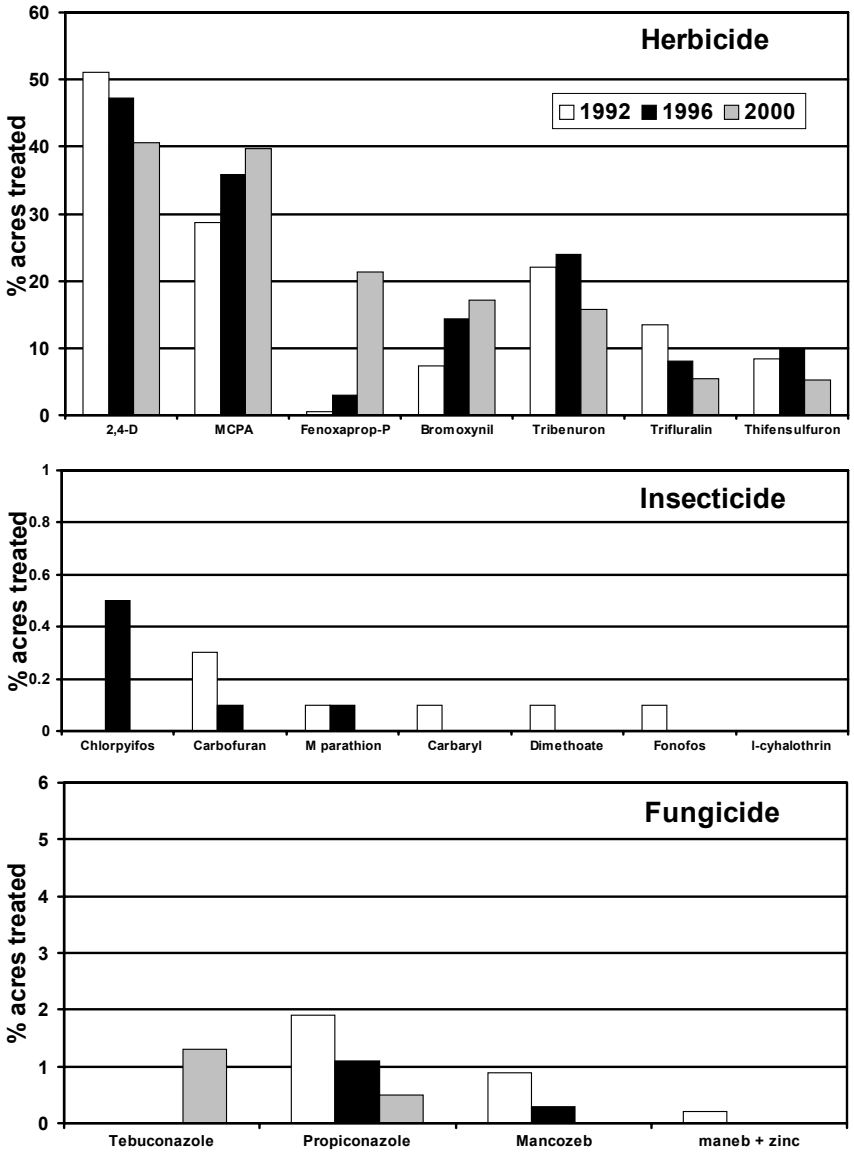

Figure 2. Percent of North Dakota barley acres treated with the top five active ingredients from the herbicide, insecticide, and fungicide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR OAT

North Dakota oat is used primarily for livestock feed and forage.

Total herbicide use on oat acreage was 43.6% (Table 11), slightly less than the 48% treated in 1996. The most frequently used herbicide was 2,4-D applied to 21.8% acres, alone or as a commercial premix. The second most frequently used herbicide was MCPA applied to 13% of oat acres, alone or as a premix. Dicamba was third and was applied to only 3.3% of the oat acreage. The majority of herbicides on oat were applied once by the farmer with ground equipment. No major changes in the use of herbicide active ingredients have occurred in the past 10 years (Figure 3).

No insecticide or fungicide usage on oat was reported by the survey respondents.

TABLE 10. Production summary for OAT, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Bu.)*	*(000 Bu.)*	*($/Bu.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	530	380	50.0	19,000	1.68	31,920	84.00	12	2
1997	700	425	44.0	18,700	1.32	24,684	58.08	10	2
1998	730	420	60.0	25,200	0.93	23,436	55.80	16	1
1999	650	330	51.0	16,830	0.90	15,147	45.90	12	3
2000	600	315	63.0	19,845	1.50	22,320	54.18	13	2

TABLE 11 . OAT: Herbicide, Insecticide, and Fungicide usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	129.4	21.6	100.0	---	---	89.7	10.3	0.8	99.2
Bromoxynil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil + MCPA	11.6	1.9	100.0	---	---	95.1	4.9	4.9	95.1
Clopyralid + 2,4-D	1.4	0.2	100.0	---	---	71.4	28.6	---	100.0
Clopyralid + MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicamba	19.9	3.3	100.0	---	---	85.7	14.3	---	100.0
Fenoxaprop-P + Safener	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluroxypyr + MCPA Ester	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	15.4	2.6	100.0	---	---	74.4	25.6	---	100.0
MCPA	66.3	11.1	100.0	---	---	90.4	9.6	0.8	99.2
Nicosulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 11. ***Continued***

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Picloram	NS	NS	NS	NS	NS	NS	NS	NS	NS
Propanil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-P	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thifensulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thifensulfuron + Tribenuron	4.4	0.7	100.0	---	---	61.1	38.9	---	100.0
Tribenuron	4.7	0.8	100.0	---	---	100.0	---	---	100.0
All Herbicides	261.3	43.6	100.0	---	---	88.4	11.6	0.8	99.2

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

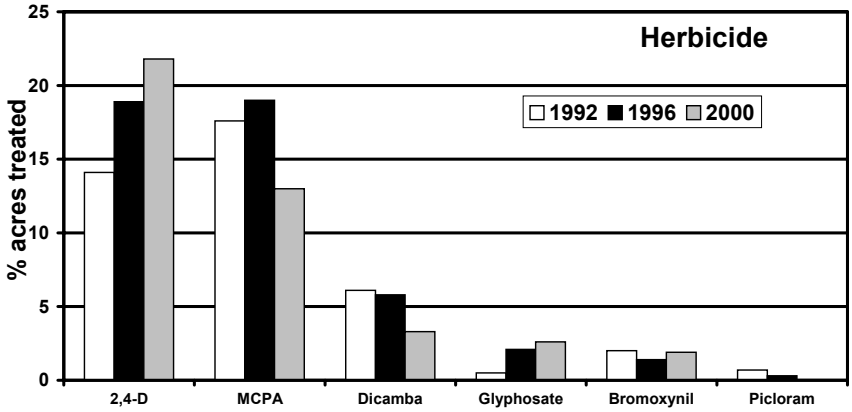

Figure 3. Percent of North Dakota oat acres treated with the top five active ingredients from the herbicide pesticide group reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR FLAX

Two types of flax are grown, seed flax, for the oil in its seed, and fiber flax, for the fiber in its stem. Today producers in the Upper Midwest and the Prairie Provinces of Canada primarily grow seed flax. Flax seed is crushed to produce linseed oil and linseed meal. Human consumption of flax seed is increasing rapidly for its high dietary fiber, its omega 3 oils, and the anticarcinogenic lignans. Flax seed oil is used as a vegetable oil by some consumers.

Eighty-six percent of the North Dakota flax acres were treated with at least one type of herbicide (Table 1). Due to multiple herbicide applications to the same acres, the equivalent of 138% of the flax acres were treated with herbicides (Table 13). The most frequently used herbicide was MCPA, applied to 53.7% of the flax acres, alone or as a premix; second was sethoxydim, applied to 46.8% of the flax acreage (Table 13). These two herbicide actives have increased in usage over the past 10 years while trifluralin and picloram have declined (Figure 4). Herbicide applications were made about 85% of the time by the farm operator with ground equipment.

The survey reported no insecticide or fungicide usage on flax. However, localized outbreaks of grasshopper have plagued flax growers, particularly in the southwest part of the state. Outbreaks have often been dealt with through the issuance of Section 18 Crisis Exemptions due to lack of effective, registered insecticides.

No insecticide or fungicide usage on oat was reported by the survey respondents.

TABLE 12. Production summary for FLAX, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Bu.)*	*(000 Bu.)*	*($/Bu.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	80	77	18.0	1,386	6.38	8,843	114.84	87	1
1997	125	121	16.5	1,997	5.81	11,603	95.89	81	1
1998	280	277	21.0	5,817	5.05	29,376	106.05	87	1
1999	330	327	21.0	6,867	3.79	26,026	79.59	87	1
2000	490	475	21.0	9,975	3.31	33,017	69.51	93	1

TABLE 13 . FLAX: Herbicide, Insecticide, and Fungicide usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	34.6	7.1	100.0	---	---	76.6	23.4	7.2	92.8
Bentazon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil	6.7	1.4	100.0	---	---	100.0	---	---	100.0
Bromoxynil + MCPA	152.4	31.1	97.1	2.9	---	91.5	8.5	4.8	95.2
Clopyralid + 2,4-D	14.3	2.9	100.0	---	---	83.1	16.9	---	100.0

Table 13. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Clopyralid + MCPA	21.0	4.3	100.0	---	---	97.9	2.1	---	100.0
Dicamba	5.1	1.0	100.0	---	---	63.5	36.5	---	100.0
Ethalfluralin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fenoxaprop-p + Safener	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluroxypyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	66.3	13.5	100.0	---	---	50.2	49.8	16.7	83.3
Imazamethabenz	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
MCPA	89.5	18.3	100.0	---	---	90.5	9.5	4.9	95.1
Picloram	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-P	23.2	4.7	100.0	---	---	94.0	6.0	---	100.0
Sethoxydim	229.1	46.8	95.2	4.8	---	90.6	9.4	4.4	95.6
Thifensulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trifluralin	20.1	4.1	100.0	---	---	59.6	40.4	---	100.0
All Herbicides	676.9	138.1	97.7	2.3	---	84.8	15.2	5.4	94.6

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

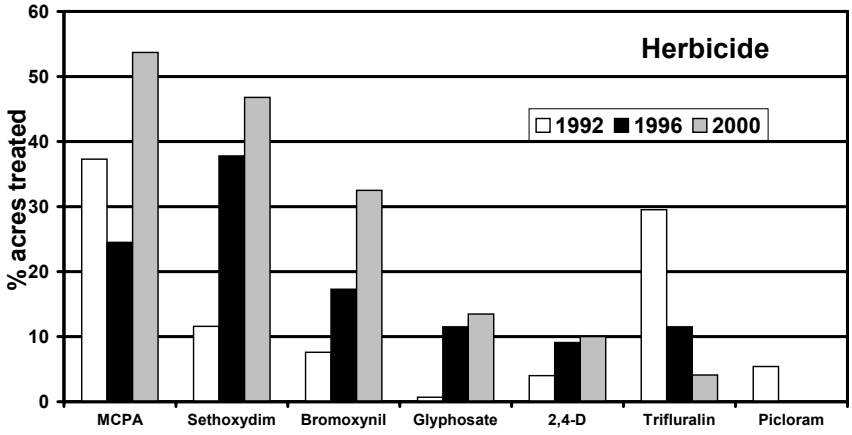

Figure 4. Percent of North Dakota flax acres treated with the top five active ingredients from the herbicide pesticide group reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR CORN

Corn production has been increasing in North Dakota during the past five years. Acreage has expanded northward and westward from the traditional production areas in the southeastern counties.

Herbicides were applied to 86.4% of the North Dakota corn acres (Table 1). Because of multiple active ingredients applied to some acres, the equivalent of 141.7% (Table 15) of the corn acres were treated with herbicides. Nicosulfuron and Dicamba were both used on 43.6% of the corn acreage, either alone or as part of a premix (Table 15). Other notable herbicides used were acetochlor at 22.8%, diflufenzopyr at 19.8%, EPTC at 17.9%, atrazine at 12%, and glyphosate at 7.8%. The top five herbicides mentioned by respondents have experienced increased usage during the past 10 years (Figure 5). Most corn herbicides were applied by the farm operator with ground equipment.

Only 1.9% of the corn acres in 2000 were estimated to have been treated with insecticides (Table 15). Five different insecticide actives were mentioned by survey respondents, but only tefluthrin, at 0.8%, was reported at a level allowing acreage estimates. Small populations of European corn borer, *Ostrinia nubilalis*, and grasshoppers kept treated acres low in number.

The fungicide chlorothalonil was reportedly used on corn but at a low level that did not allow acreage estimation.

TABLE 14. Production summary for CORN, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Bu.)*	*(000 Bu.)*	*($/Bu.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	750	600	91.0	54,600	2.43	132,678	221.13	1	19
1997	780	590	99.0	58,410	2.12	123,829	209.88	1	19
1998	970	825	107.0	88,275	1.71	150,950	182.97	1	32
1999	800	655	117.0	76,635	1.59	121,850	186.03	1	15
2000	1,080	930	112.0	104,160	1.65	171,864	184.80	1	16

TABLE 15 . CORN: Herbicide, Insecticide, and Fungicide usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	23.8	2.2	100.0	---	---	82.9	17.1	12.0	88.0
Acetochlor + EPTC	174.1	16.1	100.0	---	---	70.5	29.5	---	100.0
Acetochlor + Safener	72.9	6.7	93.8	6.2	---	85.2	14.8	---	100.0
Alachlor	NS	NS	NS	NS	NS	NS	NS	NS	NS
Atrazine	129.7	12.0	100.0	---	---	65.9	34.1	4.0	96.0

Table 15. ***Continued***

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Bentazon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil	30.6	2.8	100.0	---	---	78.3	21.7	5.3	94.7
Bromoxynil + MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clopyralid + 2,4-D	5.2	0.5	100.0	---	---	86.7	13.3	---	100.0
Clopyralid + Flumetsulam	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cyanazine	6.7	0.6	100.0	---	---	24.4	75.6	4.7	95.3
Dicamba	257.1	23.8	100.0	---	---	82.1	17.9	1.6	98.4
Dicamba + Diflufenzopyr + Nicolsulfuron	116.3	10.8	99.1	0.9	---	87.8	12.2	---	100.0
Dicamba + Primisulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicambo + Diflufenzopyr	97.1	9.0	100.0	---	---	71.8	28.2	---	100.0
Dimethenamid	NS	NS	NS	NS	NS	NS	NS	NS	NS
Diquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
EPTC + Safener	19.2	1.8	100.0	---	---	54.2	45.8	---	100.0
Ethalfluralin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fenoxaprop-P + Safener	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glufosinate	41.0	3.8	94.6	5.4	---	75.3	24.7	---	100.0
Glyphosate	83.9	7.8	73.9	26.1	---	65.4	34.6	1.6	98.4
Halosulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazamethabenz	3.3	0.3	100.0	---	---	77.8	22.2	---	100.0
Imazethapyr + Glyphosate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazethapyr + Imazapyr	16.8	1.6	100.0	---	---	90.1	9.9	9.9	90.1
Isoxaflutole	17.5	1.6	100.0	---	---	81.2	18.8	---	100.0
MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Metolachlor	14.0	1.3	100.0	---	---	93.2	6.8	---	100.0
Metsulfuron + Chlorsulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Nicosulfuron	283.5	26.3	99.9	0.1	---	77.3	22.7	3.2	96.8
Nicosulfuron + Rimsulfuron + Atrazine	4.7	0.4	100.0	---	---	39.4	60.6	---	100.0
Nicosulfuron + Rimsulfuron + Clopyralid + Flumetsulam	65.5	6.1	100.0	---	---	70.0	30.0	---	100.0
Oxyfluorfen	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pendimethalin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Rimsulfuron + Thifensulfuron	9.8	0.9	100.0	---	---	83.5	16.5	20.3	79.7
Sethoxydim	2.9	0.3	100.0	---	---	100.0	---	---	100.0
Tribenuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trifluralin	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Herbicides	1529.9	141.7	97.9	2.1	---	74.0	26.0	2.5	97.5

Table 15. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Insecticide									
Diazinon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fipronil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lambda-cyhalothrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Permethrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tefluthrin	9.1	0.8	100.0	---	---	100.0	---	---	100.0
All Insecticides	21.0	1.9	100.0	---	---	50.6	49.4	49.4	50.6
Fungicide									
Chlorothalonil	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Fungicides	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

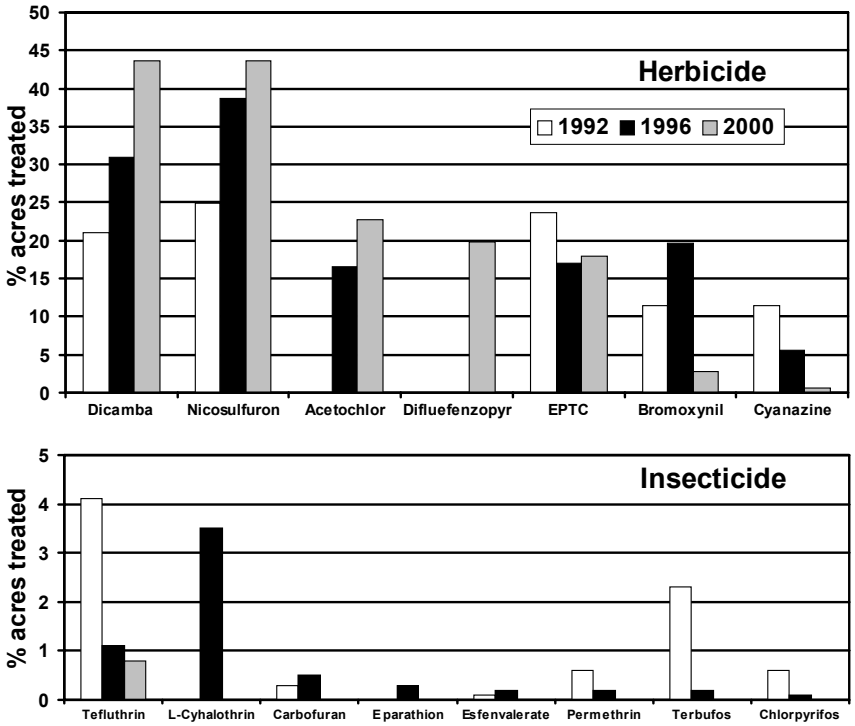

Figure 5. Percent of North Dakota corn acres treated with the top five active ingredients from the herbicide and insecticide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR SUNFLOWER

Oilseed and confectionary sunflower are both grown in North Dakota. Sunflower acreage has fluctuated (Table 16) in recent years in response to oilseed markets. Confectionary sunflowers account for 20 to 25% of the acres annually.

Ethalfluralin, at 37.5% of the acres, was the most frequently applied herbicide to sunflower (Table 17). The second most often used herbicide was trifluralin at 23.9% of the acres. These two products have been the most frequently used herbicides for grass and broadleaf control over the past 10 years (Figure 6). Sethoxydim was used for post emergent grass control on 14.2% of the sunflower acres and its use has increased during the past 10 years. The newest herbicide mentioned was sulfentrazone at 8.5%. This product was registered as a Section 18 Emergency Exemption for managing difficult to control broadleaf weeds. Over 85% of the herbicides were applied by the farm operator and over 95% by ground equipment.

Six different insecticides were applied to 10.6% of the sunflower acres. Multiple applications occurred on 17.8% of the treated acres. Esfenvalerate and lambda cyhalothrin were the most common insecticides at 8.3% and 1.6% of the treated acres, respectively. Other insecticides mentioned were carbofuran, cyfluthrin, and ethyl parathion. Many of the acres were treated for seed feeding insects that can severely impact confectionary sunflower processing quality.

TABLE 16 Production summary for ALL SUNFLOWER, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Lbs.)*	*(000 Lbs.)*	*($/Cwt.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	1,180	1,165	1,488	1,733,750	12.10	206,524	177.27	48	1
1997	1,470	1,410	1,321	1,862,900	11.80	219,979	156.01	50	1
1998	1,990	1,960	1,517	2,972,800	10.90	307,016	156.64	57	1
1999	1,700	1,645	1,134	1,866,250	8.18	154,576	93.97	43	1
2000	1,340	1,280	1,375	1,759,800	7.46	125,169	98.95	49	1

TABLE 17 . SUNFLOWER: Herbicide, Insecticide, Fungicide, and Desiccant usage and application method. North Dakota, 2000

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	NS	NS	NS	NS	NS	NS	NS	NS	NS
Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clethodim	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
EPTC	3.3	0.2	100.0	---	---	100.0	---	---	100.0

Table 17. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Ethalfluralin	501.9	37.5	100.0	---	---	84.4	15.6	0.6	99.4
Fenoxaprop+MCPA+ Thifensulfuron+Tribenuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	31.7	2.4	100.0	---	---	96.4	3.6	1.5	98.5
Imazamethabenz	91.8	6.9	100.0	---	---	83.7	16.3	6.5	93.5
Nicosulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pendimethalin	35.1	2.6	100.0	---	---	91.7	8.3	---	100.0
Pyrazon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pyridate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-P	45.2	3.4	100.0	---	---	94.1	5.9	4.8	95.2
Sethoxydim	189.7	14.2	100.0	---	---	85.1	14.9	4.6	95.4
Sulfentrazone	114.5	8.5	97.4	2.6	---	93.1	6.9	7.3	92.7
Tralkoxydim	NS	NS	NS	NS	NS	NS	NS	NS	NS
Triallate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trifluralin	320.0	23.9	100.0	---	---	82.4	17.6	8.1	91.9
All Herbicides	1352.8	101.0	99.8	0.2	---	85.1	14.9	4.2	95.8
Insecticide									
Carbofuran	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chlorpyrifos	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cyfluthrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Esfenvalerate	111.4	8.3	100.0	---	---	61.0	39.0	41.1	58.9
Ethyl Parathion	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lambda-cyhalothrin	21.0	1.6	82.2	17.8	---	43.3	56.7	56.7	43.3
All Insecticides	142.2	10.6	97.4	2.6	---	59.0	41.0	43.0	57.0
Desiccant									
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Desiccants	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

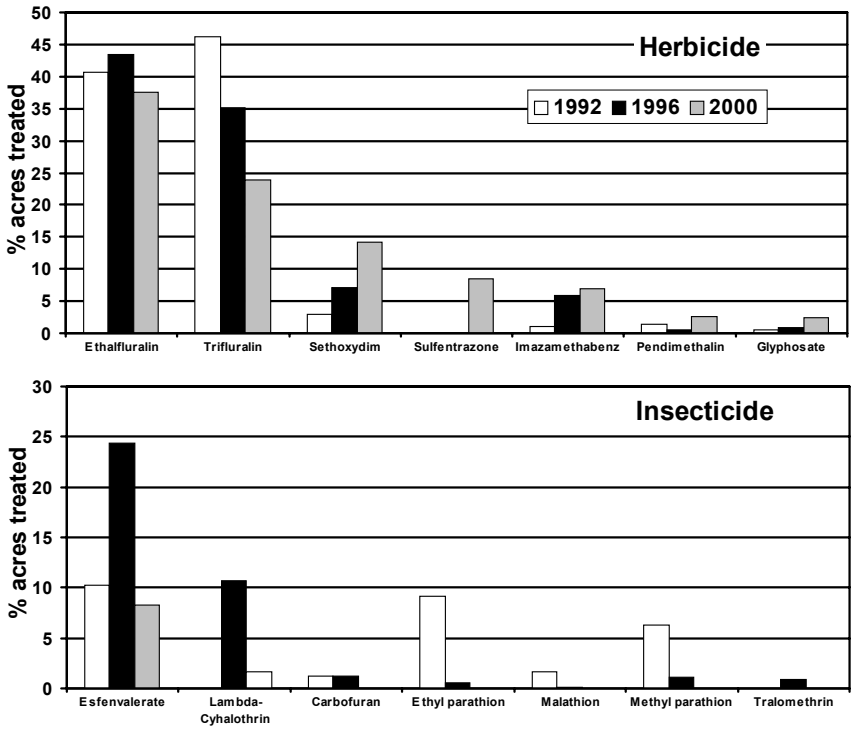

Figure 6. Percent of North Dakota sunflower acres treated with the top five active ingredients from the herbicide and insecticide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR SOYBEAN

Soybean is a full season crop primarily grown in southeastern North Dakota. However, acreage has been increasing in recent years (Table 18), particularly, northward and westward. The need for a long growing season and satisfactory soil moisture during flowering and pod filling may limit the westward expansion in the state, though.

Ninety-four percent of the soybean acres were treated with at least one herbicide (Table 1). Because of multiple active ingredients applied to some acres, the equivalent of 165.7% of the soybean acres were treated with herbicides. The most frequently used herbicide was glyphosate on 35.8% of the acres (Table 19). Use of this active reflects the statewide planting of glyphosate-resistant soybean on 28.7% of the acres (Table 42). The next most frequently used active was imazethapyr, applied to 27.6% of the soybean acres. Bentazon was applied to 20.2%, trifluralin to 20.3%, imazomox to 17.5%, sethoxydim to 13.3%, and ethalfluralin to 8.6% of the soybean acreage. The use of trifluralin and bentazon has declined over the past 10 years, while glyphosate and imazamox have increased (Figure 7). Over 76% of the herbicides were applied by the farm operator and over 97% by ground equipment.

The only insecticide mentioned by survey respondents was esfenvalerate. The only fungicide mentioned was mancozeb. The dessicant, paraquat, was also mentioned. Usage of these three products was insufficient to project acreage use estimates.

TABLE 18. Production summary for SOYBEAN, North Dakota, 1996-2000 (NDASS, 2001).

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Bu.)*	*(000 Bu.)*	*($/Bu.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	850	845	29.0	24,505	7.05	172,760	204.45	1	18
1997	1,150	1,140	29.5	33,630	6.10	205,143	179.95	1	18
1998	1,550	1,475	32.0	47,200	4.64	219,008	148.48	2	13
1999	1,350	1,340	35.0	46,900	4.19	196,511	146.65	2	13
2000	1,900	1,850	33.0	61,050	4.00	250,416	135.36	2	11

TABLE 19 . SOYBEAN: Herbicide, Insecticide, Fungicide and Desiccant usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acifluorfen	19.5	1.0	100.0	---	---	91.3	8.7	---	100.0
Acifluorfen + Bentazon	5.8	0.3	100.0	---	---	89.1	10.9	10.9	90.8
Bentazon	183.5	9.7	87.3	3.4	9.3	77.2	22.8	9.2	90.8
Bentazon + Sethoxydim	193.3	10.2	100.0	---	---	62.1	37.9	5.4	94.6

Table 19. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Clethodim	78.1	4.1	19.1	80.9	---	90.0	10.0	8.9	91.1
Clopyralid + 2,4-D	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cloransulam Methyl	72.4	3.8	100.0	---	---	90.7	9.3	---	100.0
Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicamba + Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
EPTC	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ethalfluralin	163.4	8.6	100.0	---	---	63.8	36.2	3.9	96.1
Fenoxaprop-P + Safener	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluazifop-P	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fluazifop-P + Fenoxaprop P	29.4	1.5	100.0	---	---	78.3	21.7	3.6	96.4
Flumetsulam	32.3	1.7	100.0	---	---	67.4	32.6	---	100.0
Flumetsulam + Metolachlor	NS	NS	NS	NS	NS	NS	NS	NS	NS
Flumetsulam + Trifluralin	19.0	1.0	100.0	---	---	100.0	---	---	100.0
Fomesafen	131.6	6.9	99.4	0.6	---	67.4	32.6	10.1	89.9
Glyphosate	666.8	35.1	63.2	36.6	0.3	72.2	27.8	2.0	98.0
Hexazinone	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazamox	331.8	17.5	100.0	---	---	80.0	20.0	9.5	90.5
Imazethapyr	446.5	23.5	100.0	---	---	76.6	23.4	3.0	97.0
Imazethapyr + Glyphosate	12.9	0.7	100.0	---	---	93.2	6.8	---	100.0
Imazethapyr + Pendimethalin	65.5	3.4	100.0	---	---	84.2	15.8	7.2	92.8
Lactofen	82.1	4.3	100.0	---	---	92.0	8.0	3.8	96.2
Metribuzin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pendimethalin	63.0	3.3	100.0	---	---	91.6	8.4	---	100.0
Quizalofop-P	30.7	1.6	97.3	2.7	---	93.9	6.1	---	100.0
Sethoxydim	58.7	3.1	67.3	3.6	29.1	88.6	11.4	---	100.0
Sulfentrazone	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thifensulfuron	48.2	2.5	100.0	---	---	86.4	13.6	---	100.0
Thifensulfuron + Tribenuron	3.3	0.2	100.0	---	---	63.9	36.1	---	100.0
Tralkoxydim	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trifluralin	366.4	19.3	99.6	0.4	---	80.7	19.3	1.3	98.7
All Herbicides	3148.6	165.7	88.7	10.1	1.1	76.9	23.1	4.2	95.8
Insecticide									
Esfenvalerate	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 19. ***Continued***

Fungicide									
Mancozeb	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Fungicides	NS	NS	NS	NS	NS	NS	NS	NS	NS
Desiccants									
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Desiccants	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

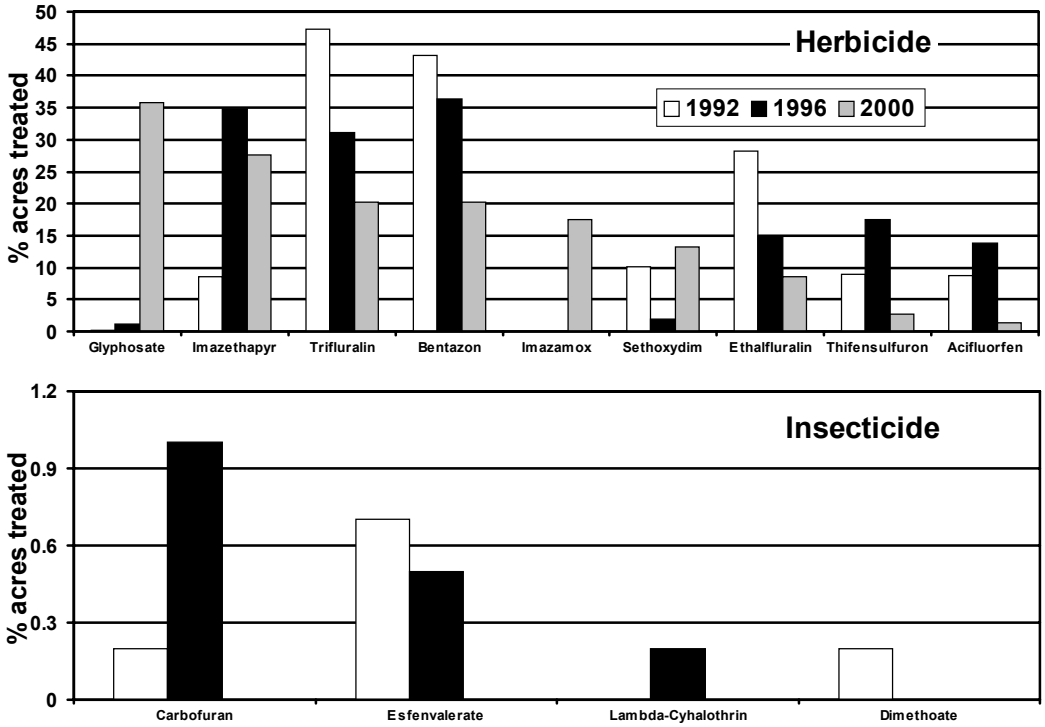

Figure 7. Percent of North Dakota soybean acres treated with the top five active ingredients from the herbicide and insecticide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR DRY EDIBLE BEAN

North Dakota has become a major producer of dry edible bean (Table 20). Two classes of dry bean (navy and pinto) encompass the major commercial acreage. In addition, black turtle, red kidney, cranberry, pinks, and small red bean classes are also grown on limited acres.

The top three herbicide active ingredients used were bentazon on 62.6%, sethoxydim on 37.9%, ethalfluralin on 31%, alone or as commercial premixes (Table 21). Sethoxydim use has increased while ethalfluralin use has decreased during the past 10 years (Figure 8). Herbicide applications were made by the farm operator 85% of the time. Ninety-four percent of those acres were treated by ground application.

Foliar insecticide usage is normally low on dry bean acres. Only esfenvalerate was mentioned by survey respondents and not at a sufficient level to make acreage projections.

Foliar fungicides were applied to 5% of the dry bean acres (Table 21). Thiophanate methyl and chlorothalonil were applied to 3.1% and 1.1% of the acres, respectively.

The dessicants, Paraquat (1.2%) and sodium chlorate (NS) were applied to dry edible bean (Table 21).

TABLE 20. Production summary for ALL DRY EDIBLE BEAN, North Dakota, 1996-2000 (NDASS, 2001).

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Lbs.)*	*(000 Lbs.)*	*($/Cwt.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	580.0	570.0	1,320	7,524	20.30	152,737	267.96	28	1
1997	620.0	565.0	1,260	7,119	16.80	119,599	211.68	24	1
1998	750.0	710.0	1,380	9,798	15.50	151,869	213.90	32	1
1999	630.0	570.0	1,450	8,265	13.90	114,884	201.55	25	1
2000	610.0	525.0	1,450	7,613	12.60	95,924	182.71	29	1

TABLE 21. DRY EDIBLE BEAN: Herbicide, Insecticide, Fungicide and Desiccant usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications			Applicator		Method of Application	
			1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
Alachlor	NS	NS	NS	NS	NS	NS	NS	NS	NS
Atrazine + Bromoxynil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bentazon	205.7	33.7	89.6	10.4	---	88.6	11.4	8.7	91.3
Bentazon + Sethoxydim	176.0	28.9	74.5	25.5	---	92.4	7.6	3.7	96.3
Clethodim	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicamba + Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dimethenamid	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 21. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
EPTC	10.3	1.7	100.0	---	---	90.0	10.0	---	100.0
Ethalfluralin	189.0	31.0	100.0	---	---	84.2	15.8	4.4	95.6
Fluazifop-P	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fomesafen	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	4.0	0.7	100.0	---	---	70.3	29.7	---	100.0
Imazamethabenz	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazamox	61.4	10.1	100.0	---	---	68.9	31.1	8.4	91.6
Imazethapyr	66.1	10.8	100.0	---	---	70.1	29.9	23.2	76.8
Imazethapyr + Pendimethalin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Metolachlor	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pendimethalin	5.2	0.8	100.0	---	---	100.0	---	---	100.0
Quizalofop-P	21.8	3.6	100.0	---	---	100.0	---	---	100.0
Sethoxydim	55.1	9.0	82.8	17.2	---	96.2	3.8	3.8	96.2
Trifluralin	110.5	18.1	100.0	---	---	72.9	27.1	---	100.0
All Herbicides	936.7	153.6	91.9	8.1	---	84.8	15.2	6.0	94.0
Insecticide									
Esfenvalerate	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fungicide									
Benlate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Chlorothalonil	6.6	1.1	73.8	---	26.2	64.2	35.8	---	100.0
Mancozeb	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thiophanate Methyl	18.9	3.1	55.7	44.3	---	88.9	11.1	11.1	88.9
All Fungicides	30.9	5.1	67.4	27.0	5.6	78.8	21.2	6.8	93.2
Desiccant									
Paraquat	7.3	1.2	100.0	---	---	13.3	86.7	28.5	71.5
Sodium Chlorate	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Desiccants	8.3	1.4	100.0	---	---	11.7	88.3	36.9	63.1

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

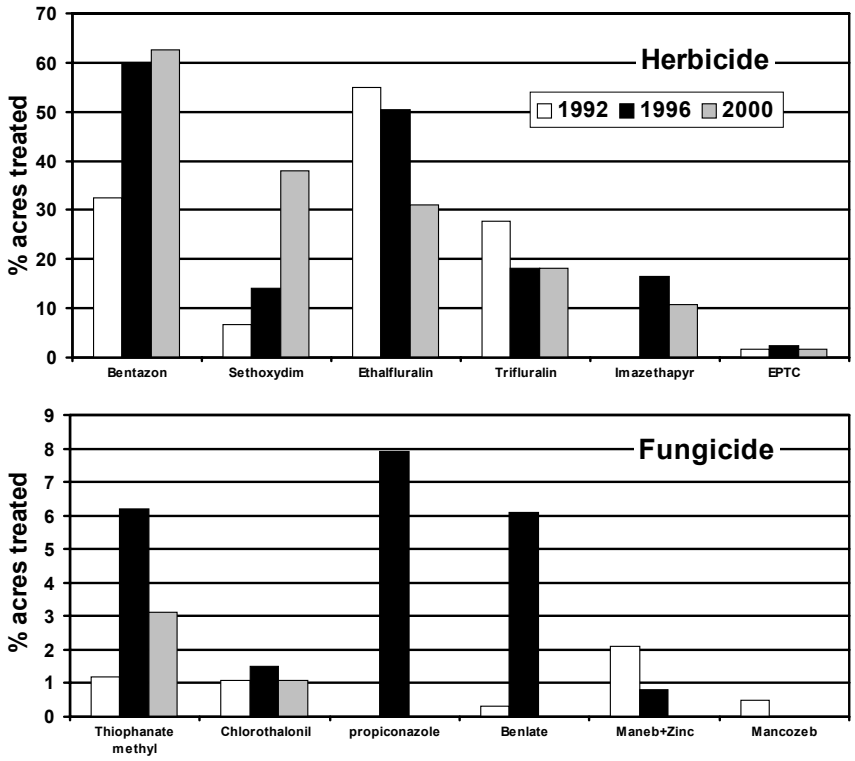

Figure 8. Percent of North Dakota dry edible bean acres treated with the top five active ingredients from the herbicide and fungicide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR CANOLA

Canola acreage has increased significantly in North Dakota during the past decade (Table 22). The state is the number one producer in the United States of this oilseed.

Glyphosate was used on 55.3% of the herbicide treated canola acres (Table 23). Twenty-four percent of those acres were treated twice during the season. The use of this active mirrors the 50.4% of the acres planted to glyphosate-resistant, genetically modified (GM) canola in 2000 (Table 43). Glufosinate was applied to 5.6% of the treated acres and reflects the planting of 4.5% of the acres to another GM herbicide-resistant canola. Other herbicides used in canola were quizalofop-p on 20.6%, ethalfluralin on 7.9%, and trifluralin on 6.0% of the acres (Table 23). The most significant trend in changing herbicide use patterns was the shift to GM crops and the active associated with the resistant trait (Figure 9).

The most frequently used insecticides for canola production were the seed treatment products, imidacloprid and thiamethoxam, used on 58.1 and 2.3% of the acres, respectively (Table 4). Thiamethoxam was issued as a Section 18 emergency Exemption in 2000 and was available for only a limited number of acres. The foliar insecticide, bifenthrin, was used on 1.7% of the canola acres.

Foliar fungicides were estimated to have been used on only 1.4% of the acres. Four fungicides were mentioned by survey respondents, however, all were reported at insufficient levels to allow individual acreage estimates. However, benomyl and several other fungicides were used as seed treatments on more than 23.6% of the acres (Table 4).

TABLE 22. Production summary for CANOLA, North Dakota, 1996-2000 (NDASS, 2001).

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Lbs.)*	*(000 Lbs.)*	*($/Cwt.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	220.0	217.0	1,380	299,460	12.90	38,630	178.02	-	-
1997	460.0	430.0	1,180	507,400	11.10	56,321	130.98	-	-
1998	800.0	775.0	1,480	1,147,000	10.20	116,994	150.96	-	-
1999	855.0	835.00	1,300	1,085,500	7.50	81,413	97.50	-	-
2000	1,270.0	1,250.0	1,320	1,650,000	6.55	108,075	86.46	82	1

TABLE 23 . CANOLA: Herbicide, Insecticide, Fungicide and Desiccant usage and application method. North Dakota, 2000

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
Clopyralid	42.0	3.3	100.0	---	---	90.7	9.3	0.6	99.4
Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ethalfluralin	100.1	7.9	100.0	---	---	73.8	26.2	1.3	98.7
Ethametsulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fenoxaprop-P + Safener	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glufosinate	70.6	5.6	97.6	2.4	---	87.0	13.0	4.1	95.9

Table 23. ***Continued***

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm Operator	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Glyphosate	702.4	55.3	75.3	24.4	0.2	82.2	17.8	1.6	98.4
Imazamethabenz	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazamox	28.3	2.2	100.0	---	---	83.1	16.9	---	100.0
Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-P	261.1	20.6	100.0	---	---	88.8	11.2	---	100.0
Sethoxydim	34.5	2.7	100.0	---	---	82.8	17.2	2.5	97.5
Tralkoxydim	5.8	0.5	100.0	---	---	100.0	---	---	100.0
Trifluralin	76.7	6.0	100.0	---	---	74.4	25.6	---	100.0
All Herbicides	1335.7	105.2	86.9	13.0	0.1	83.0	17.0	1.2	98.8
Insecticide									
Bifenthrin	21.5	1.7	100.0	---	---	79.3	20.7	---	100.0
Esfenvalerate	5.7	0.4	100.0	---	---	86.2	13.8	5.0	95.0
Imidacloprid	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lambda-cyhalothrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	29.5	2.3	100.0	---	---	75.8	24.2	1.0	99.0
Fungicide									
Azoxystrobin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Propiconazole	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tebuconazole	NS	NS	NS	NS	NS	NS	NS	NS	NS
Vinclozolin	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Fungicides	18.1	1.4	100.0	---	---	50.0	50.0	61.0	39.0

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

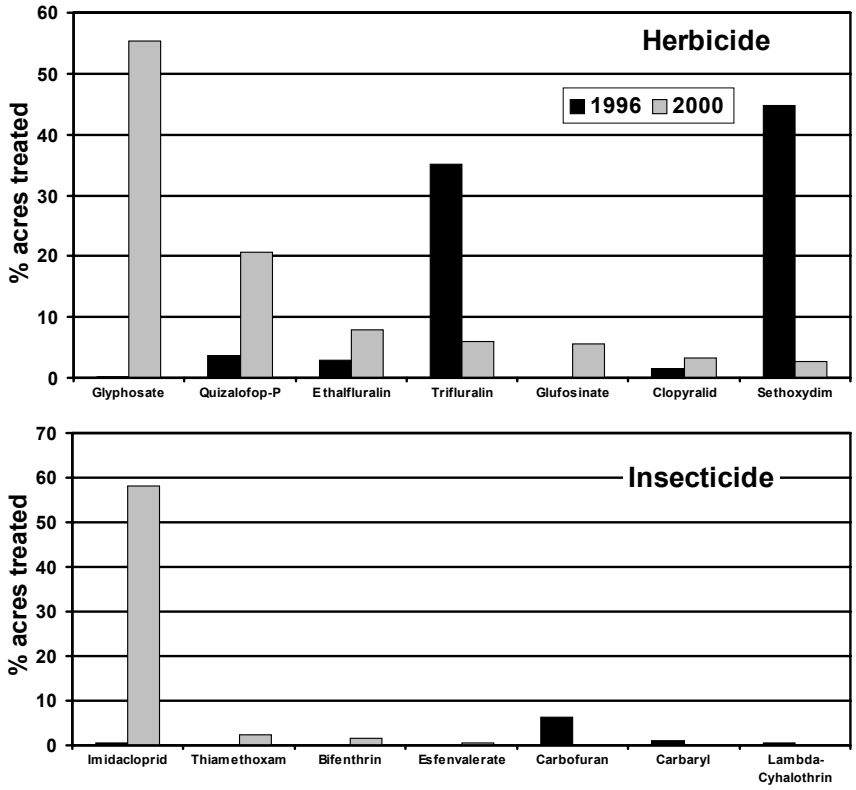

Figure 9. Percent of North Dakota canola acres treated with the top five active ingredients from the herbicide and insecticide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR FIELD PEA

North Dakota began producing significant acres of dry pea in the past 10 years. Approximately 1,600 acres of dry pea in 1991 and 102,000 acres in 1998 were produced in North Dakota. Field pea is an annual cool-season legume, also known as a pulse crop. Field pea is primarily used for human consumption or as a livestock feed. Field pea also may be grown as a green manure or green fallow crop.

This is the first time the pesticide use pattern on field pea has been documented for North Dakota. The only pesticides reported were from the herbicide group. Ninety-six percent of the field pea acres was treated with herbicides. A total of nine different active ingredients were reported by survey respondents. Quizalofop-p was applied on 42.2% of the acres (Table 24) and was the most frequently used herbicide. Other herbicides were bentazon on 16.1%, sethoxydim on 14.4%, ethalfluralin on 7.0%, glyphosate on 5.9%, and imazethapyr on 4.6% of the acres.

Paraquat was used as a desiccant, but reporting was insufficient to permit acreage estimates.

TABLE 24 . FIELD PEA: Herbicide, Insecticide, Fungicide, and Desiccant usage and application method. North Dakota, 2000

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bentazon	10.8	16.1	100.0	---	---	100.0	---	---	100.0
Ethalfluralin	4.7	7.0	100.0	---	---	100.0	---	---	100.0
Glyphosate	4.0	5.9	100.0	---	---	100.0	---	---	100.0
Imazethapyr	3.1	4.6	100.0	---	---	100.0	---	---	100.0
MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-P	28.3	42.2	100.0	---	---	100.0	---	---	100.0
Sethoxydim	9.7	14.4	100.0	---	---	100.0	---	---	100.0
Triallate + Trifluralin	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Herbicides	64.4	96.0	100.0	---	---	100.0	---	---	100.0
Desiccant									
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Desiccants	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

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PESTICIDE USE FOR LENTIL

Lentil is a pulse crop gaining popularity in North Dakota. Grown in rotation with cereals, lentil is beneficial for reducing soil erosion, managing cereal plant diseases, aiding in controlling grassy weeds, and fixing nitrogen.

This is the first time the pesticide use pattern on lentil has been documented for North Dakota. The only pesticides reported were from the herbicide group.

One-hundred percent of the lentil acres was treated with herbicides (Table 25). Quizalofop-p was used on 75% of the acres, making it the most frequently used herbicide. Six other herbicide actives were mentioned by survey respondents. Of those, glyphosate at 5.7% was the only one used at sufficient levels to make acreage estimates. Paraquat was used as a desiccant.

TABLE 25. LENTIL: Herbicide, Insecticide, Fungicide, and Desiccant usage and application method. North Dakota, 2000

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
Ethalfluralin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	2.5	5.7	100.0	---	---	100.0	---	---	100.0
Metribuzin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pendimethalin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-p	33.3	75.0	100.0	---	---	91.2	8.8	---	100.0
Trifluralin	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Herbicides	45.1	101.5	100.0	---	---	82.3	17.7	0.7	99.3
Desiccant									
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Desiccants	NS	NS	NS	NS	NS	NS	NS	NS	NS

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

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PESTICIDE USE FOR ALFALFA

Alfalfa is the most widely grown perennial legume in North Dakota (Table 26). Its primary use is for hay, but it is also used for pasture and haylage, and as a green manure crop.

Herbicides were applied to only 1% of the alfalfa acreage (Table 27). Nine different herbicide actives were mentioned by survey respondents. Only 2,4-D at 0.1%, glyphosate at 0.3%, and picloram at 0.3% were reported at sufficient levels to estimate use.

Insecticides were applied to only 0.2% of the 1.3 million alfalfa acres. Three insecticide actives were mentioned. None were reported at a sufficient level to estimate use.

TABLE 26. Production summary for ALFALFA, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres Planted	Acres Harvested	Yield Per Acre	Yield Production	Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	(000 Acres)		*(tons)*	*(000 tons)*	*($/ton)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	1,700	1,700	1.85	3,145	55.50	174,548	102.68	4	11
1997	1,750	1,750	1.50	2,625	65.00	170,625	97.50	3	13
1998	1,400	1,400	1.75	2,450	57.50	140,875	100.63	3	13
1999	1,450	1,450	2.15	3,118	43.00	134,074	92.46	4	12
2000	1,350	1,350	2.40	3,240	46.00	149,040	110.40	4	11

TABLE 27 . ALFALFA: Herbicide and Insecticide usage and application method. North Dakota, 2000

	Acres Treated [2]	Acres Treated	Applications 1 X	Applications 2 X	Applications 3 X	Applicator Farm	Applicator Custom	Method of Application Aerial	Method of Application Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	1.1	0.1	96.7	3.3	---	51.8	48.2	---	100.0
Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	4.7	0.3	100.0	---	---	31.1	68.9	---	100.0
Glyphosate + Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazethapyr + Pendimethalin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	4.1	0.3	99.1	0.9	---	99.8	0.2	---	100.0
Sethoxydim	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	13.5	1.0	99.5	0.5	---	69.3	30.7	---	100.0
Insecticide									
Bifenthrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Carbofuran	NS	NS	NS	NS	NS	NS	NS	NS	NS
Malathion	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Insecticides	2.8	0.2	100.0	---	---	16.7	83.3	83.3	16.7

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

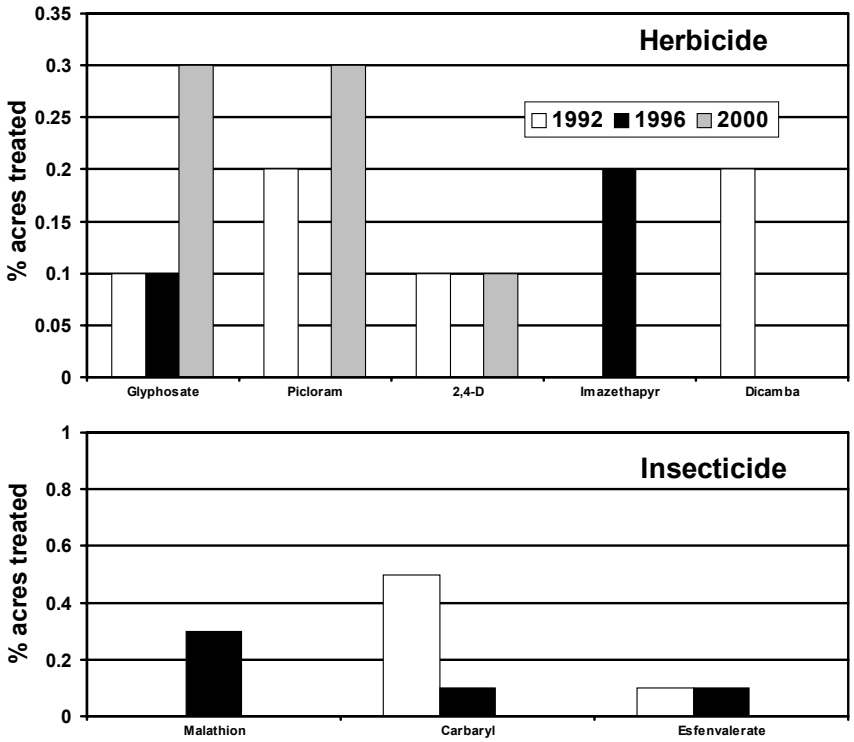

Figure 10. Percent of North Dakota alfalfa acres treated with the top five active ingredients from the herbicide and insecticide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR OTHER HAY

Over one million acres in North Dakota are classified as other hay (Table 28). Only 1.8% of these acres was treated with herbicides (Table 29). A total of seven herbicide actives were mentioned by survey respondents. 2,4-D was applied to 0.9% of the acres, alone or as a premix.

No use of insecticides or fungicides was reported by survey respondents.

TABLE 28. Production summary for OTHER HAY, North Dakota, 1996-2000 (NDASS, 2001).

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(tons)*	*(000 tons)*	*($/ton)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	1,200	1,200	1.40	1,680	39.00	65,520	54.60	2	15
1997	1,400	1,400	1.25	1,750	43.50	76,125	54.38	2	15
1998	1,200	1,200	1.45	1,740	37.50	65,250	54.38	3	13
1999	1,450	1,450	1.65	2,393	29.00	69,397	47.86	3	9
2000	1,100	1,100	1.70	1,870	31.00	57,970	52.70	3	13

TABLE 29 . OTHER HAY: Herbicide usage and application method. North Dakota, 2000

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	9.6	0.9	100.0	---	---	91.4	8.6	---	100.0
Alachlor + Glyphosate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clopyralid + 2,4-D	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicamba	0.5	0.0	100.0	---	---	35.3	64.7	---	100.0
Glyphosate	3.0	0.3	100.0	---	---	79.9	20.1	---	100.0
MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	5.5	0.5	98.5	1.5	---	86.1	13.9	---	100.0
All Herbicides	19.7	1.8	99.6	0.4	---	87.2	12.8	---	100.0

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

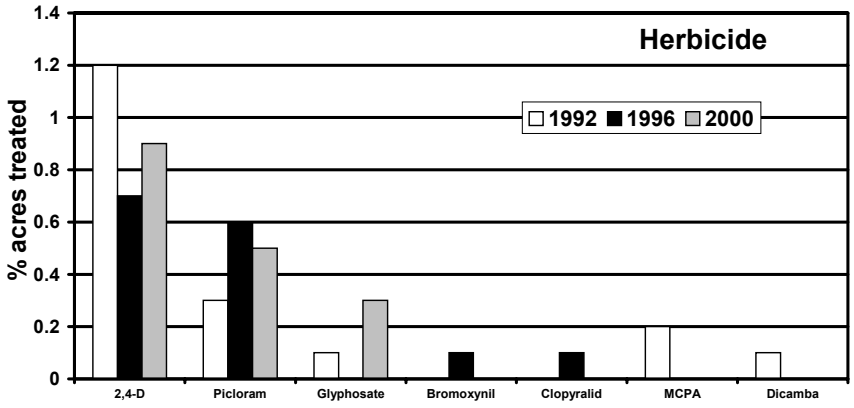

Figure 11. Percent of North Dakota other hay acres treated with the top five active ingredients from the herbicide pesticide group reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR SUMMER FALLOW

About 1.9 million acres were designated as summer fallow in 2000. Herbicides were applied to 23.5% of these acres (Table 30). Eleven different herbicide actives were mentioned by survey respondents.

Glyphosate, alone or as a premix, was applied to 21.4% of the treated acres. Dicamba was used alone or as a premix on 7.8% of the treated acres. The premix used combined these two actives.

TABLE 30. SUMMER FALLOW: Herbicide usage and application method. North Dakota, 2000

			Applications			Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]									
2,4-D	11.0	0.9	84.7	15.3	---	91.9	8.1	---	100.0
Clopyralid + 2,4-D	1.3	0.1	100.0	---	---	77.2	22.8	---	100.0
Dicamba	2.4	0.2	100.0	---	---	94.5	5.5	2.1	97.9
Fenoxaprop-P + Safener	NS	NS	NS	NS	NS	NS	NS	NS	NS
Glyphosate	160.8	13.8	85.7	14.3	---	75.8	24.2	2.9	97.1
Glyphosate + Dicamba	88.3	7.6	71.9	27.6	0.6	92.4	7.6	---	100.0
MCPA	0.6	0.1	100.0	---	---	100.0	---	---	100.0
Pendimethalin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	0.7	0.1	71.5	28.5	---	100.0	---	---	100.0
Quizalofop-P	NS	NS	NS	NS	NS	NS	NS	NS	NS
Triallate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Trifluralin	1.7	0.1	100.0	---	---	87.8	12.2	---	100.0
All Herbicides	273.7	23.5	81.8	18.0	0.2	82.8	17.2	1.7	98.3

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

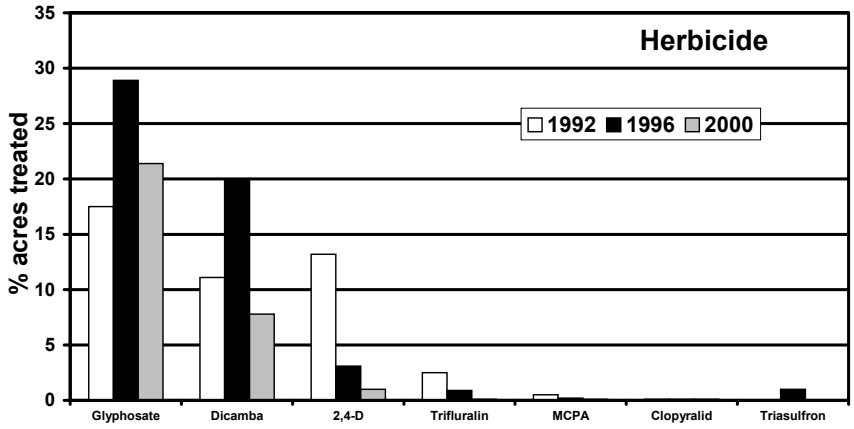

Figure 12. Percent of North Dakota fallow acres treated with the top five active ingredients from the herbicide pesticide group reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR CONSERVATION RESERVE PROGRAM (CRP)

Herbicides were applied to 10% of the CRP acreage in 2000 (Table 31). Thirteen different herbicide actives were mentioned by survey respondents. The most frequently used herbicide was 2,4-D, applied to 5.6% of the acres. Picloram was used on 2.2% of the acres. Farm operators made 68% of the applications. Ground application was used for 87% of the treatments.

TABLE 31 . CRP: Herbicide usage and application method. North Dakota, 2000

			Applications				Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	4 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]										
2,4-D	155.9	4.9	89.2	9.8	0.6	0.4	73.1	26.9	12.2	87.8
Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bromoxynil + MCPA	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clopyralid	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clopyralid + 2,4-D	20.9	0.7	90.0	10.0	---	---	74.0	26.0	11.7	88.3
Dicamba	19.0	0.6	85.5	14.5	---	---	66.6	33.4	15.1	84.9
Glyphosate	45.3	1.4	95.8	1.5	2.8	---	74.9	25.1	2.9	97.1
Imazameth	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MCPA	4.4	0.1	100.0	---	---	---	100.0	---	28.2	71.8
Metsulfuron	2.2	0.1	100.0	---	---	---	59.7	40.3	21.3	78.7
Picloram	68.3	2.2	99.9	0.1	---	---	53.6	46.4	19.1	80.9
Thifensulfuron + Tribenuron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tribenuron	4.0	0.1	100.0	---	---	---	38.9	61.1	---	100.0
All Herbicides	324.3	10.2	92.7	6.4	0.7	0.2	68.3	31.7	13.2	86.8

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

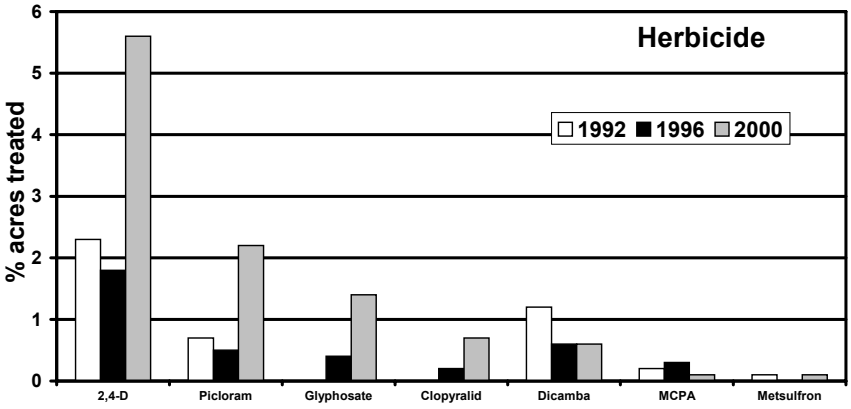

Figure 13. Percent of North Dakota CRP acres treated with the top five active ingredients from the herbicide pesticide group reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR PASTURE

In 2000, 11.9 million acres in North Dakota were designated as pasture. Only 1.4%, or 170,000, of these acres were treated with herbicides (Table 32). Eleven herbicide actives were mentioned by survey respondents. 2,4-D at 0.7% and picloram at 0.6% were the two most frequently used herbicides. These two actives have been the most widely used products during the past 10 years (Figure 14). No insecticides were reportedly used on these acres.

TABLE 32. PASTURE: Herbicide usage and application method. North Dakota, 2000

			Applications				Applicator		Method of Application	
	Acres Treated [2]	Acres Treated	1 X	2 X	3 X	4 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]										
2,4-D	79.8	0.7	93.6	4.7	1.7	---	67.4	32.6	28.3	71.7
Clopyralid + 2,4-D	1.1	0.0	100.0	---	---	---	98.2	1.8	---	100.0
Dicamba	6.3	0.1	94.6	5.4	---	---	88.8	11.2	0.2	99.8
Glyphosate	4.9	0.0	58.4	41.6	---	---	77.4	22.6	2.5	97.5
Glyphosate + 2,4-D	1.0	0.0	10.4	89.6	---	---	100.0	---	---	100.0
Glyphosate + Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazethapyr	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
MCPA	1.3	0.0	100.0	---	---	---	100.0	---	0.4	99.6
Metsulfuron	1.9	0.0	100.0	---	---	---	59.3	40.7	40.7	59.3
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Picloram	70.7	0.6	89.2	3.5	0.2	7.1	83.4	16.6	13.2	86.8
Quinclorac	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Thifensulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
All Herbicides	170.5	1.4	90.6	5.6	0.9	3.0	76.1	23.9	19.4	80.6

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate district or state projections.

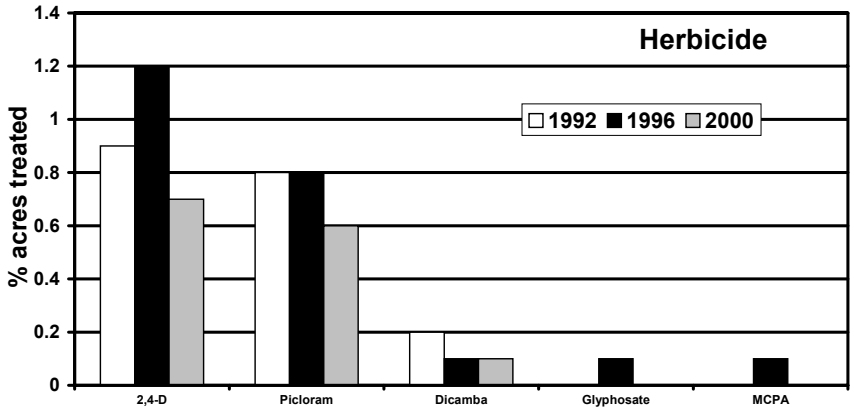

Figure 14. Percent of North Dakota pasture acres treated with the top five active ingredients from the herbicide

pesticide group reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR POTATO

Potato acreage in North Dakota averaged 126,000 acres during the past five years (Table 33). As a major crop, potato had been included in previous statewide surveys. Due to NASS Agricultural Resource Management Surveys (ARMS) implemented on this crop in 1999, potato growers were not adequately represented by this survey to make pesticide use estimates. Pesticide use information from the published ARMS report [6] was summarized here to provide some continuity in reporting. This information from the ARMS report was based on interviews with 49 producers from North Dakota.

Nine herbicide actives were used on North Dakota potatoes. Metribuzin was applied to 42% of the acres and was the most frequently used herbicide (Table 34). Rimsulfuron at 25%, metolachlor at 21%, pendimethalin at 11%, and sethoxydim at 6% were the remaining herbicides used at sufficient levels to estimate acreage. Usage of the top three actives increased significantly compared to earlier records (Figure 15).

Potato acres were treated with 12 different insecticides. Total acres treated were 219% due to multiple applications to the same acres. Imidacloprid was applied to 68% of the acres and was the most frequently applied product. Increased usage was largely due to control failures of Colorado potato beetle with carbofuran, the most frequently used insecticide in 1996 (Figure 15). Dimethoate, azinphos-methyl, esfenvalerate, endosulfan, cyfluthrin, and phorate were applied to 24%, 19%, 19%, 15%, 8%, and 8% of the potato acres, respectively. A new active, spinosad, was used on 20% of the acres in 1999, the first year it was registered.

Foliar fungicide use was common on potato, and included multiple applications of compounds (Table 34). However, total use was lower than recorded in 1996 (Figure 15). Chlorothalonil was the most commonly used foliar fungicide accounting for 82% of the treated acres. It was applied an average of 6.2 times per acre when used. Other fungicides used at significant levels were mancozeb at 57%, azoxystrobin at 49%, cymoxanil at 34%, triphenyltin hydroxide at 24%, and mefenoxam at 20% of the acres.

TABLE 33. Production summary for POTATO, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(Cwt.)*	*(000 Cwt.)*	*($/Cwt.)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	134	131	220	28,820	4.70	135,454	1,034.00	6	6
1997	125	110	200	22,000	5.65	124,300	1,130.00	5	6
1998	126	122	235	28,670	5.30	151,951	1,245.50	6	4
1999	121	110	240	26,400	5.60	147,840	1,344.00	6	6
2000	124	110	245	26,950	5.45	146,878	1,335.25	4	6

TABLE 34. POTATO: Herbicide, Insecticide, Fungicide, and Desiccant usage and application method. North Dakota, 1999
(Source: USDA, NASS. 2000)

	Acres Treated [2]	Acres Treated	Average Number of Applications per acre	Applicator		Method of Application	
				Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(#)	(%)	(%)	(%)	(%)
Herbicide [1]							
2,4-D	NS	NS	NS	---	---	---	---
EPTC	NS	NS	NS	---	---	---	---
Glyphosate	NS	NS	NS	---	---	---	---
Metolachlor	25	21	1.0	---	---	---	---
Metribuzin	51	42	1.0	---	---	---	---
Pendimethalin	13	11	1.0	---	---	---	---
Rimsulfuron	30	25	1.0	---	---	---	---
Sethoxydim	7	6	1.0	---	---	---	---
Trifluralin	NS	NS	NS	---	---	---	---
All Herbicides	126	104	---	---	---	---	---
Insecticide							
Azinphos-methyl	23	19	1.0	---	---	---	—
Carbaryl	NS	NS	NS	---	---	---	---
Carbofuran	NS	NS	NS	---	---	---	---
Cyfluthrin	10	8	1.2	---	---	---	---
Dimethoate	29	24	2.2	---	---	---	---
Endosulfan	18	15	1.6	---	---	---	---
Esfenvalerate	23	19	1.0	---	---	---	---
Imidacloprid	82	68	1.1	---	---	---	---
Methamidophos	NS	NS	NS	---	---	---	---
Phorate	10	8	1.0	---	---	---	---
Phosmet	NS	NS	NS	---	---	---	---
Spinosad	24	20	1.0	---	---	---	---
All Insecticides	219	181	---	---	---	---	---
Fungicide							
Azoxystrobin	59	49	3.1	---	---	---	---
Chlorothalonil	99	82	6.2	---	--	---	---
Cymoxanil	41	34	2.0				
Mancozeb	69	57	3.1				
Maneb	NS	NS	NS	---	---	---	---
Mefenoxam	24	20	1.1	---	---	---	---
Metalaxyl	NS	NS	NS	---	---	---	---
Metiram	NS	NS	NS	---	---	---	---
Propramocarb	NS	NS	NS	---	---	---	---
Triphenyltin hydroxide	29	24	2.8	---	---	---	---
All Fungicides	322	266	---	---	---	---	---
Desiccants							
Diquat	50	41	1.1	---	---	---	---
Sulfuric acid	NS	NS	NS	---	---	---	---
All Desiccants	50	41	1.1	---	---	---	---

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate state projections.

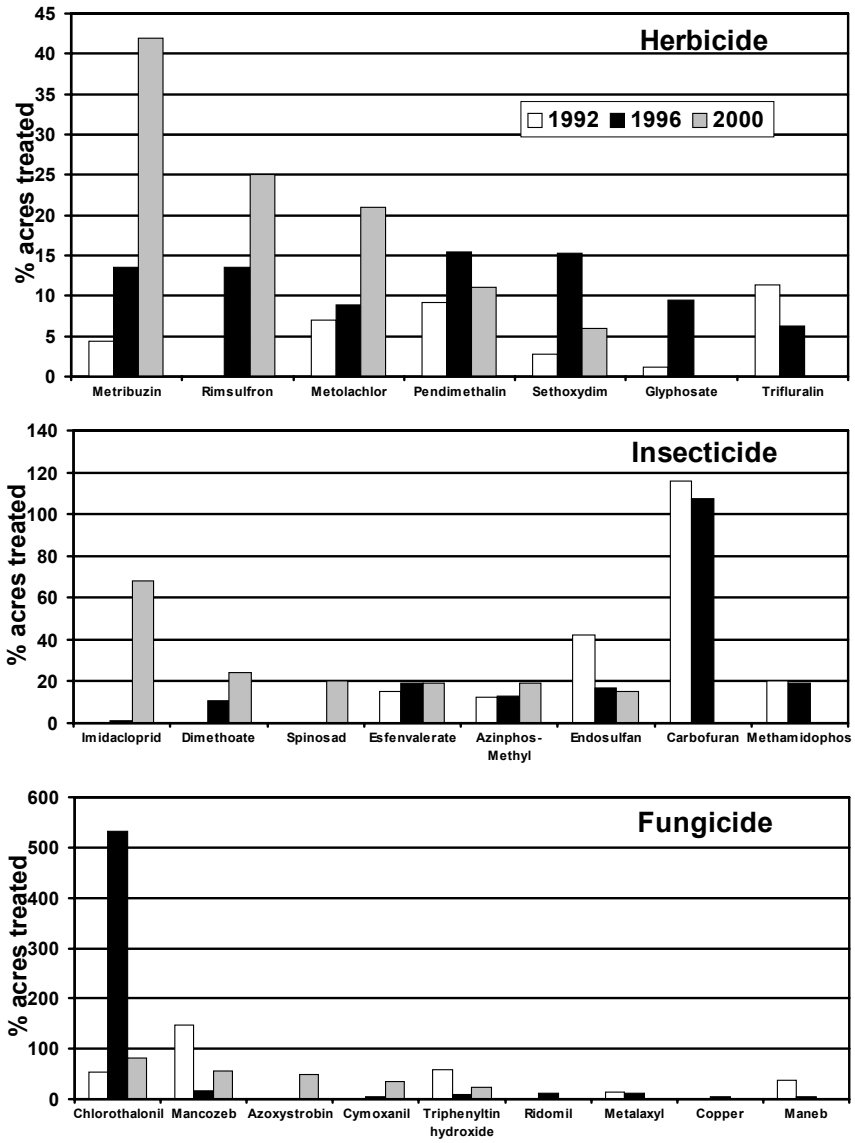

Figure 15. Percent of North Dakota potato acres treated with the top five active ingredients from the herbicide, insecticide, and fungicide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE FOR SUGARBEET

Sugarbeet in North Dakota averaged 243,000 acres during the past five years (Table 35). As a major crop, sugarbeet had been included in previous statewide surveys. Due to NASS Agricultural Resource Management Surveys (ARMS) implemented on this crop in 2000, sugarbeet growers were not adequately represented by this survey to make pesticide use estimates. Pesticide use information from the published ARMS report [7] was summarized here to provide some continuity in reporting. This information from the ARMS report was based on interviews with 152 producers from North Dakota.

Herbicides were applied to 481% of the sugarbeet acres as herbicide mixtures and/or multiple applications of the same active (Table 36). An average of 2.6 herbicide applications were made per acre. Twelve herbicide actives were identified by survey respondents. The most frequently applied herbicide was desmedipham, applied to 98% of the sugarbeet acres. Triflusulfuron at 87%, clopyralid at 85%, clethodim at 83%, and phenmedipham at 75% were used almost as frequently. Desmedipham use declined and the top five actives were used more evenly when compared to previous use estimates (Figure 16).

Insecticides were applied on 89% of the sugarbeet acres (Table 36). Terbufos at 69% was the most frequently used insecticide. It is applied as a granular formulation for control of soil insects. Chlorpyrifos was applied on 13% of the acres as either a granular or liquid formulation. A preference shift to terbufos has occurred during the past 10 years (Figure 16).

Fungicides were applied an average of 1.2 times per acre. Foliar fungicides were applied to 183% of the sugarbeet acreage as a result of multiple application and multiple actives. Tetraconazole at 85% and triphenyltin hydroxide at 83% were the most frequently used fungicides (Table 36). Tetraconazole was first made available in 1999 as a Section 18 Emergency Exemption to manage Cercospora leafspot and was quickly incorporated into production programs (Figure 16). It is recommended that sugarbeet growers rotate tetraconazole with fungicides having different modes of action, such as triphenyltin hydroxide, to aid in managing fungicide resistance.

TABLE 35. Production summary for SUGARBEET, North Dakota, 1996-2000 (NDASS, 2001)

Year	Acres		Yield		Marketing Year Avg. Price	Value of Production	Value per harvested Acre	U.S. Production	
	Planted	Harvested	Per Acre	Production					
	(000 Acres)		*(tons)*	*(000 tons)*	*($/ton)*	*(000 Dols.)*	*(Dols.)*	*(%)*	*(Rank)*
1996	226.6	225.3	18.7	4,213	46.10	194,219	862.05	16	3
1997	231.4	227.5	18.5	4,205	37.90	159,370	700.53	14	3
1998	250.0	242.6	22.2	5,386	35.40	190,664	785.92	16	3
1999	251.6	247.0	20.8	5,138	38.00	195,244	790.46	15	2
2000	258.0	232.0	22.1	5,127	37.80	193,801	835.35	16	3

TABLE 36. SUGARBEET: Herbicide, Insecticide, Fungicide, and Desiccant usage and application method. North Dakota, 2000 *(Source: USDA, NASS. 2001)*

	Acres Treated [2]	Acres Treated	Average Number of Applications per acre	Applicator		Method of Application	
				Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(#)	(%)	(%)	(%)	(%)
Herbicide [1]							
Clethodim	214	83	2.9	---	---	---	---
Clopyralid	219	85	3.1	---	---	---	---
Cycloate	NS	NS	NS	---	---	---	---
Desmedipham	253	98	3.3	---	---	---	---
Ethofumesate	83	32	2.5	---	---	---	---
Glyphosate	23	9	1.0	---	---	---	---
Paraquat	NS	NS	NS	---	---	---	---
Phenmedipham	194	75	3.0	---	---	---	---
Quizalofop-P	21	8	1.4	---	---	---	---
Sethoxydim	10	4	3.4	---	---	---	---
Trifluralin	NS	NS	NS	---	---	---	---
Triflusulfuron	224	87	3.2	---	---	---	---
All Herbicides	1241	481	---	---	---	---	---
Insecticide							
Bacillus thuringiensis	NS	NS	NS	---	---	---	---
Chlorpyrifos	34	13	1.3	---	---	---	---
Esfenvalerate	8	3	1.7	---	---	---	---
Phorate	10	4	1.0	---	---	---	---
Terbufos	178	69	1.0	---	---	---	---
All Insecticides	230	89	---	---	---	---	---
Fungicide							
Benomyl	NS	NS	NS	---	---	---	---
Mancozeb	13	5	1.0	---	---	---	---
Maneb	NS	NS	NS	---	---	---	---
Tetraconazole	219	85	1.4	---	--	---	---
Thiophanate-methyl	26	10	1.0	---	---	---	---
Triphenyltin hydroxide	214	83	1.3	---	---	---	---
All Fungicides	472	183	---	---	---	---	---

[1] Herbicides applied as a tank mixture were considered separately unless a commercial premix was used.
[2] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate state projections.

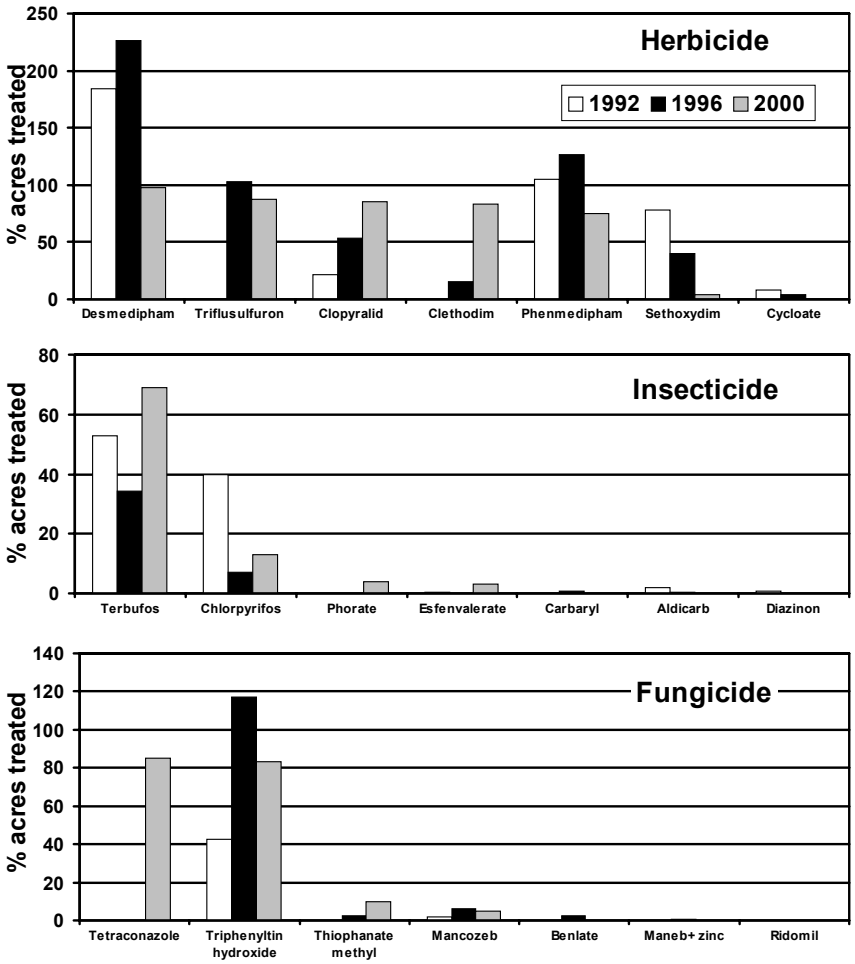

Figure 16. Percent of North Dakota sugarbeet acres treated with the top five active ingredients from the herbicide, insecticide, and fungicide pesticide groups reported in the 1992, 1996, and 2000 statewide pesticide use surveys.

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PESTICIDE USE STATEWIDE BY PESTICIDE GROUP AND ACTIVE COMPOUND

Tables 37, 38, 39, and 40 summarize all herbicide, insecticide, fungicide, and desiccant usage by active ingredient or commercial premix used in North Dakota during 2000. The summaries do not include pesticide usage for potato and sugarbeet since the information was obtained by separate survey efforts.

The most frequently used herbicide in North Dakota was 2,4-D, applied to 16.8% of the acres, alone or as a commercial premix. MCPA was the second most often used herbicide at 12.5% of the acres treated alone or as a commercial premix. The most frequently used insecticide was esfenvalerate, applied to only 0.4% of the acres treated, but representing 47% of all insecticide applications reported by this project. Tebuconazol was the most frequently used fungicide, applied to 1.4% of the acres treated, but representing 68% of all fungicide applications surveyed by this project.

At 95.5%, the vast majority of herbicide applications were with ground sprayers. The farm operator applied herbicides 84.5% of the time. Insecticides and fungicides were more evenly split between aerial and ground application. Insecticides were applied 56.8% of the time by ground, and fungicides were applied 52.6% by ground. The farm operator accounted for most of the ground applications.

TABLE 37. HERBICIDE Usage in North Dakota, 2000. Summary does not include potato or sugarbeet herbicide use

			Applications				Applicator		Method of Application	
	Acres Treated [1]	Acres Treated	1 X	2 X	3 X	4 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Herbicide [1]										
2,4-D	5927.0	15.3	98.9	1.1	0.0	0.0	85.6	14.4	6.5	93.5
2,4-D + Dicamba	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acetochlor + EPTC	174.1	0.5	100.0	---	---	---	70.5	29.5	---	100.0
Acetochlor + Safener	72.9	0.2	93.8	6.2	---	---	85.2	14.8	---	100.0
Acetochlor + Safener + Atrazine	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Acifluorfen	21.4	0.1	100.0	---	---	---	92.0	8.0	---	100.0
Acifluorfen + Bentazon	18.7	0.0	100.0	---	---	---	96.6	3.4	3.4	96.6
Alachlor	12.2	0.0	100.0	---	---	---	61.2	38.8	---	100.0
Alachlor + Glyphosate	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Ametryn	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Atrazine	139.4	0.4	100.0	---	---	---	61.3	38.7	5.6	94.4
Atrazine + Bromoxynil	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bentazon	403.2	1.0	88.9	6.9	4.2	---	83.3	16.7	8.6	91.4
Bentazon + Sethoxydim	369.3	1.0	87.9	12.1	---	---	76.5	23.5	4.5	95.5
Bromoxynil	139.2	0.4	100.0	---	---	---	79.2	20.8	1.2	98.8
Bromoxynil + MCPA	1757.6	4.5	96.8	3.2	---	---	92.9	7.1	2.7	97.3
Bromoxynil + MCPA + Fenoxaprop-P	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Bronate+ Agsco 400	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Clopyralid + 2,4-D	314.9	0.8	99.3	0.7	---	---	76.5	23.5	9.5	90.5
Clopyralid + Flumetsulam	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 37. ***Continued***

	Acres Treated [1]	Acres Treated	Applications				Applicator		Method of Application	
			1 X	2 X	3 X	4 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Clopyralid + MCPA	70.8	0.2	100.0	---	---	---	77.8	22.2	10.6	89.4
Cloransulam + Methyl	72.4	0.2	100.0	---	---	---	90.7	9.3	---	100.0
Cyanazine	6.7	0.0	100.0	---	---	---	24.4	75.6	4.7	95.3
Dicamba	2520.0	6.5	99.9	0.1	---	---	87.1	12.9	4.2	95.8
Dicamba + Difluefenzopyr + Nicolsulfuron	116.3	0.3	99.1	0.9	---	---	87.8	12.2	---	100.0
Dicamba + Imazethapyr	17.7	0.0	100.0	---	---	---	100.0	---	---	100.0
Dicamba + Primisulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dicamba + Diflufenzopyr	97.1	0.3	100.0	---	---	---	71.8	28.2	---	100.0
Diclofop	8.7	0.0	100.0	---	---	---	72.0	28.0	28.0	72.0
Difenzoquat	30.6	0.1	100.0	---	---	---	74.2	25.8	25.8	74.2
Dimethenamid	5.2	0.0	100.0	---	---	---	6.9	93.1	30.9	69.1
Diquat	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
EPTC	16.5	0.0	100.0	---	---	---	93.8	6.2	---	100.0
EPTC + Safener	19.2	0.0	100.0	---	---	---	54.2	45.8	---	100.0
Ethalfluralin	961.6	2.5	100.0	---	---	---	79.9	20.1	2.0	98.0
Ethametsulfuron	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fenoxaprop + 2,4-D + MCPA	215.7	0.6	84.2	15.8	---	---	78.2	21.8	13.8	86.2
Fenoxaprop + MCPA	193.0	0.5	100.0	---	---	---	81.6	18.4	6.3	93.7
Fenoxaprop + MCPA+ Thifensulfuron + Tribenuron	429.6	1.1	100.0	---	---	---	66.0	34.0	4.1	95.9
Fenoxaprop-P + Safener	2803.6	7.2	98.8	1.2	---	---	89.3	10.7	3.9	96.1
Fenoxaprop-P-ethyl + MCPA+ Isooctylester+ Thifensulfuron	21.7	0.1	100.0	---	---	---	58.1	41.9	16.2	83.8
Fluazifop-P	3.8	0.0	100.0	---	---	---	86.3	13.7	---	100.0
Fluazifop-P + Fenoxaprop	29.4	0.1	100.0	---	---	---	78.3	21.7	3.6	96.4
Flumetsulam	32.3	0.1	100.0	---	---	---	67.4	32.6	---	100.0
Flumetsulam + Metolacher	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Flumetsulam + Trifluralin	19.0	0.0	100.0	---	---	---	100.0	---	---	100.0
Fluroxypyr	269.7	0.7	99.0	1.0	---	---	91.3	8.7	2.8	97.2
Fluroxypyr + 2,4-D Ester	32.9	0.1	100.0	---	---	---	92.7	7.3	---	100.0
Fluroxypyr + MCPA Ester	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fomesafen	134.1	0.3	99.4	0.6	---	---	66.2	33.8	10.9	89.1
Glufosinate	111.6	0.3	96.5	3.5	---	---	82.7	17.3	2.6	97.4
Glyphosate	2255.3	5.8	76.7	23.1	0.2	---	77.0	23.0	3.4	96.6
Hexazinone	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imazameth	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS

Table 37. ***Continued***

	Acres Treated [1]	Acres Treated	Applications				Applicator		Method of Application	
			1 X	2 X	3 X	4 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Imazamethabenz	323.8	0.8	100.0	---	---	---	86.0	14.0	9.8	90.2
Imazamox	421.5	1.1	100.0	---	---	---	78.6	21.4	8.7	91.3
Imazethapyr	523.8	1.4	100.0	---	---	---	75.4	24.6	5.7	94.3
Imazethapyr + Glyphosate	25.6	0.1	100.0	---	---	---	47.2	52.8	---	100.0
Imazethapyr + Imazapyr	16.8	0.0	100.0	---	---	---	90.1	9.9	9.9	90.1
Imazethapyr + Pendimethalin	68.2	0.2	100.0	---	---	---	84.3	15.7	6.9	93.1
Isozaflutole	17.5	0.0	100.0	---	---	---	81.2	18.8	---	100.0
Lactofen	82.1	0.2	100.0	---	---	---	92.0	8.0	3.8	96.2
MCPA	2245.3	5.8	99.6	0.4	---	---	88.8	11.2	2.9	97.1
Metolachlor	14.5	0.0	100.0	---	---	---	93.5	6.5	---	100.0
Metribuzin	1.4	0.0	100.0	---	---	---	67.1	32.9	---	100.0
Metsulfuron	90.1	0.2	100.0	---	---	---	90.2	9.8	4.8	95.2
Metsulfuron + Chlorsulfuron	23.4	0.1	100.0	---	---	---	86.8	13.2	---	100.0
Nicosulfuron	286.6	0.7	99.9	0.1	---	---	77.6	22.4	3.2	96.8
Nicosulfuron + Rimsulfuron + Atrazine	4.7	0.0	100.0	---	---	---	39.4	60.6	---	100.0
Nicosulfuron + Rimsulfuron + Clopyralid + Flumetsulam	65.5	0.2	100.0	---	---	---	70.0	30.0	---	100.0
Oxadiazon	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Oxyfluorfen	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Paraquat	6.7	0.0	100.0	---	---	---	85.9	14.1	14.1	85.9
Pendimethalin	127.4	0.3	100.0	---	---	---	88.8	11.2	---	100.0
Picloram	210.2	0.5	96.2	1.4	0.1	2.4	73.2	26.8	13.3	86.7
Propanil	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pyrazon	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Pyridate	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quinclorac	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Quizalofop-P	450.7	1.2	99.8	0.2	---	---	91.2	8.8	0.5	99.5
Rimsulfuron + Thifensulfuron	9.8	0.0	100.0	---	---	---	83.5	16.5	20.3	79.7
Sethoxydim	594.2	1.5	93.3	3.8	2.9	---	89.1	10.9	3.6	96.4
Sulfentrazone	117.6	0.3	97.5	2.5	---	---	93.3	6.7	7.1	92.9
Thifensulfuron	339.8	0.9	100.0	---	---	---	84.5	15.5	5.9	94.1
Thifensulfuron + Tribenuron	348.9	0.9	98.2	1.8	---	---	86.0	14.0	8.0	92.0
Tralkoxydim	280.4	0.7	100.0	---	---	---	82.2	17.8	1.0	99.0
Triallate	119.2	0.3	100.0	---	---	---	82.5	17.5	3.9	96.1
Trifluralin	1360.5	3.5	99.9	0.1	---	---	82.7	17.3	2.3	97.7
Total	30112.3	77.9	96.5	3.3	0.1	0.0	84.5	15.5	4.5	95.5

[1] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate state projections.

TABLE 38. INSECTICIDE Usage in North Dakota, 2000. Summary does not include potato or sugarbeet insecticide use

			Applications			Applicator		Method of Application	
	Acres Treated [1]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Insecticide									
Bifenthrin	22.7	0.1	100.0	---	---	75.1	24.9	5.2	94.8
Carbofuran	2.7	0.0	100.0	---	---	76.4	23.6	82.4	17.6
Chlorpyrifos	68.0	0.2	100.0	---	---	60.6	39.4	32.2	67.8
Cyfluthrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Diazinon	NS	NS	NS	NS	NS	NS	NS	NS	NS
Dimethoate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Encapsulated Methyl Parathion	14.7	0.0	100.0	---	---	---	100.0	100.0	---
Esfenvalerate	136.9	0.4	88.4	11.6	---	66.5	33.5	45.2	54.8
Ethyl Parathion	NS	NS	NS	NS	NS	NS	NS	NS	NS
Fipronil	NS	NS	NS	NS	NS	NS	NS	NS	NS
Imidacloprid	NS	NS	NS	NS	NS	NS	NS	NS	NS
Lambda-cyhalothrin	31.2	0.1	88.0	12.0	---	33.0	67.0	67.0	33.0
Malathion	NS	NS	NS	NS	NS	NS	NS	NS	NS
Permethrin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Tefluthrin	9.1	0.0	100.0	---	---	100.0	---	---	100.0
Total	301.4	0.8	93.5	6.5	---	59.2	40.8	43.2	56.8

[1] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.
NS - not sufficient to estimate state projections.

TABLE 39. FUNGICIDE Usage in North Dakota, 2000. Summary does not include potato or sugarbeet fungicide use

			Applications			Applicator		Method of Application	
	Acres Treated [1]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Fungicide									
Azoxystrobin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Benlate	29.9	0.1	100.0	---	---	81.3	18.7	44.7	55.3
Chlorothalonil	10.7	0.0	83.8	---	16.2	61.3	38.7	38.4	61.6
Mancozeb	44.2	0.1	100.0	---	---	28.1	71.9	67.2	32.8
Propiconazole	130.7	0.3	99.5	0.5	---	64.8	35.2	32.7	67.3
Tebuconazole	524.7	1.4	96.7	3.3	---	47.1	52.9	51.4	48.6
Thiophanate Methyl	18.9	0.0	55.7	44.3	---	88.9	11.1	11.1	88.9
Vinclozolin	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total	769.8	2.0	96.3	3.4	0.2	52.1	47.9	47.4	52.6

[1] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.

TABLE 40. DESICCANT Usage in North Dakota, 2000. Summary does not include potato desiccant use

			Applications			Applicator		Method of Application	
	Acres Treated [1]	Acres Treated	1 X	2 X	3 X	Farm Operator	Custom	Aerial	Ground
	(1000)	(%)	(%)	(%)	(%)	(%)	(%)	(%)	(%)
Desiccant									
Paraquat	NS	NS	NS	NS	NS	NS	NS	NS	NS
Sodium Chlorate	NS	NS	NS	NS	NS	NS	NS	NS	NS
Total	12.0	0.0	100.0	---	---	13.4	86.6	51.0	49.0

[1] Multiple applications to the same acre were reported as separate values. Acres treated can exceed 100% of the planted acres.

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GENETICALLY MODIFIED CROPS - CORN

Corn hybrids are available in the region that have the *Bt*-insect resistant trait for managing European corn borer. Corn has three herbicide resistant traits available, one for resistance to glyphosate (Roundup Ready©), one for glufosinate (Liberty©), and one for imazethapyr + imazapyr (Clearfield©).

Bt-corn was estimated to have been used on 11.7% of the North Dakota corn acres (Table 41). The southeast district had the greatest percentage of total acres and the greatest number of acres planted to *Bt*-corn. Second, was the east central with 18,900 acres (8.8%). These areas are considered to have the greatest risk of losses to corn borer due to the presence of both two- and one-generation corn borers. Their presence complicates insecticide management decisions. The two ecological types of corn borer infest corn at different times. Multiple applications of insecticides may be required if populations of both types exceed economic levels.

The glyphosate (Roundup Ready©) corn was planted on 5.8% of the corn acres in North Dakota (Table 41). The southeast district had 22,000 acres, the greatest total acres by district, but it represented only 4.3% of the total acres grown in the district. The southwest district was second with 19,700 acres, but this district had the greatest percentage of acres where used at 49.9%.

The glufosinate (Liberty©) corn was reported from four of the nine districts. Statewide, the Liberty© trait was used on 3.1% of the total corn acres (Table 41). The southeast district had 20,690 acres, the greatest total acres by district, which represented 4.1% of the total acres grown in the district. The east central district had the second highest total at 7,810 acres, or 3.6% of the district's acres.

The imazethapyr + imazapyr (Clearfield©) trait was used on 0.7% of the state's corn acres (Table 41). All acres were in the southeast and south central districts. The Clearfield© trait, though included in the section on genetically modified crops, is not the result of genetic modification. The tolerance of Clearfield© corn to imazethapyr is made possible by the insertion of a naturally occurring dominant gene for resistance into a hybrid through one of the two parents (imidazolinone tolerant corn or IT corn). The tolerance of Clearfield© corn is made possible using traditional plant breeding methods, not through the introduction of foreign genetic material. Therefore, Clearfield© corn is a non-GMO.

Some usage of the stacked gene corn hybrids was reported. The stacked gene hybrids include both insect and a herbicide resistant traits. Stacked gene hybrids were grown on 0.7% of the corn acres (Table 41).

TABLE 41. Types and Acres of Genetically Modified Corn grown in North Dakota by district, 2000

District	Corn Acres	Bt-insect Resistant		Glyphosate Resistant		Liberty Resistant		Clearfield Resistant		Stacked Gene (Bt + Herbicide)	
		Acres Used		Acres Used		Acres Used		Acres Used		Acres Used	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Northwest	5.5	---	---	0.4	7.0	---	---	---	---	---	---
North Central	33.5	0.7	2.0	0.5	1.6	---	---	---	---	---	---
Northeast	93.0	0.5	0.6	0.5	0.5	---	---	---	---	---	---
West Central	31.0	3.2	10.2	7.5	24.2	0.3	1.0	---	---	---	---
Central	65.5	5.8	8.9	1.1	1.7	4.4	6.8	---	---	---	---
East Central	216.0	18.9	8.8	---	---	7.8	3.6	---	---	3.4	1.6
Southwest	39.5	---	---	19.7	49.9	---	---	---	---	---	---
South Central	86.0	2.9	3.4	11.4	13.3	---	---	1.3	1.5	2.4	2.8
Southeast	510.0	94.6	18.6	22.2	4.3	20.7	4.1	6.5	1.3	2.1	0.4
State Totals	1080.0	126.6	11.7	63.3	5.9	33.3	3.1	7.8	0.7	7.9	0.7

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GENETICALLY MODIFIED CROPS - SOYBEAN

Soybean varieties are available in the region that are genetically modified to be resistant to glyphosate (Roundup Ready©). The glyphosate can be applied up until full flowering with complete crop safety, while the herbicide controls both grass and broadleaf weeds.

In North Dakota, growers planted an estimated 28.7% of their soybean acres to the glyphosate resistant varieties (Table 42). The eastern districts had 93% of the soybean acres. Of the 1.76 million acres in these areas, 26.2% were glyphosate resistant. The southeastern district had the greatest number of acres of resistant soybean with 290,000 acres, or 40% (Table 42). Districts with fewer of the total state acres had high percentages of their acres planted to the resistant varieties.

TABLE 42. Acres of Genetically Modified Soybean in North Dakota by district, 2000

District	Soybean Acres	Glyphosate Resistant Acres Used	
	(1000)	(1000)	%
Northwest	3.9	2.5	64.3
North Central	7.7	5.4	69.6
Northeast	200.0	23.7	11.9
West Central	1.9	—	---
Central	100.0	60.0	60.0
East Central	850.0	149.2	17.6
Southwest	1.5	0.2	11.1
South Central	20.0	15.1	75.5
Southeast	715.0	290.0	40.6
State Totals	1900.0	546.1	28.7

Pesticide Use and Pest Management Practices for Major Crops in North Dakota - 2000

ER-79
October 2002

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GENETICALLY MODIFIED CROPS - CANOLA

Canola has three herbicide resistant traits available, one for resistance to glyphosate (Roundup Ready©), one for glufosinate (Liberty©), and one for imazamox (Clearfield©). A total of 707,700 acres of canola, or 55.8%, were planted to these three resistance traits.

The glyphosate (Roundup Ready©) canola was planted on 50.5% of the canola acres in North Dakota (Table 43). Percentages by district ranged from a low of 25% in the south central to a high of 64.7% in the southwest. The northern districts had 68.8% of the total canola acres with 46.5% of those acres as resistant varieties.

The glufosinate (Liberty©) canola was reported from seven of the nine districts. Statewide, the Liberty© trait was used on 4.5% of the total canola acres (Table 43). The northwest and north central districts had 35,800 acres which represented 14.3% of the total acres grown in those districts.

The imazamox (Clearfield©) trait was used on 0.8% of the state's canola acres (Table 43). Acres were planted in the northeast, east central, and south central districts. The Clearfield© trait, though included in the section on genetically modified crops, is not the result of genetic modification. The tolerance of Clearfield© canola to imazamox is made possible using traditional plant breeding methods, not through the introduction of foreign genetic material. Therefore, Clearfield© canola is a non-GMO.

TABLE 43. Types and Acres of Genetically Modified Canola in North Dakota by district, 2000

District	Canola Acres	Glyphosate Resistant Acres Used		Liberty Resistant Acres Used		Clearfield Resistant Acres Used	
	(1000)	(1000)	(%)	(1000)	(%)	(1000)	(%)
Northwest	232.0	121.0	52.1	19.6	8.4	---	---
North Central	275.0	134.4	48.9	16.2	5.9	---	---
Northeast	367.0	151.1	41.2	7.2	2.0	2.3	0.6
West Central	103.0	65.2	63.3	6.6	6.4	---	---
Central	145.0	90.8	62.6	3.6	2.5	---	---
East Central	32.0	17.2	53.8	1.2	3.9	0.6	1.9
Southwest	72.0	46.6	64.7	2.9	4.0	---	---
South Central	27.0	6.8	25.0	---	---	6.9	25.7
Southeast	17.0	7.6	44.7	---	---	---	---
State Totals	1270.0	640.7	50.5	57.2	4.5	9.8	0.8

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PEST PROBLEMS REPORTED WITHOUT AN EFFECTIVE PESTICIDE

With the objective of identifying possible pesticide priorities, respondents were asked to identify crop and pest problems that did not have a pesticide available to adequately manage a pest problem. This was a new section added to the survey.

Responses for a pest problem were assigned to a predetermined category to facilitate response summaries. Weeds were categorized as annual broadleaf, annual grasses, perennial weeds, or other. Insects were categorized as grasshoppers, soil insects, caterpillars, plant bugs, beetles, aphids, or other. Plant diseases were categorized as leaf diseases, head diseases, seed diseases, root diseases, or other.

Table 44 summarizes the total survey respondents by crop and indicates the number who reported a pest problem where they felt effective pesticides were not available. Crops with the higher percentages of respondents reporting problems were most often the smaller acreage crops. These crops had fewer overall survey contacts.

TABLE 44. Crops grown in 2000 where respondents reported a pest problem (Weed, Insect, Disease) where available pesticides (Herbicide, Insecticide, Fungicide) were inadequate to manage the problem

Crop	Total Respondents by Crop	Respondents Reporting a Pest Problem without Adequate Pesticide	
		Number	%
Wheat	1903	124	6.5
Barley	931	22	2.4
Oat	739	10	1.4
Flax	282	10	3.6
Corn	500	19	3.8
Sunflower	512	51	10.0
Soybean	403	30	7.4
Dry Edible Bean	153	14	9.2
Canola	408	24	5.9
Pea	63	7	11.1
Lentil	27	6	22.2
Crambe	8	2	25.0
Safflower	14	1	7.1
Mustard	7	1	14.3
Alfalfa	1468	17	1.2
Other hay	1295	9	0.7
CRP	1326	17	1.3
Fallow	902	4	0.4
Pasture	2107	22	1.0
Sugarbeet	30	3	10.0
Total	13,078	393	3.0

Table 45 summarizes the percent of respondents, by crop, identifying a weed category where an adequate herbicide was not available. Nineteen of the 20 crops listed on the survey instrument were mentioned by respondents. The annual weed categories tended to have a higher response rate for the annual crops. The response rate for perennial weeds was higher for the perennial crops.

The intent of the survey question was to identify pest problems where an adequate pesticide was not available to manage a pest problem. In the weed/herbicide responses, respondents may have focused more on weed types that are difficult to control with currently available options, or where control was not as economical as desired.

For example, wheat, barley, and oat have numerous broadleaf herbicides available, yet some respondents are indicating adequate products were not available. The perennial weed category for these crops would refer to Canada thistle which had clopyralid + 2,4-D available. A large number of respondents identified perennial weeds in CRP, fallow, and pasture as having inadequate herbicides available. However, clopyralid, picloram, glyphosate, 2,4-D, and dicamba all had registrations for application to these sites.

Therefore, it is difficult to thoroughly interpret the results obtained.

TABLE 45. Percent of Respondents, by Crop, reporting a Weed Problem without an Adequate Herbicide to manage the problem

Crop	Annual Broadleaf	Annual Grass	Perennial Weeds	Other
Wheat	8.9	9.7	23.4	0.8
Barley	13.6	0	36.4	9.1
Oat	20.0	30.0	40.0	0
Flax	70.0	0	20.0	10.0
Corn	21.0	36.8	36.8	0.0
Sunflower	35.3	0	27.5	3.9
Soybean	66.7	0	30.0	3.3
Dry Edible Bean	50.0	0	28.6	0
Canola	37.5	8.3	29.2	0
Lentil	66.7	0	16.7	0
Crambe	50.0	0	0	0
Safflower	100.0	0	0	0
Mustard	100.0	0	0	0
Alfalfa	17.6	0	47.1	11.8
Other Hay	0	11.1	66.7	0
CRP	29.4	0	70.6	0
Fallow	0	0	100.0	0
Pasture	13.6	0	81.8	4.6
Sugarbeet	100.0	0	0	10.0

Table 46 summarizes the percent of respondents, by crop, identifying an insect category where an adequate insecticide was not available. Only five of the 20 crops listed on the survey instrument were mentioned by respondents.

Wheat midge was mentioned by 10% of the wheat respondents. There were two insecticides approved for use, chlorpyrifos and encapsulated methyl parathion. Grasshoppers were mentioned by 10% of the oat respondents. Five insecticides were available for their control in oat; all were organophosphate or carbamate insecticides. Grasshoppers were also mentioned by 11.8% of the alfalfa growers. Nine insecticides were available, seven organophosphates, one carbamate, and one pyrethroid. In these cases where insecticides were available, these responses would suggest grower's dissatisfaction with available alternatives, but does not indicate why they were dissatisfied.

Other hay was identified as having soil insect and beetle problems. In this case, insecticide alternatives were limited. The few insecticides approved for sites often cut for hay were limited to use against grasshoppers and often had haying restrictions.

TABLE 46. Percent of Respondents, by Crop, reporting an Insect Problem without an Effective Insecticide to manage the problem

Crop	grasshopper	soil insects	caterpillars	plant bugs	beetles	aphids	other	wheat midge
Wheat	0	0	0	0	0	0	1.2	10.5
Oats	10.0	0	0	0	0	0	0	
Sunflower	0	0	0	2.0	2.0	0	5.9	
Alfalfa	11.8	5.9	0	0	5.9	0	0	
Other Hay	0	11.1	0	0	11.1	0	0	

Table 47 summarizes the percent of respondents, by crop, identifying a plant disease category where an adequate fungicide was not available. Eight of the 20 crops listed on the survey instrument were mentioned by respondents.

Head diseases in small grains was the most frequently mentioned problem overall in the survey. Fusarium head blight (FHB), or scab, a fungal disease, would have most likely been the problem. Two fungicides, propiconazole and tebuconazole were available as 24(c) and Section 18 labels, respectively, in 2000. These products were estimated to have been used on 6.1% of the wheat acres and 1.8% of the barley acres (Tables 8 and 9). Tebuconazole was the most frequently used of the two fungicides. This product was available as an emergency exemption. It could be inferred that full registration of this compound would be desirable by grain growers so a fungicide would be fully available, or that more effective fungicides are desired.

Head, or flower, disease for sunflower, canola, and crambe was mentioned by 23% of growers reporting a problem with these crops. The disease was likely sclerotinia which affects these and other broadleaf field crops in the region. No fungicide was registered for sclerotinia control in sunflower or crambe. Two fungicides, azoxystrobin (Section 3 label in 1999) and vinclozolin,(Section 3 label in 2000) were registered for use on canola in 2000. Both fungicides were reported in the survey but not on enough acres to make a statewide estimate for the individual products.

Seed diseases for lentil and dry edible bean were mentioned by a few growers. The two most serious diseases of lentil are anthracnose and ascochyta blight. Both can be seed-borne at low levels. No registered fungicide was effective for either of these disease fungi on the seed. Most dry bean seed is treated prior to sale, often with a combination of fungicide, insecticide and bactericide. The most serious seed-borne diseases of dry edible bean in North Dakota are bacterial blights and root rot. Bacterial blight is managed with a seed treatment containing streptomycin, an antibiotic which eliminates surface bacterial contaminants. Its use requires growers to use a granular, in-furrow inoculant rather than a seed-applied inoculant. The root rots include rhizoctonia and pythium, but *Fusarium* spp. has been the most troublesome. Seed treatment products for these diseases include one of the fungicides captan, carboxin, metalaxyl, mefenoxam or combinations.

TABLE 47. Percent of Respondents, by Crop, reporting a Plant Disease Problem without an Effective Fungicide to manage the problem

Crop	leaf diseases	head diseases	seed diseases	root diseases	other
Wheat	4.8	37.1	0.8	1.6	0.8
Barley	4.6	31.8	4.5	0	0
Corn	0	5.3	0	0	0
Sunflower	0	21.6	2.0	0	0
Lentil	0	0	16.7	0	0
Dry Edible Bean	0	0	14.3	0	7.1
Canola	0	25.0	0	0	0
Crambe	0	50.0	0	0	0

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PEST MANAGEMENT DECISIONS AND PRACTICES

Growers use many information sources to help make pest management decisions. In general, they gather information about pest populations on the farm, making management decisions based on a perceived need and economic benefit. Questions were asked of the survey respondents to determine whether they use certain management tools and some practices they implement when managing pests within the weed, insect, and plant disease categories.

Field scouting is a practice of surveying fields to detect the presence, concentration, and type of pest(s) present. This information is considered valuable in determining the need for and assessing the success of management practices. Sixty-four percent of all respondents answered “yes” to using scouting for all three pest categories (Table 48). Scouting for making weed management decisions was used by 75% of the respondents.

An alternative approach to making decisions based on field scouting would be routinely treating pests based on the previous season’s experience. The affirmative responses were 31% when routine treatments were used for all three pest categories (Table 49). This method was used for weed management decisions by 45.9% of respondents. Weeds infesting fields one season would be more likely to be present the next season, near the same location, compared to most insects and plant diseases, whose presence would be less predictable.

A practice more compatible with field scouting would be making treatments based on a pest’s identity, density, or population size. Respondents answered “yes” 52% of the time for all three pest categories (Table 50). Again, the response for weeds was higher at 65.6%. Decisions using this information could be made based on specific management guidelines. Forty-two percent of the respondents indicated they used University/Extension guidelines when making decisions for all three pest categories (Table 51). Responses for weeds were only slightly higher than for insects and plant diseases.

Mechanical control methods have been used for managing pests. Examples of mechanical methods would be plowing, cultivation, harrowing and stubble burning. Respondents answered “yes” only 37% for all three pest categories (Table 52). These practices are associated more often with weed management. Responses were higher for weeds at 52.7%.

Plant pest resistance was considered by 34% of the respondents for all three categories (Table 53). Response rates for the separate pest categories were similar. Alternating pesticides to avoid pests developing resistance to pesticides was practiced by 35.3% of the respondents for all three pest categories (Table 54). Rotating crops to manage pests was practiced by 50.7% of the respondents for all pest categories (Table 55). Predictive models for weeds, insects, and plant diseases were available for some individual pests. Respondents used these models only 12.2% of the time (Table 56). The response rate was higher than the state average in the east central and northeast districts, areas where wheat disease and insect problems have been significant and predictive models are available. Only 14.4% of the respondents reported using the services of a crop consultant to manage their pest problems (Table 57).

The planting of genetically modified (GM) crops has been adopted by North Dakota corn, soybean, and canola growers. Respondents were asked if they plan to increase their use of GM crops. They responded “yes” 8.2% of the time for all three pest categories (Table 58). The response rate by pest category was similar. The GM crops currently grown, however, are modified for herbicide or insect resistance, not plant disease. The GM crops have faced some opposition to their use by certain markets. Only 1.8% of the respondents indicated their intention of decreasing the use of GM crops (Table 59).

Finally, growers were asked if they use the internet for finding information about pest management. The statewide average was 16.5% when used for all three pest categories (Table 60).

The affirmative responses for weeds were greater than insects and plant diseases for 11 of the 12 questions asked in this section. In the future, more specific questions about pest management practices may be needed. Splitting out responses by pest category generally did not provide additional insight into growers practices.

TABLE 48. Percent of respondents answering "Yes" to scouting fields regularly for the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	76.7	69.0	68.6	67.6
North Central	430	80.0	72.8	70.5	70.2
Northeast	462	81.8	71.0	71.4	70.6
West Central	409	71.4	60.9	58.7	58.4
Central	366	73.8	61.2	61.5	60.1
East Central	283	80.6	72.8	72.8	72.1
Southwest	292	73.3	62.0	59.2	59.2
South Central	420	68.6	59.8	59.3	58.8
Southeast	428	72.0	59.8	60.0	59.3
State Totals	3580	75.4	65.5	64.8	64.1

TABLE 49. Percent of respondents answering "Yes" to making routine treatments based on the previous year's experience for the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	50.4	35.5	35.1	34.3
North Central	430	47.9	36.3	36.0	35.1
Northeast	462	51.5	40.5	42.9	40.3
West Central	409	44.7	28.4	28.1	27.4
Central	366	43.7	28.4	29.0	27.9
East Central	283	51.6	38.9	40.6	38.5
Southwest	292	36.6	20.2	18.2	17.8
South Central	420	39.5	25.7	25.7	25.2
Southeast	428	44.2	30.6	30.1	29.9
State Totals	3580	45.9	32.0	32.2	31.1

TABLE 50. Percent of respondents answering "Yes" to making treatments based on identity, density, or population size for the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	70.8	57.1	56.3	55.7
North Central	430	70.7	61.9	60.9	60.5
Northeast	462	71.0	60.8	60.4	59.7
West Central	409	64.5	48.9	46.7	46.5
Central	366	66.1	50.8	50.5	50.0
East Central	283	75.6	68.2	67.1	66.8
Southwest	292	52.1	42.8	39.4	39.4
South Central	420	56.2	45.0	42.9	42.6
Southeast	428	61.2	48.4	47.4	47.0
State Totals	3580	65.6	53.8	52.5	52.1

TABLE 51. Percent of respondents answering "Yes" to using University/Extension treatment guidelines when making decisions for the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	51.8	45.7	46.1	45.5
North Central	430	54.4	49.5	47.7	47.7
Northeast	462	53.2	48.9	48.9	48.5
West Central	409	48.7	40.1	38.4	38.4
Central	366	45.9	38.5	38.5	38.0
East Central	283	56.9	54.4	54.4	54.1
Southwest	292	45.9	41.1	40.4	39.7
South Central	420	36.4	30.7	31.2	30.5
Southeast	428	44.4	38.8	38.6	38.6
State Totals	3580	48.6	42.9	42.5	42.2

TABLE 52. Percent of respondents answering "Yes" to using mechanical control methods for the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	46.9	33.3	32.9	32.0
North Central	430	55.1	41.6	39.5	39.3
Northeast	462	66.2	51.5	51.3	50.4
West Central	409	43.0	28.9	26.9	26.4
Central	366	57.4	41.0	40.2	39.6
East Central	283	65.0	53.7	51.9	51.6
Southwest	292	38.0	23.6	23.6	23.3
South Central	420	43.6	31.4	31.4	30.7
Southeast	428	58.2	41.6	40.4	40.2
State Totals	3580	52.7	38.5	37.6	37.1

TABLE 53. Percent of respondents answering "Yes" to considering pest resistance when selecting varieties to manage pests in the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	46.9	42.7	44.5	42.0
North Central	430	45.6	41.2	41.4	40.0
Northeast	462	48.7	43.5	45.2	42.0
West Central	409	33.0	28.1	29.1	27.1
Central	366	34.2	28.7	29.8	28.1
East Central	283	50.9	47.7	50.2	46.3
Southwest	292	26.0	21.2	21.9	20.9
South Central	420	29.0	25.5	25.7	25.0
Southeast	428	36.0	32.2	32.7	31.5
State Totals	3580	39.3	34.9	35.9	34.0

TABLE 54. Percent of respondents answering "Yes" to alternating pesticides to avoid resistance in the different pest categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	50.8	41.0	42.0	40.8
North Central	430	47.9	39.8	39.8	39.3
Northeast	462	53.9	45.9	46.1	45.5
West Central	409	36.7	26.7	26.4	26.2
Central	366	39.9	33.6	34.2	33.1
East Central	283	58.3	54.4	53.7	53.7
Southwest	292	30.8	21.2	20.9	20.9
South Central	420	28.6	23.3	23.6	23.1
Southeast	428	39.7	34.6	34.6	34.3
State Totals	3580	43.2	35.7	35.8	35.3

TABLE 55. Percent of respondents answering "Yes" to rotating crops for managing pests in the different categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	64.3	57.6	58.2	56.7
North Central	430	60.0	54.9	56.7	54.7
Northeast	462	60.6	56.7	58.0	56.5
West Central	409	60.9	49.9	51.1	48.9
Central	366	51.4	45.1	46.7	44.3
East Central	283	68.9	63.3	65.4	63.3
Southwest	292	42.1	31.5	35.3	30.8
South Central	420	52.9	45.5	46.9	45.0
Southeast	428	58.6	52.8	53.5	51.9
State Totals	3580	58.1	51.3	52.8	50.7

TABLE 56. Percent of respondents answering "Yes" to using predictive models to schedule practices for managing pests in the different categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	17.1	15.1	15.5	14.5
North Central	430	14.0	12.3	13.0	11.9
Northeast	462	19.3	18.4	18.4	16.9
West Central	409	12.0	10.0	9.8	9.5
Central	366	11.2	9.3	9.8	9.3
East Central	283	21.6	21.2	21.2	20.5
Southwest	292	7.9	5.1	5.1	5.1
South Central	420	9.0	8.3	8.6	8.3
Southeast	428	14.3	13.1	13.1	12.9
State Totals	3580	14.1	12.7	12.8	12.2

TABLE 57. Percent of respondents answering "Yes" to employing the services of a crop consultant to help manage pests in the different categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	16.3	14.9	14.9	14.7
North Central	430	11.4	10.0	10.0	10.0
Northeast	462	18.6	18.0	17.5	17.5
West Central	409	11.7	9.3	9.3	9.0
Central	366	11.5	9.6	9.3	9.3
East Central	283	29.0	27.6	27.9	27.6
Southwest	292	12.3	10.3	9.9	9.9
South Central	420	16.4	15.2	15.0	14.8
Southeast	428	21.7	19.4	18.9	18.9
State Totals	3580	16.3	14.7	14.6	14.4

TABLE 58. Percent of respondents answering "Yes" to INCREASING the use of genetically modified crops to help manage pests in the different categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	9.2	8.8	8.8	8.8
North Central	430	9.3	8.1	7.9	7.9
Northeast	462	16.2	13.6	13.6	13.4
West Central	409	7.3	5.6	5.6	5.6
Central	366	5.5	3.8	3.8	3.8
East Central	283	20.5	16.3	15.9	15.9
Southwest	292	6.2	3.8	3.8	3.8
South Central	420	4.5	3.8	3.6	3.6
Southeast	428	12.6	11.0	10.5	10.5
State Totals	3580	10.0	8.3	8.2	8.2

TABLE 59. Percent of respondents answering "Yes" to DECREASING the use of genetically modified crops to help manage pests in the different categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	1.6	1.4	1.4	1.4
North Central	430	2.3	2.3	2.3	2.3
Northeast	462	1.7	1.3	1.3	1.3
West Central	409	2.0	1.7	1.5	1.5
Central	366	3.8	3.6	3.6	3.6
East Central	283	3.5	3.2	2.8	2.8
Southwest	292	0.7	0.7	0.7	0.7
South Central	420	1.0	1.0	1.0	1.0
Southeast	428	2.1	1.6	1.6	1.6
State Totals	3580	2.0	1.8	1.8	1.8

TABLE 60. Percent of respondents answering "Yes" to using the internet to find information about managing pests in the different categories and those responding "Yes" for all three pest categories

District	Total Responses	Weed Management	Insect Management	Plant Disease Management	Weed+Insect+Disease
		----------	----------	%	----------
Northwest	490	23.9	21.8	21.6	21.6
North Central	430	20.5	19.5	19.5	19.5
Northeast	462	18.6	17.3	17.3	17.3
West Central	409	17.8	15.9	15.2	15.2
Central	366	13.9	13.1	13.4	13.1
East Central	283	25.4	25.1	25.1	25.1
Southwest	292	15.8	13.7	13.7	13.7
South Central	420	13.8	12.4	12.1	12.1
Southeast	428	12.4	11.4	12.1	11.4
State Totals	3580	18.0	16.6	16.6	16.5

Pesticide Use and Pest Management Practices for Major Crops in North Dakota - 2000

ER-79
October 2002

P. Glogoza, M. McMullen, R. Zollinger, A. Thostenson,
T. DeJong, W. Meyer, N. Schauer, J. Olson

North Dakota State University
NDSU Extension Service

PESTICIDE DRIFT PROBLEMS AND MANAGEMENT

Spray drift during pesticide applications is an increasing concern in agriculture. Diversification of crops, more active and non-selective herbicides, and a greater awareness of pesticides in the environment have caused spray drift management to become every applicator's business. Spray drift is the movement of a pesticide through the air, during or after application, to a site other than the intended target. Drift may occur as vaporized active pesticide from the application site, but it is usually the physical movement of very small drops from the target area.

To obtain some baseline information on spray drift issues, survey respondents were asked questions regarding their experiences with pesticide spray drift problems and methods they use to manage drift.

Of the 3,580 respondents, 8.9% reported having experienced spray drift injury on their farm (Table 61). The average was 1.5 incidents per report to the enumerator, with an average of 28.7 acres affected for each incident. Responses were similar for all reporting districts.

A number of drift control methods are available to applicators. They include proper volume selection, drift retarding nozzles and adjuvants, and shielded spray booms.

Of particular interest was the spray volume used for postemergent herbicides. The most frequently used volume range was five to 10 gallons per acre, reported by 62.8% of the respondents (Table 62). The second most frequently used range was 2.5 to five gallons per acre, reported by 25.4% of the respondents. By reducing spray volume, the herbicide concentration increases to maintain the same dose of active ingredient. As spray volume is reduced, the droplet size decreases, and increases drift potential.

Potential drift problems associated with reduced volumes can be addressed through the use of nozzles, adjuvants and shields. Of these practices, 16.4% used drift retarding nozzles, 15.3% used drift retarding adjuvants, and 11.6% used spray boom shields (Table 63). Other methods, such as reduced pressure, increased nozzle size, or watching wind speed were mentioned by 31.5% of the respondents.

TABLE 61. Respondents who indicated pesticide drift injury, their number of incidents, and the acres affected

District	Total Responses	% Reporting Drift Injury	Incidents Reported	Avg. Incidents per Report	Affected Acres	Acres Affected per Report
Northwest	490	11.0	77	1.4	1313	24.3
North Central	430	10.9	68	1.5	1480	31.5
Northeast	462	10.6	76	1.6	1771	36.1
West Central	409	7.1	39	1.3	344	11.9
Central	366	10.1	59	1.6	1130	30.5
East Central	283	9.5	41	1.5	781	28.9
Southwest	292	5.1	28	1.9	756	50.4
South Central	420	4.5	30	1.6	465	24.5
Southeast	428	9.3	61	1.5	1043	26.1
State Totals	3580	8.9	479	1.5	9083	28.7

TABLE 62. Spray volume used by respondents when applying postemergent herbicides with ground spray equipment

Spray Volume (gallons per acre)	Respondents	
	Total	%
2.5 to 5	544	25.4
5 to 10	1345	62.8
10 to 15	212	9.9
15 to 20	31	1.5
greater than 20	10	0.5

TABLE 63. Percent of respondents who managed spray drift using different practices

District	Total Responses	Drift Retarding Nozzles	Drift Retarding Adjuvants	Sprayer Boom Shields	Other Methods
		----------	%	----------	
Northwest	490	20.2	18.8	17.3	35.3
North Central	430	20.0	18.6	13.3	31.2
Northeast	462	18.4	18.4	12.8	31.0
West Central	409	14.9	10.3	7.3	34.5
Central	366	12.8	13.4	7.9	31.1
East Central	283	23.0	22.3	11.3	35.0
Southwest	292	13.7	8.9	13.7	30.5
South Central	420	9.3	7.6	5.2	25.7
Southeast	428	15.4	18.5	14.0	29.9
State Totals	3580	16.4	15.3	11.6	31.5

APPENDIX A

North Dakota Agricultural Statistics Service

P.O. Box 3166
Fargo, ND 58108-3166
701-239-5306
FAX: 701-239-5613
nass-nd@nass.usda.gov
http:www.nass.usda.gov/nd/

NASS
FACT FINDERS FOR AGRICULTURE
UNITED STATES DEPARTMENT OF AGRICULTURE

Douglas Hartwig
State Statistician
William Meyer
Deputy State Statistician

February 16, 2001

Dear North Dakota Farm Operator:

Help us keep the record straight! Managing pest problems in agriculture is a challenge you face every growing season. Your background in handling these demands is unique. When it comes to pesticides in agriculture, much of the controversy over their usage is fueled by misinformation. It is vitally important that current, accurate pesticide usage information is available to demonstrate that producers are good stewards of the land. This study will provide a profile of pesticide use and pest management practices at state and district levels for North Dakota.

This study is a joint undertaking of the North Dakota State University Extension Service, North Dakota Department of Agriculture and the North Dakota Agricultural Statistics Service. Through this cooperative effort, we are able to provide reliable results in a very efficient manner.

The study will be conducted as a telephone interview. Interviews will begin in late February and continue through March. Information that will be requested includes crop acres, use of seed treatments, acres and crops treated with specific pesticides, use of genetically modified crops and information about pest management practices and decisions.

Regarding the interview, confidentiality is assured and response will be voluntary. Since you are only part of a small group selected from across the state, we hope you understand the importance and value of this information and will be willing to participate when contacted. The results of the survey will be available by Fall 2001 through NDSU and your local extension agent.

Thank you in advance for your time and cooperation.

Sincerely,

Sharon Anderson, Director
Extension Service
North Dakota State University

William Meyer
Deputy State Statistician
ND Agricultural Statistics Service

North Dakota
Agricultural
Statistics Service
U.S. Department of Agriculture - National Agricultural Statistics Service
P.O. Box 3166, Fargo, ND 58108-3166
Telephone: 701-239-5306 FAX: 701-239-5613
E-mail: nass-nd@nass.usda.gov

North Dakota Pesticide Use Survey Instrument for 2000 Cropping Year

I. ACREAGE AND TREATMENTS BY CROP

REPORT FOR THE FARM YOU OPERATE *(Include Land Rented From Others, Exclude Land Rented Out)*

2000 Crop	Total Acres Planted	Acres Planted with Treated Seed *(Exclude Inoculant)*		Number of Acres Treated for Each of the Following: *(Include 1999 applications for 2000 Crop)*			
		Total	With on Farm Treated Seed	Weed Control *(Herbicides)*	Insect Control *(Insecticides) (Exclude seed treatment)*	Disease Control *(Fungicides) (Exclude seed treatment)*	Dessicants *(Vine killers, etc.)*
WHEAT *(Durum, Other Spring, Winter)*	1001	1002	1003	1004	1005	1006	1007
BARLEY	1011	1012	1013	1014	1015	1016	1017
OATS	1021	1022	1023	1024	1025	1026	1027
FLAX	1031	1032	1033	1034	1035	1036	1037
CORN	1041	1042	1043	1044	1045	1046	1047
SUNFLOWER	1051	1052	1053	1054	1055	1056	1057
SOYBEANS	1061	1062	1063	1064	1065	1066	1067
FIELD PEAS	1071	1072	1073	1074	1075	1076	1077
LENTILS	1081	1082	1083	1084	1085	1086	1087
POTATOES	1091	1092	1093	1094	1095	1096	1097
SUGARBEETS	1101	1102	1103	1104	1105	1106	1107
DRY EDIBLE BEANS	1111	1112	1113	1114	1115	1116	1117
CANOLA	1121	1122	1123	1124	1125	1126	1127
CRAMBE	1131	1132	1133	1134	1135	1136	1137
SAFFLOWER	1141	1142	1143	1144	1145	1146	1147
MUSTARD, DRY	1151	1152	1153	1154	1155	1156	1157
ALFALFA HAY	1161	1162	1163	1164	1165	1166	1167
OTHER HAY	1171	1172	1173	1174	1175	1176	1177
CRP	1301	1302	1303	1304	1305	1306	1307
FALLOW AND SET ASIDE ACREAGE	1311	1312	1313	1314	1315	1316	1317
PASTURE AND RANGE	1321	1322	1323	1324	1325	1326	1327
TOTAL ACRES OPERATED	1501						

II. FARM TREATED SEED - for 2000 crop *(Please report for seed that was treated on your farm and used on your operation, excluding inoculants. Include on-farm custom and self applied treatment.)*

PRODUCT USED TO TREAT *(Refer to enclosed list)*	Office Use	Acres Seeded With this Seed	Method 1 = Drill box 2 = Auger 3 = Other	PRODUCT USED TO TREAT *(Refer to enclosed list)*	Office Use	Acres Seeded With this Seed	Method 1 = Drill box 2 = Auger 3 = Other
WHEAT SEED *(All)*				CANOLA SEED			
	2001	2002	2003		2401	2402	2403
	2011	2012	2013		2411	2412	2413
	2021	2022	2023		2421	2422	2423
	2031	2032	2033	SOYBEAN SEED			
	2041	2042	2043		2501	2502	2503
BARLEY SEED					2511	2512	2513
	2101	2102	2103	POTATO SEED			
	2111	2112	2113		2601	2602	2603
	2121	2122	2123		2611	2612	2613
OAT SEED					2621	2622	2623
	2201	2202	2203	FIELD PEA SEED			
	2211	2212	2213		2701	2702	2703
FLAX SEED					2711	2712	2713
	2301	2302	2303	OTHER SEED			
	2311	2312	2313		2801	2802	2803
	2321	2322	2323		2811	2812	2813

III. USAGE OF INDIVIDUAL PESTICIDES ON 2000 CROPS - Include applications after September 1, 1999 on crops for 2000 harvest. *(Please report below the acres treated with each individual chemical during 2000 by crop and/or land use. If pesticides were applied in combination, report each separately.* ***Exclude seed treatment and inoculants.****)*

NAME OF PESTICIDE USED *(Please list chemicals used. If necessary, refer to the enclosed list)*	Office Use	Acres Treated	No. of Applications	APPLICATOR 1 = Self 2 = Custom	METHOD 1 = Aerial 2 = ground	NAME OF PESTICIDE USED *(Please list chemicals used. If necessary, refer to the enclosed list)*	Office Use	Acres Treated	No. of Applications	APPLICATOR 1 = Self 2 = Custom	METHOD 1 = Aerial 2 = ground
WHEAT *(Durum, Other Spring, Winter)*						BARLEY					
	3001	3002	3003	3004	3005		3101	3102	3103	3104	3105
	3011	3012	3013	3014	3015		3111	3112	3113	3114	3115
	3021	3022	3023	3024	3025		3121	3122	3123	3124	3125
	3031	3032	3033	3034	3035		3131	3132	3133	3134	3135
	3041	3042	3043	3044	3045		3141	3142	3143	3144	3145
	3051	3052	3053	3054	3055		3151	3152	3153	3154	3155
OATS						FLAX					
	3201	3202	3203	3204	3205		3301	3302	3303	3304	3305
	3211	3212	3213	3214	3215		3311	3312	3313	3314	3315
	3221	3222	3223	3224	3225		3321	3322	3323	3324	3325
CORN						SOYBEANS					
	3401	3402	3403	3404	3405		3501	3502	3503	3504	3505
	3411	3412	3413	3414	3415		3511	3512	3513	3514	3515
	3421	3422	3423	3424	3425		3521	3522	3523	3524	3525
	3431	3432	3433	3434	3435		3531	3532	3533	3534	3535
SUNFLOWER						DRY EDIBLE BEANS					
	3601	3602	3603	3604	3605		3701	3702	3703	3704	3705
	3611	3612	3613	3614	3615		3711	3712	3713	3714	3715
	3621	3622	3623	3624	3625		3721	3722	3723	3724	3725

III. USAGE OF INDIVIDUAL PESTICIDES ON 2000 CROPS CONTINUED

NAME OF PESTICIDE USED *(Please list chemicals used. If necessary, refer to the enclosed list)*	Office Use	Acres Treated	No. of Appli-cations	APPLI-CATOR 1 = Self 2 = Custom	METHOD 1 = Aerial 2 = ground	NAME OF PESTICIDE USED *(Please list chemicals used. If necessary, refer to the enclosed list)*	Office Use	Acres Treated	No. of Appli-cations	APPLI-CATOR 1 = Self 2 = Custom	METHOD 1 = Aerial 2 = ground
POTATOES						SUGARBEETS					
	3801	3802	3803	3804	3805		3901	3902	3903	3904	3905
	3811	3812	3813	3814	3815		3911	3912	3913	3914	3915
	3821	3822	3823	3824	3825		3921	3922	3923	3924	3925
	3831	3832	3833	3834	3835		3931	3932	3933	3934	3935
	3841	3842	3843	3844	3845		3941	3942	3943	3944	3945
	3851	3852	3853	3854	3855		3951	3952	3953	3954	3955
	3861	3862	3863	3864	3865		3961	3962	3963	3964	3965
CANOLA						CRAMBE					
	4001	4002	4003	4004	4005		4101	4102	4103	4104	4105
	4011	4012	4013	4014	4015		4111	4112	4113	4114	4115
	4021	4022	4023	4024	4025		4121	4122	4123	4124	4125
SAFFLOWER						MUSTARD, DRY					
	4201	4202	4203	4204	4205		4301	4302	4303	4304	4305
	4211	4212	4213	4214	4215		4311	4312	4313	4314	4315
	4221	4222	4223	4224	4225		4321	4322	4323	4324	4325
FIELD PEAS						LENTILS					
	4401	4402	4403	4404	4405		4501	4502	4503	4504	4505
	4411	4412	4413	4414	4415		4511	4512	4513	4514	4515
	4421	4422	4423	4424	4425		4521	4522	4523	4524	4525
ALFALFA HAY						OTHER HAY					
	4601	4602	4603	4604	4605		4701	4702	4703	4704	4705
	4611	4612	4613	4614	4615		4711	4712	4713	4714	4715
	4621	4622	4623	4624	4625		4721	4722	4723	4724	4725
CRP						FALLOW, SET ASIDE ACREAGE					
	4801	4802	4803	4804	4805		4901	4902	4903	4904	4905
	4811	4812	4813	4814	4815		4911	4912	4913	4914	4915
	4821	4822	4823	4824	4825		4921	4922	4923	4924	4925

IV. Genetically modified crops are available in North Dakota for corn, soybeans, canola, and potatoes. Please report the acres you planted of these crops in 2000.

CORN	*Bt* variety for insect resistance	Glyphosate resistant variety	Liberty resistant variety	Clearfield, non-GM, herbicide resistant variety	Stacked Gene Variety (*Bt* + Herbicide)
Acres =	6101	6102	6103	6104	6105

SOYBEANS	Glyphosate resistant variety
Acres =	6111

POTATOES	*Bt* variety for insect resistance
Acres =	6121

CANOLA	Glyphosate resistant variety	Liberty resistant variety	Clearfield, non-GM, herbicide resistant variety
Acres =	6131	6132	6133

V. Please report crops you grew in 2000 and the pest problem *(Weed, Insect, Disease)* that you did not have a pesticide *(Herbicide, Insecticide, Fungicide)* available to adequately manage the problem.

CROP	Office Use	Pest Problem with no pesticide available *(see codes)*		
		WEED	INSECT	DISEASE
	6201	6202	6203	6204
	6211	6212	6213	6214
	6221	6222	6223	6224
	6231	6232	6233	6234

Codes:

Weeds
1 = annual broadleaf
2 = annual grasses
3 = perennial weeds
4 = other _____

Insects
1 = grasshoppers
2 = soil insects *(example, wireworms)*
3 = caterpillar(s)
4 = plant bugs *(example, Lygus, leafhoppers)*
5 = beetles
6 = aphids
7 = other _____

Diseases
1 = leaf diseases *(example, rust, Septoria, brown spot, Cercospora)*
2 = head diseases *(sclerotinia , white mold, head scab)*
3 = seed diseases *(example, mildew, Aschochyta)*
4 = root diseases *(example, blackleg, Rhizoctonia, Phytopthora, Fusarium, Helminthsporium, Aphonomyces)*
5 = other _____

VI. Your pest management decisions and practices **Yes = 1 No = 3**

Do you . . . answer Yes or No for each pest category	Weeds	Insects	Diseases
• scout fields regularly for pests?	6301	6302	6303
• make routine treatments for pests you experienced the previous year?	6311	6312	6313
• make treatments based on identity, density, or population size?	6321	6322	6323
• use University or Extension treatment guidelines for making pest treatment decisions?	6331	6332	6333
• use tilling, chopping, mowing, burning of field edges, lanes, ditches, roadways or fence lines to manage pests in your fields?	6341	6342	6343
• consider pest resistence when selecting varieties to manage pests?	6351	6352	6353
• alternate pesticides to keep pests from becoming resistant to pesticides?	6361	6362	6363
• rotate crops to manage pests?	6371	6372	6373
• use predictive models to schedule pest management practices?	6381	6382	6383
• employ the services of a crop consultant to help manage pests?	6391	6392	6393
• plan to **INCREASE** acres of genetically modified crops used for pest management?	6401	6402	6403
• plan to **DECREASE** acres of genetically modified crops used for pest management?	6411	6412	6413
• use internet to find information necessary for pest management decisions?	6421	6422	6423

At what spray volume (gallons per acre, *gpa*) do you normally apply postemergence herbicides by ground? . . .

1	2.5 to 5 gpa
2	5 to 10 gpa
3	10 to 15 gpa
4	15 to 20 gpa
5	greater than 20 gpa

. . . . . **Code** 6501

Have you experienced pesticide spray drift injury on your farm during the past four years? . . . . Yes = 1 No = 3 — 6601

If **YES**, how many incidents? . . . . . Number — 6602

If **YES**, estimated acres affected? . . . . . Acres — 6603

Yes = 1 No = 3

Have you managed spray drift by using - drift-retarding nozzles? 6604

- drift-retarding adjuvants? 6605
- sprayer boom shields? 6606
- other? _____ 6607

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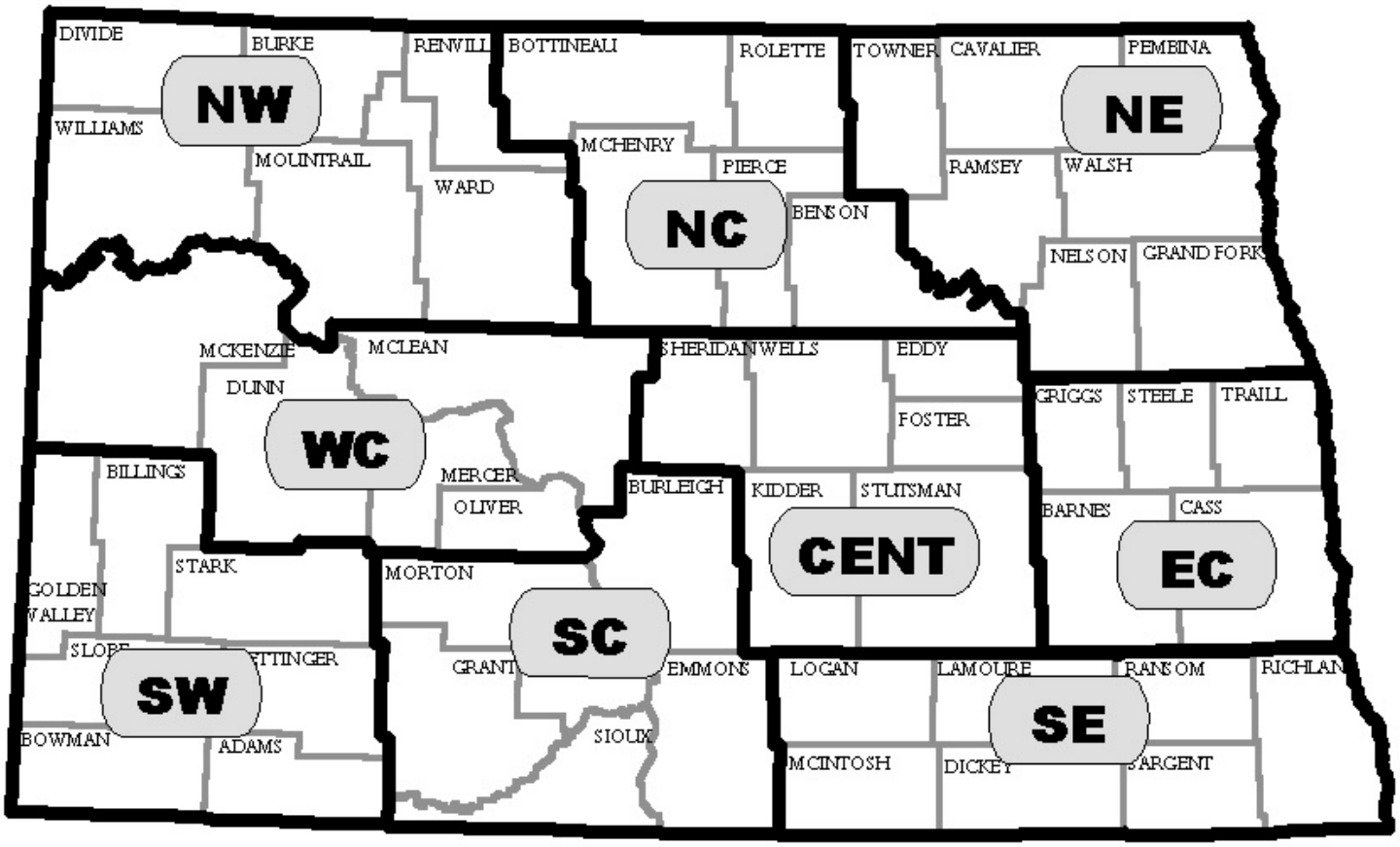
APPENDIX B

North Dakota
Agricultural Statistics Districts



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APPENDIX C

Common and Trade Names of Pesticides

Common Name	Trade Name	Common Name	Trade Name
2,4-D	2,4-D Amine	2,4-D + Dicamba	Weed Master
2,4-D	2,4-D Amine 4 pound	2,4-D + Ester	Weedone 638
2,4-D	2,4-D Ester	2,4-DB	2,4-DB
2,4-D	2,4-D LV Ester	2,4-DB	2,4-DB 1.75
2,4-D	2,4-D LV Ester 6	2,4-DB	Aqua-Kleen
2,4-D	2,4-D LV-4	2,4-DB	Butyrac 175
2,4-D	2,4-D LV-6	2,4-DB	Butyrac 200
2,4-D	Agsco 400	Abamectin	Agrimek
2,4-D	Barrage	Acephate	Orthene
2,4-D	Class 40 A	Acetochlor	Degree 3.8ME
2,4-D	Class 80 A WSP	Acetochlor	TopNotch
2,4-D	Cornbelt 2,4-D	Acetochlor + Atrazine	Degree Xtra
2,4-D	Cornbelt Hi-Pen	Acetochlor + EPTC	DoublePlay
2,4-D	Cornbelt LV-4	Acetochlor + Safener	Harness
2,4-D	Cornbelt LV-6	Acetochlor + Safener	Surpass
2,4-D	Dacamine 4D	Acetochlor + Safener + Atrazine	Harness Xtra
2,4-D	Envert 171	Acetochlor + Safener + Atrazine	Surpass 100
2,4-D	Formula 40	Acifluorfen	Blazer
2,4-D	Hi-Dep	Acifluorfen	Status
2,4-D	Low Vol Ester 4	Acifluorfen	Ultra Blazer
2,4-D	Low Vol Ester 6	Acifluorfen + Bentazon	Galaxy
2,4-D	Phenoxy	Acifluorfen + Bentazon	Storm
2,4-D	Salvo	Alachlor	Arena
2,4-D	Savage	Alachlor	Confidence
2,4-D	SEE 2,4-D LV4	Alachlor	Cornbelt Saddle
2,4-D	Solution	Alachlor	Crop Star GB
2,4-D	Sulv	Alachlor	Judge
2,4-D	Wedar 64	Alachlor	Lasso
2,4-D	Weed Pro 3# Amine	Alachlor	Lasso II
2,4-D	Weed Rhap A-4D	Alachlor	Micro Tech
2,4-D	Weed Rhap LV-6D	Alachlor	Partner
2,4-D	Weedar 64	Alachlor	Stall
2,4-D	Weedone 170	Alachlor	Stall MT
2,4-D	Weedone LV 4	Alachlor + Atrazine	Bullet
2,4-D	Weedone LV 6	Alachlor + Atrazine	Lariat
2,4-D	Weed Pro 4# Low Vol	Alachlor + Glyphosate	Bronco
2,4-D	Weed Pro 6# Low Vol	Alachlor + Trifluralin	Cannon
2,4-D	DPD Ester Brush Killer	Alachlor + Trifluralin	Freedom
2,4-D	Brush Rhap Low Volatile	Aldicarb	Temik
2,4-D + Dicamba	Brash	Ametryn	Evic

Common Name	Trade Name
Amitrole	Amitrol-T
Atrazine	Cornbelt Atrazine 4L
Atrazine	Cornbelt Atrazine 90 D
Atrazine	Aatrex
Atrazine	Aatrex Nine-O
Atrazine	Atrazine
Atrazine	Atrazine 4L
Atrazine	Atrazine 90
Atrazine	Atrazine 90 DF
Atrazine	Atrazine 90 WDG
Atrazine	Sostrum Atrazine
Atrazine	Weed Pro Atrazine
Atrazine	Farmland Liquid Atrazine
Atrazine + 2,4-D	Shotgun
Atrazine + Dimethenamid	Guardsman
Atrazine + Flufenacet + Metribuzin	Axiom AT
Atrazine + Glyphosate	ReadyMaster
Atrazine + Metolachlor	Bicep II
Azadirachtin	Margosan-O
Azinphos-methyl	Guthion
Azoxystrobin	Quadris
Bacillus subtilis	Kodiak
Bacillus Thuringiensis	Bt
Bacillus thuringiensis	Dipel
Benefin	Balan
Benlate	Benlate
Benomyl	Benlate
Bentazon	Ascend
Bentazon	Basagran
Bentazon	Depend
Bentazon	Leader
Bentazon	Pacer
Bentazon	Pledge
Bentazon	Scope
Bentazon + Atrazine	Laddok S-12
Bentazon + Sethoxydim	Rezult
Bifenthrin	Capture
Bromacil	Hyvar XL
Bromacil + Diuron	Krovar I
Bromacil + Diuron + Sodium Chlorat	Total 94G
Bromoxynil	Broclean 2EC
Bromoxynil	Bromox
Bromoxynil	Buctril
Bromoxynil	Connect 20WSP
Bromoxynil	Moxynil
Bromoxynil + Atrazine	Bromox + Atrazine
Bromoxynil + Atrazine	Brozine
Bromoxynil + Atrazine	Buctril + Atrazine
Bromoxynil + MCPA	Bison
Bromoxynil + MCPA	Bromox MCP Ester
Bromoxynil + MCPA	Bromox MCPA 2-2

Common Name	Trade Name
Bromoxynil + MCPA	Bronate
Bromoxynil + MCPA Ester	Bromac
Bromoxynil + MCPAe + Fenoxaprop-P	Bronate Pro
Bronate + Agsco 400	B-4
Butylate + Atrazine + Safener	Sutazine +
Butylate + Safener	Sutan +
Captan	Captan
Captan	Nu-Gro Captan
Captan	Nu-Gro Soybean Seed Protectant
Captan + Carboxin	Bean Guard
Captan + Carboxin	Seed Mate Captan Vitavax
Captan + Carboxin	Nu-Gro Captan Carboxin
Captan + Diazinon	Agrox 2-Way
Captan + Lindane	Gammasan
Captan + Lindane	Isotox Seed Treater F
Captan + PCNB + Thiabendazole	Rival
Captan + Thiabendazole	Agrosol
Carbaryl	Sevin
Carbofuran	Furadan
Carboxin	Vitavax
Carboxin + Diazinon + Lindane	Germate Plus
Carboxin + Imaz. + Thiabendazole	Vitavax Extra
Carboxin + Maneb + Lindane	DB Green + Vitavax
Carboxin + Maneb + Lindane	Enhance Plus
Carboxin + Thiram	RTU-Vitavax-Thiram
Carboxin + Thiram	Vitavax 200
Carboxin + Thiram	Vitavax Pour-On
Carboxin + Thiram + Lindane	VTL
Carboxin + Thiram + Metalaxyl	Stilletto
Carfentrazone	Aim 40DF
Chlorethoxyfos	Fortress
Chlorimuron	Classic
Chloroneb	Chloroneb
Chlorothalonil	Bravo
Chlorothalonil	Supanil 720
Chlorpyrifos	Lorsban
Chlorpyrifos	Lorsban 30
Chlorpyrifos	Lorsban 50-SL
Chlorpyrifos-Methyl	Reldon
Chlorsulfuron	Glean
Clethodim	Prism
Clethodim	Select
Clodinafop	Discover 2EC
Clomazone	Command
Clopyralid	Stinger
Clopyralid	Transline
Clopyralid + 2,4-D	Curtail
Clopyralid + 2,4-D + Flumetsulam	Scorpion III
Clopyralid + Flumetsulam	Hornet
Clopyralid + MCPA	Curtail M
Clopyralid + Triclopyr	Redeem

Common Name	Trade Name
Cloransulam + Methyl	FirstRate
Copper	Basicop
Copper	Champ
Copper	Champion
Copper	Kocide
Copper	Top Cop Tribasi
Copper + Sulfur hydroxide	Kocide 404S
Cyanazine	Bladex
Cyanazine	Cy-Pro
Cyanazine + Atrazine	Cy-Pro AT
Cyanazine + Atrazine	Extrazine II
Cycloate	Ro-Neet
Cyfluthrin	Baythroid
Cyfluthrin	Tempo
Cyfluthrin+Tebupirimiphos	Aztec
Cypermathrin	Cymbush
DCPA	Dacthal
Desmedipham	Betanex
Desmedipham + Phenmedipham	Betamix
Desmedipham + Phenmedipham + Ethofumesate	Progress
DesSodium Chlorate	Chlorate Defoliant
Diazinon	Diazinon
Diazinon	Diazinon
Dicamba	Banvel
Dicamba	Banvel SGF
Dicamba	Clarity
Dicamba	Sterling
Dicamba + Atrazine	Marksman
Dicamba + Atrazine	Sterling Plus
Dicamba + Diflufenzopyr + Nicosulfuron	Celebrity Plus
Dicamba + Diflufenzopyr	Distinct
Dicamba + Imazethapyr	Resolve CP
Dicamba + Imazethapyr	Resolve SG
Dicamba + Primisulfuron	Northstar
Dichlobenil	Casoron
Dichlorvos, DDVP	Vapona
Diclofop	Hoelon
Dicofol	Kelthane
Diethatyl	Antor
Difenoconazole	Dividend
Difenzoquat	Avenge
Dimethenamid	Frontier
Dimethenamid	Outlook 6EC
Dimethoate	Cygon
Dimethoate	Digon
Dimethoate	Dimethoate
Diquat	Diquat
Diquat	Diquat
Disulfoton	Di-Syston
Dithiocarbamates	Manzate

Common Name	Trade Name
Diuron	Diuron
Diuron	Diuron 80 WDG
Diuron	Karmex
Diuron + Bromacil	Weed Blast
Encapsulated methyl parathion	Penncap M
Endosulfan	Phaser
Endosulfan	Thiodan
Endothall	Des-i-cate
Endothall	Herbicide 273
EPTC	Eptam
EPTC + Safener	Eradicane
EPTC + Safener + extender	Eradicane Extra
Esfenvalerate	Asana XL
Ethalfluralin	Sonalan
Ethametsulfuron	Muster 75DF
Ethofumesate	Nortron SC
Ethoprop	Mocap
Ethyl parathion	Parathion
Fenoxaprop	Acclaim
Fenoxaprop	Option II
Fenoxaprop	Silverado
Fenoxaprop + 2,4-D + MCPA	Tiller
Fenoxaprop + Bromoxynil	Laser
Fenoxaprop + MCPA	Dakota
Fenoxaprop+MCPA+ Thifensulfuron+Tribenuron	Cheyenne
Fenoxaprop-P + Safener	Puma
Fenvalerate	Pydrin
Fipronil	Regent
Fluazifop-P	Fusilade DX
Fluazifop-P + Fenoxaprop	Fusion
Flucarbazone	Everest 70WDG
Fludioxonil	Celest
Flumetsulam	Python
Flumetsulam + Clopyralid	Broadstrike Plus
Flumetsulam + Metolachlor	Broadstrike + Dual
Flumetsulam + Trifluralin	Broadstrike + Treflan
Flumiclorac + Lactofen	Stellar
Flumioxazin	Valor
Fluroxypyr	Starane
Fluroxypyr + 2,4-D Amine	Starane + Saber
Fluroxypyr + 2,4-D Ester	Starane + Esteron
Fluroxypyr + 2,4-D Ester	Starane + Salvo
Fluroxypyr + MCPA Ester	Starane + MCPA
Fluroxypyr + MCPA Ester	Starane + Sword
Fluvalinate	Mavrik
Fomesafen	Flexstar
Fonofos	Dyfonate
Formaldehyde	Formaldehyde
Fosamine	Krenite
Fosamine	Krenite 4L
Glufosinate	Liberty

Common Name	Trade Name
Glyphosate	Accord
Glyphosate	Glyphomax 3AS
Glyphosate	Glyphomax Plus 3AS
Glyphosate	Glyphos
Glyphosate	Honcho
Glyphosate	Jury
Glyphosate	Mirage
Glyphosate	Pond Master
Glyphosate	Protocol
Glyphosate	Ranger
Glyphosate	Rascal
Glyphosate	Rattler
Glyphosate	Rodeo
Glyphosate	Roundup
Glyphosate	Roundup RT
Glyphosate	Roundup Ultra
Glyphosate	Roundup Ultra Dry
Glyphosate	Roundup Ultra Max
Glyphosate	Roundup Ultra RT
Glyphosate	Ruler
Glyphosate	Silhouette
Glyphosate	Touchdown
Glyphosate + 2,4-D	Landmaster BW
Glyphosate + Dicamba	Fallow Master
Halosulfuron	Permit
Hexazinone	Velpar
Imazalil	Double R
Imazalil	Flo-Pro IMZ
Imazalil	Imazalil
Imazalil	Nuzone
Imazameth	Plateau
Imazamethabenz	Assert
Imazamox	Raptor
Imazapyr	Arsenal
Imazapyr	Contain
Imazapyr + Diuron	Sahara
Imazethapyr	Pursuit
Imazethapyr + Glyphosate	Extreme
Imazethapyr + Imazapyr	Lightning
Imazethapyr + Pendimethalin	Pursuit Plus
Imidacloprid	Admire
Imidacloprid	Gaucho
Imidacloprid	Gaucho
Imidacloprid	Provado
Iprodione	Rovral
Isazophos	Triumph
Isophenfos	Oftanol
Isozaflutole	Balance
Lactofen	Cobra
Lambda Cyhalothrin	Karate
Lambda-Cyhalothrin	Warrior
Lindane	Lindane

Common Name	Trade Name
Linuron	Linex 4 L
Linuron	Linex 50 DF
Linuron	Lorox
Malathion	Malathion
Mancozeb	Dithane
Mancozeb	Dithane
Mancozeb	Grain Guard
Mancozeb	Mancozeb
Mancozeb	Mancozeb
Mancozeb	Manex II
Mancozeb	Manex II
Mancozeb	Manzate
Mancozeb	Penncozeb
Mancozeb	PST Plus Bark
Mancozeb	Spud Bark
Mancozeb + Cymoxanil	Curzate
Mancozeb + Cymoxanil	Manex C-8
Mancozeb + Dimethomorph	Acrobat MZ
Maneb	Maneb
Maneb + Lindane	DB Green
Maneb + Lindane	Granol NM
Maneb + Lindane	Maneb + Lindane
Maneb + Lindane	Seed Mate Maneb Lindane
Maneb + Streptomycin + Bark	Dustret A
Maneb + Thiabendazole	Granox Plus
Maneb + Triphenyltin hydro	Blite Out Plus
Maneb + Triphenyltin hydro	Pro-Tex
Maneb + Zinc	Maneb Plus Zinc F4
MCPA	MCP 2 Sodium Herbicide
MCPA	MCPA 4 Ester Herbicide
MCPA	MCPA Amine Herbicide
MCPA	Chiptox
MCPA	Class MCPA
MCPA	Class MCPE
MCPA	MCP Amine 4
MCPA	MCPA LV Ester
MCPA	MXL
MCPA	Rhomene
MCPA	Rhonox MCP Ester
MCPA	Sword
MCPA	Weedar Sodium MCPA
MCPA	Weedestroy
MCPA Ester	MXL 4EC
MCPA Ester/Bromoxynil	MXL - B 4EC
Mecoprop	MEC Amine D 4SL
Mesotrione	Callisto
Metalaxyl	Apron
Metalaxyl + Chlorothalo	Ridomil/Bravo
Metalaxyl + Mancozeb	Ridomil MZ58
Metalaxyl + PCNB	Apron-Terraclor
Methamidophos	Monitor
Methidathion	Supracide

Common Name	Trade Name
Methiocarb	Mesurol
Methomyl	Lannate
Methoxychlor	Marlate
Methyl parathion	Methyl parathion
Metiram	Polyram
Metolachlor	Dual 25G
Metolachlor	Dual II
Metolachlor	Dual IIG
Metolachlor	Pennant
Metolachlor + Atrazine + Glyphosate	Expert
Metolachlor + Cyanazine	Cycle
Metribuzin	Lexone
Metribuzin	Sencor
Metribuzin + Flufenacet	Domain
Metribuzin + Metolachlor	Boundary
Metribuzin + Metolachlor	Turbo
Metsulfuron	Ally
Metsulfuron	Escort
Metsulfuron + Chlorsulfuron	Finesse
Naled	Dibrom
Naptalam + 2,4-D	Rescue
Nicosulfuron	Accent
Nicosulfuron + Rimsulfuron	Steadfast
Nicosulfuron + Rimsulfuron + Atrazine	Basis Gold
Nicosulfuron + Rimsulfuron + Clopyralid	Accent Gold
Nosema Locustae	Nolobait
Nosema locustae fungus	NOLO (TM) Bait
Oryzalin	Surflan
Oxadiazon	Ronstar
Oxamyl	Vydate
Oxyfluorfen	Goal
Paraquat	Cyclone CF
Paraquat	Cyclone CF
Paraquat	Gramoxone Extra
Paraquat	Gramoxone Extra
Paraquat	Paraquat
Paraquat	Reglone
Paraquat	Reglone
Paraquat	Starfire
PCNB	RTU-PCNB
PCNB	TerraCoat
Pendimethalin	Pendimax
Pendimethalin	Pendulum
Pendimethalin	Pentagon
Pendimethalin	Prowl
Pendimethalin	Stomp
Permethrin	Ambush
Permethrin	Pounce
Phorate	Phorate
Phorate	Thimet

Common Name	Trade Name
Phosmet	Imidan
Phosphmidon	Phosphamidon
Picloram	Tordon 22K
Primisulfuran + Prosulfuron	Exceed
Primisulfuron	Beacon
Prochloraz	Omega
Prometon + others	Pramitol
Pronamide	Kerb
Propachlor	Ramrod
Propamocarb + Chlorothalonil	Tattoo C
Propanil	Propanil 4E
Propanil	Propanil 60 DF
Propanil	Stampede
Propanil + MCPA	Stampede CM
Propiconazole	Tilt
Prosulfuron	Peak
Prothiocarb	Previcur
Pymetrozine	Fulfill
Pyrazon	Pyramin
Pyrethrin	Pyrenone
Pyridate	Tough
Quinclorac	Drive 75DF
Quinclorac	Paramount 75DF
Quizalofop-P	Assure II
Reldan	Reldan
Resmethrin	Scourge
Ridomil	Ridomil
Rimsulfuron	Matrix
Rimsulfuron + Thifensulfuron	Basis
Sethoxydim	Poast
Sethoxydim	Poast Plus
Sethoxydim	Prestige
Sethoxydim	Ultima 160
Sethoxydim	Vantage
Simazine	Princep Caliber 90
Simazine	Simazine 4L
Simazine	Simazine 80 W
Simazine	Simazine 90 DF
Simazine	Simazine 90 WDG
Sodium Chlorate	Defol 6
Sodium Chlorate	Defol-6
Sodium Chlorate	Drexel Defol 6SL
Sodium Chlorate	Harvest Aid Liquid
Sodium Chlorate	Leafex-3
Sodium Chlorate	Sodium Chlorate
Sodium Chlorate	Sodium Chlorate 6
Spinosad	SpinTor, Tracer
Streptomycin	Agri-Strep
Streptomycin	AS-50
Sulfentrazone	Authority
Sulfentrazone	Spartan
Sulfentrazone/Cloransulam	Gauntlet

Common Name	Trade Name
Sulfometuron	Oust
Sulfosulfuron	Maverick 75DF
Sulfur	Microthiol
Sulfur	Sulfur
Sulfur	Sulfur DF
Sulfur	Super Six
Sulfur	That Flowable
Sulfur	Thiolux
Sulfur	Uniflow
Sulfur + Copper	Top Cop W
Sulfuric Acid	Sulfuric Acid
Tebuconazole	Folicur
Tebuconazole	Raxil
Tebuthiuron	Spike
Tefluthrin	Force
Terbacil	Sinbar
Terbufos	Counter
Tetracoazole	Eminent
Thiabendazole	LSP
Thiabendazole	Mertect
Thiabendazole	Sim-Tec Plus
Thiamethoxam + Apron + Maxim + Dividend	Helix
Thifensulfuron	Harmony
Thifensulfuron	Pinnacle
Thifensulfuron + Chlorimuron	Concert
Thifensulfuron + Chlorimuron	Reliance STS
Thifensulfuron + Tribenuron	Harmony Extra
Thiodicarb	Larvin
Thiophanate methyl	Dustret T
Thiophanate methyl	Tops 2.5D
Thiophanate methyl	Topsin M
Thiram	Gustafson 42S
Thiram	Thiram
Thiram	Triple Noctin
Thiram	Yield Shield
Thiram + Thiabendazole	Agrosol Pour-On
Thiram + Thiabendazole	Agrosol T
Tralkoxydim	Achieve
Tralomethrin	Scout X-TRA

Common Name	Trade Name
Triademefon	Bayleton
Triadimenol	Baytan
Triallate	Far-Go
Triallate + Trifluralin	Buckle
Triasulfuron	Amber
Tribenuron	Express
Triclopyr	Turflon Ester
Triclopyr + 2,4-D	Crossbow
Trifluralin	Cornbelt Trifluralin
Trifluralin	Class Trust
Trifluralin	Treflan
Trifluralin	Treflan 5
Trifluralin	Treflan 80 DC
Trifluralin	Treflan EC
Trifluralin	Treflan M.T.F.
Trifluralin	Treflan Pro-5
Trifluralin	Treflan TR-10
Trifluralin	Tri-4
Trifluralin	Trific
Trifluralin	Trific 60 DF
Trifluralin	Trifluralin 10G
Trifluralin	Trifluralin 4 AT
Trifluralin	Trifluralin 4 EC
Trifluralin	Trilin
Trifluralin	Trilin 10 G
Trifluralin	Trilin 4 AT
Trifluralin + Clomazone	Commence
Trifluralin + Imazethapyr	Passport
Trifluralin + Metribuzin	Salute
Triflusulfuron	UpBeet
Triphenyltin hydroxide	Du-Ter
Triphenyltin hydroxide	Super Tin
Vinclozloin	Ronilin
WSP Dithiopyr	Dimension Ultra 40
Zineb	Fir Bark