Expanded Minnesota Agricultural Statistics Pesticide Use Data

A Pilot Project using Data from the 2001 Agricultural Resource Management Study of the National Agricultural Statistics Service

August 2003

Compiled by:
Minnesota Agricultural Statistics Services
Minnesota Department of Agriculture

Funded by:
U.S. Environmental Protection Agency
Minnesota Agricultural Statistics Services
Minnesota Department of Agriculture
U.S. Department of Agriculture's North Central Pest Management Center – Minnesota Project

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Pilot Project Report Summary

The Minnesota Department of Agriculture (MDA) developed a pilot project to determine whether utilization of data collection and analysis methods available through the Minnesota Agricultural Statistics Service (MASS)[1] could provide estimates of pesticide use and pest management practices on specific geographic regions within the state. Specifically, the 2001 survey was adjusted to increase coverage of operators that grew corn in specific agricultural statistics reporting districts, potentially enhancing related information in these districts. Useable MASS corn surveys for Minnesota between 1997 and 2000 ranged from 143 to 190, and were not linked to specific reporting districts. Because of the pilot project, pesticide use data from the 2001 corn survey is based on 418 useable reports statewide, distributed among reporting districts as shown in the table below.

Minnesota Agricultural Statistics Service Reporting District(s)	Useable Reports	Percent of Statewide Total
50 (Central)	108	26
80 (South Central)	122	29
90 (Southeast)	127	30
Other	61	15
Statewide Total	**418**	**100**

The enhanced survey effort resulted in the three reporting districts each accounting for between 26 and 30% of the statewide results, and collectively accounting for 85% of the statewide results. Thus, that portion of the state outside of the three enhanced reporting districts may be slightly under-represented in the data summaries.

This report documents pilot project results, and several findings are of interest to the MDA as it explores ways to monitor pesticide use and pesticide management practices in corn production. The major findings are listed below:

1. **Corn Production and Pesticide Use in Context** Corn production in Minnesota has remained relatively stable over the past 10 years with planted acres in Minnesota ranging from 6.3 million acres in 1993 to 7.5 million acres in 1996. In 2001, 6.8 million acres of corn were planted and treated with a total of 13.5 million pounds of pesticides. Although individual herbicide active ingredients may exhibit greater or lesser use during a particular year, overall pesticide use to produce Minnesota corn appears to have fallen since a high of nearly 18 million pounds in 1996. The drop in use may be due to the introduction of reduced-rate herbicides, wiser use of available

[1] The Minnesota Agricultural Statistics Service (MASS) is a division of the MDA under cooperative agreement with the U.S. Department of Agriculture's National Agricultural Statistics Service (NASS). The MASS is established to consolidate and coordinate activities in the collection, analysis, and publication of agricultural statistical data for the state of Minnesota from numerous NASS surveys and non-NASS sources of information.

herbicides, adherence to management practices that reduce herbicide inputs, the introduction of pest-resistant seed varieties, or other factors.

2. **Pesticide Active Ingredient Use and Use-Related Decisions** According to the results of the 2001 Agricultural Resource Management Study (ARMS) Corn Production Practices and Costs Survey summarized in this report, pesticides were applied to an estimated 99% of all corn acres in Minnesota.

   - Statewide use estimates:
     - The six active ingredients used in greatest quantity on 6.8 million planted corn acres statewide were:
       - 4.2 million pounds of acetochlor applied to 42% of acreage.
       - 3.0 million pounds of atrazine applied to 51% of acreage.
       - 1.7 million pounds of EPTC applied to 7.5% of acreage.
       - 0.8 million pounds metolachlor applied to 6% of acreage.
       - 0.9 million pounds of s-metolachlor applied to 7.5% of acreage.
       - 0.8 million pounds of dimethenamid applied to 10.4% of acreage.
     - These six active ingredients by quantity account for 84% of all pesticides used in corn production statewide.
     - Glyphosate use on corn, by comparison, was limited to an estimated 387,000 pounds applied to 7.5% of acreage.

   - District-level use estimates:[2]
     - In contrast to the remainder of the state, the enhanced districts had no reportable use of EPTC. After acetochlor and atrazine, the pesticides used in greatest quantity in Districts 50 (Central) and 90 (Southeast) were as follows:
       - Glyphosate in District 50 (Central) at 120,000 pounds on 13.3% of a total 1.3 million acres of corn; and
       - Clopyralid in District 90 (Southeast) at 92,800 pounds on 48.4% of a total 1.0 million acres of corn.

       The inconsistency between the enhanced districts and other districts may be the result of regional differences in the types of products used or marketed to respond to specific pest problems. Additionally, the difference may relate to small sample size within a district and related statistical expansion factors, or to limitations in the way survey respondents recall products they have used. In District 80 (South Central), high use of the active ingredient vernolate was reported, but this was determined to be an error due to limitations in the way product names are cross-referenced with active ingredients in the survey code book. Vernolate has not been registered for sale in Minnesota since 1991 and once went by the tradename of Surpass 6.7 E, which

[2] The district-level data for total pounds of active ingredient applied may not multiply out to the state-level totals for two reasons: 1) rounding differences; and 2) the district-level data was required to sum to the state-level estimates. Rate information for each district and each active ingredient is, however, accurate. See individual district tables in the report for more information.

remains a product choice in the survey code book. Surpass is now a part of the tradenames for several acetochlor products, and it is likely that the recorded use of vernolate in District 80 (South Central) should be interpreted as use of acetochlor. This potential error does not appear to significantly affect the reported use acres or pounds of acetochlor reported for District 80 (South Central).

- District-level estimates of use-related decisions:
  - In all three enhanced districts, it is estimated that:
    - > 84% of operators broadcast their herbicide applications without soil incorporation, while banded application accounted for ≤ 11% of applications.
    - > 83% of operators applied herbicide after planting operations.
    - From 1/3 to 3/4 of operators applied their own herbicides as opposed to hiring custom applicators.
  - When evaluating weed control practices, is it estimated that:
    - 41% of operators in District 80 (South Central) used independent crop consultants or scouts, 8% in Districts 50 (Central) and 90 (Southeast).
    - The cost for consultant or commercial scout services on average ranged from $3.00 to $4.50 per acre.
    - Whether herbicides are applied before or after weed emergence, weeds on more than 82% of treated acres are managed based on "routine expectations of what weeds are usually present each spring" as opposed to "systematic scouting" of weed problems on 18% or less of treated acres.
  - From 70% to 90% of operations use farm supply and chemical dealers as the primary source of their pest management information.

- District-level pesticide management practice estimates:
  - The percentage of farming operations that apply herbicides before weed emergence ranges from 27% in District 50 (Central) to 75% in District 90 (Southeast).
  - The percentage of herbicide applications based on routine expectations of what weeds are usually present each spring – 88% to 97% of operations – is significantly higher than the percentage of applications based on systematic scouting from the previous year – 3% to 12% of operations.
  - When weeds are managed after weed emergence, the percentage of operations base treatments on systematic scouting about weeds or weed size is 17% to 26% of operations.
  - A high percentage of insecticide applications are based on routine treatments or expectations of what insects are usually present – 84% to 100% of operations.
  - The primary source of pest management information for farm operators is the farm supply or chemical dealer – 69% to 85% of operations.

3. **Pesticide- and Pest-Resistant Plants** The survey asked several questions about operator practices related to the use of herbicide- and insect-resistant corn varieties.

   - Statewide vs. District-level estimates:
     - 9% of surveyed corn acres statewide were planted with herbicide resistant varieties, 29% were planted with insect resistant varieties, and 6% used both technologies.
     - District 90 (Southeast) planted 15% of its corn acres to herbicide resistant varieties compared with nearly 1/3 fewer acres in Districts 50 (Central) and 80 (South Central).
     - Districts 50 (Central) and 80 (South Central) planted nearly 3 times more acreage to insect resistant corn varieties (17-18% of acres) compared with District 90 (Southeast).
     - District 50 (Central) led the state in the use of both herbicide and insect resistant technologies (15% of planted acres).
     - The primary reason cited for planting pest resistant seed varieties was "increased yields through improved pest control" (between 71% and 83% of farm operations in the enhanced survey districts).
     - For operations planting Bt corn for insect resistance, the percent of all corn acres planted to non-resistant varieties as a refuge for insect resistance management ranged from <1% in District 90 (Southeast) to 13% in District 50 (Central).

4. **Non-Chemical Pest Management Practices** Respondents were surveyed about non-chemical pest management practices, including biological, cultural, mechanical or other control mechanisms.

   - Statewide vs. District-level estimates:
     - 5.8% of operations in District 50 (Central) made pest control decisions based on a desire to protect beneficial organisms compared to 3.6% of operations statewide.
     - The cultural control practice most likely to be used to control pests was crop rotation within the last 3 years on 57% to 86% of acres planted.
     - The cleaning of equipment and implements after field work to reduce the spread of pests was used on 20% to 50% of planted acres in the enhanced survey districts.
     - Field mapping of previous weed problems to assist the operator in weed management decisions ranged from 0% to 12% in the enhanced survey districts.
     - Field cultivation during the growing season as a means of weed control ranged from 32% of operations in District 90 (Southeast) to 35% of operations in District 50 (Central).
     - Avoidance of pest resistance development by rotating chemical modes of action was a management practice used by 17-28% of operations in the enhanced survey districts.

Pilot Project Report Methods

Project Overview: The MDA is required by state law to monitor pesticide use. Much of this data is collected by the MASS and is published in annual reports for select agricultural crops that use the highest volume of various herbicides, insecticides and fungicides. The annual reports reflect statewide use, and are helpful in gauging gross changes in product selection, total pounds of active ingredient applied, and application rates.

In 2000, the MDA began exploring the possibility of using the existing framework of MASS agricultural survey efforts to enhance and broaden pesticide use monitoring efforts. The MASS, operating through the U.S. Department of Agriculture's National Agricultural Statistics Services (NASS) and Economic Research Service (ERS), conducts multiple agricultural surveys annually and publishes data reports, including data on pesticide use and pest management practices.

The goal of the pilot project was to determine whether data collected from smaller geographic areas within the state (the "agricultural statistics districts" of MASS) can provide estimates of pesticide use to benefit the development and evaluation of voluntary pesticide Best Management Practices (BMPs) capable of preventing and minimizing degradation of Minnesota's water resources.

Pilot Project Grant: A grant from the U.S. Environmental Protection Agency (EPA) was used to enhance pesticide use data collection in 2001 by USDA's National Agriculture Statistics Service (NASS) through its Agricultural Resource Management Study (ARMS) Corn Production Practices and Costs Survey in Minnesota.[3] The grant supplemented MDA and University of Minnesota Extension Service funds dedicated to pesticide regulatory and evaluation programs.

The ARMS is USDA's primary source of information about the current status and trends in crop production practices for major crop commodities (corn, soybeans, wheat, and cotton). The study also obtains data on U.S. farmers' agricultural resource use, as well as data to assess potential environmental impacts associated with crop production practices. Commodities selected for evaluation each year differ and are set by the USDA's Economic Research Service.

The 2001 ARMS Corn Production Practices and Costs Survey was conducted by assembling a sample draw of 580 farm operators (from an estimated 79,000 farms) selected at random from the MASS list of farm operators based on crop acres within each of nine agricultural statistics districts (see map below).[4] The sample was adjusted to increase coverage of operators that grew corn in agricultural statistics Districts 50

[3] Planning and execution of the ARMS was facilitated by the MASS.
[4] State agricultural statistics districts are groupings of counties defined by geography, climate and cropping practices. Geographic attributes include soil type, terrain and elevation. Climate components include mean temperature, annual precipitation and length of growing season.

(Central), 80 (South Central) and 90 (Southeast) so that separate estimates could be published for those districts. As a result, an additional 350 samples were drawn from across the three enhanced districts. After selection of the survey sample, a pre-survey letter was mailed to alert selected growers of the survey effort and content.

All data collected for the survey was done by personal interview. Enumerators from the MASS collected information through face to face interviews requiring an average of a one-hour time commitment from each operator. The effort produced 418 useable surveys representing the 2001 crop year (see table on page 1). Chemical use data were collected from mid-October through mid-December 2001, after operators had completed their 2001 field tasks. If fewer than 3 usable surveys provided information for a given data item (e.g., survey question), the results were not quantified for publication in this report.

Pesticide use and management practice data for the 2001 Minnesota corn crop are summarized in this report. Tables of results are presented in three sections:

- Section 1: Pesticide use by type of pesticide, active ingredient, and application decisions
- Section 2: Pest management practices related to use of pesticide- and pest-resistant plants
- Section 3: Pest management practices related to biological, cultural, mechanical or other control mechanisms

All tables present state-wide data and data specific to the enhanced survey districts. Data for all other districts was calculated by subtracting any data collected from the enhanced survey districts from that of the statewide ARMS dataset. Some tables express estimates of pesticide use and management practices as a percentage of planted acres. These estimates are a statistical extrapolation based on planted corn acreage reported for the geographic area of interest. Some tables express survey results as a percentage of operations actually surveyed as part of the ARMS effort.

Sample Reliability: Tables provide estimates based on survey results from 418 corn fields statewide, with a greater sampling frequency of fields in agricultural statistics Districts 50, 80 & 90 (see table on page 1). Contact the Minnesota Agricultural Statistics Service (**http://www.nass.usda.gov/mn/**) for specific information regarding survey and estimation procedures, and the reliability of survey results as affected by variability and non-sampling errors.

Sampling variability, expressed as a percentage of the estimate, is referred to as the coefficient of variation. Some pesticide use and management practices are seldom used on certain crops. In general, the more common the pest management practice, the smaller the sampling variability (or coefficient of variation).

Survey results expressed by “percent of acres” are based on information collected from individual fields and are statistically extrapolated (expanded) for each of the three

districts (and the remainder of districts) based on planted corn acreage reported within each district, the sample size and the available sampling population. The total amount of active ingredient applied for all districts (state-level) was estimated first and published in the "Agricultural Chemical Usage 2001 Field Crops Summary" report (May 2002; available online at **http://usda.mannlib.cornell.edu/reports/nassr/other/pcu-bb/agcs0502.pdf**). The district-level data for total amount of active ingredient applied may not multiply out to the state-level totals for two reasons: 1) rounding differences; and 2) the district-level data was required to sum to the state-level estimates.

Survey results expressed by "percent of operations" are based on information collected from individual survey respondents and are statistically extrapolated (expanded) for each of the three districts (and the remainder of districts) based on the number of respondents within each district, the sample size and the available sampling population.

Conclusions: Working cooperatively with the MASS has tremendous potential to help the MDA in its efforts to monitor pesticide use and evaluate pest management practices. Cooperative efforts might include enhanced versions of MASS's standard survey projects or the development of unique projects with specific objectives. The pilot project provided reliable, regionally-enhanced data on pesticide product choices and application rates. Review of the enhanced data also provided MDA and MASS with the opportunity to identify potentially problematic elements of survey questions and methodologies so as improve the quality of future surveys. Additionally, useful information was gained on certain application decisions, such as who applies pesticides (farm operators vs. custom applicators), when they are applied (before or after planting or weed emergence), primary sources of pesticide management information, and decisions related to use of pest-resistant varieties of corn and non-chemical pest control practices.

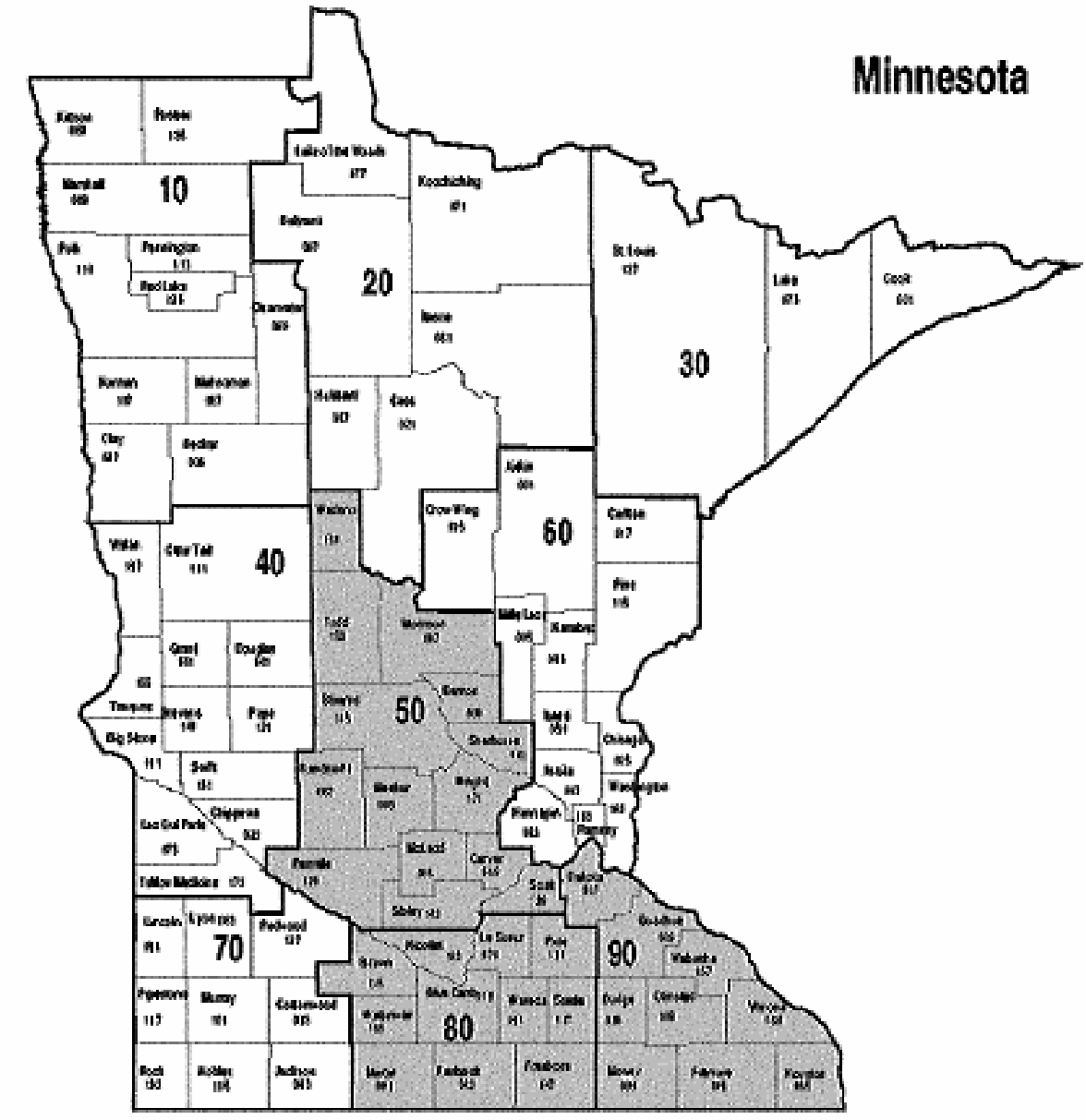
For some pest management practices that are seldom used on certain crops, or for which there were few responses among a sampled population, the sampling variability is likely to be very high. In NASS and ERS publications that report on pest management practices, sampling variability (expressed as a coefficient of variation) can be 1 – 20 percent for data summarized at the U.S. level for commonly used pest management practices, and 3 – 60 percent for data summarized at the regional level.[5] It is assumed that for data on pesticide product choices and application rates (for which all usable surveys provided results) the sampling variability will be low and, therefore, the reliability of such district level data in this report will be high relative to other pest management practices (for which fewer usable surveys provided results). Note that without access to raw, un-extrapolated sampling data, it is difficult to calculate or report certain statistical parameters (e.g., coefficient of variation or standard deviation) associated with the response to individual survey questions. Additional survey sources may be needed to complement any data collected through MASS or through other surveys that include questions related to pest management practices.

[5] See USDA/NASS "Pest Management Practices" summaries for 1999, 2000 and 2001, available at **http://www.nass.usda.gov/mn/**

In 2003, the MDA will use a second EPA grant to evaluate additional methods of cooperating with the MASS to enhance MDA pesticide use monitoring and pest management practice evaluation efforts. The 2003 project will further explore the wealth of resources and expertise within MASS, the NCPMC and ways in which the MDA can enhance its pesticide use monitoring and pest management practice evaluation efforts through complementary means.

FIGURE 1 – MINNESOTA'S NINE AGRICULTURAL STATISTICS DISTRICTS

For the 2001 ARMS survey data included in this report, districts 50, 80 & 90 (shaded) had increased sampling populations relative to other districts. See "Project Overview" text for more information.



A Note on Sources of Pesticide Use Data for Minnesota: The Minnesota Department of Agriculture (MDA) is the lead state agency for all aspects of pesticide and fertilizer environmental and regulatory functions. These authorities are described in **Minnesota Statutes §§ 18B, 18C, 18D and 103H**, including authorities and requirements to monitor pesticide use.

To meet pesticide use monitoring requirements, the MDA collects and analyzes pesticide sales and use data from a variety of available sources.

- As a general indication of long-term pesticide use trends, the MDA publishes pesticide sales data reported by pesticide registrants (**http://www.mda.state.mn.us/appd/pesticides/useandsales.htm**). Although pesticides sold in Minnesota may not be used in the same year they are sold, or in some cases may never be used in Minnesota, over the long term, sales data should be a good indicator of use.

- Regional pesticide use and management practice data for Minnesota, Wisconsin and Michigan is published by both the National Agricultural Statistics Service (**http://www.nass.usda.gov/**) and the Economic Research Service of the U.S. Department of Agriculture (**http://www.ers.usda.gov/**) with participation of the Minnesota Agricultural Statistics Service (MASS.

- The MASS also publishes annual general estimates of active ingredient use rates and total pounds applied to select Minnesota crops (**http://www.nass.usda.gov/mn/**). Both regional and state-specific MASS estimates are based on surveys conducted on several hundred farm fields, with results statistically extrapolated across the geographic area of interest based on planted commodity acreage reported for the district.

- The MDA has developed a diagnostic tool called Farm Nutrient Management Assessment Process (FaNMAP) to get a clear understanding of existing farm practices regarding agricultural inputs such as fertilizers, manures and pesticides in specific geographic areas confronting water quality problems, primarily from nitrate-nitrogen. Between 1996 and 2000, the MDA collected pesticide use data as part of four separate FaNMAP survey projects, accounting for pesticide use on a combined 36,000 acres in East-Central or Southeast Minnesota from (see **http://www.mda.state.mn.us/appd/ace/fanmap.htm**). Data from these surveys is detailed and specific to use patterns and management practices in a highly localized area. The data's high resolution and relative lack of manipulation makes it some of the most reliable information available for Minnesota farm fields.

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Section 1: Pesticide Use by Type of Pesticide, Active Ingredient, and Application Decisions

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TABLE 1 – TOTAL POUNDS PESTICIDE APPLIED

Percent of Acres

Type of Pesticide	Planted Acres		Total Pounds of Active Ingredient Applied
	Acres	Treated 1/	
	1,000	*Percent*	*1,000 lbs*
District 50 (Central)	1,343.5		
Herbicide		99.6	1,472.9
Insecticide		1.2	8.6
District 80 (South Central)	1,486.1		
Herbicide		99.6	2,206.9
Insecticide		3.6	38.9
District 90 (Southeast)	955.7		
Herbicide		99.2	2,913.7
Insecticide		23.3	60.4
Other Districts	3,014.7		
Herbicide		98.3	6,852.5
Insecticide		4.4	38.5
Minnesota	6,800.0		
Herbicide		99.0	13,446.0
Insecticide		8.0	146.4

1/ Refers to acres receiving one or more application of a specific pesticide active ingredient.

TABLE 2 – PESTICIDE APPLICATIONS AND RATES (District 50) BY ACTIVE INGREDIENT

Percent of Acres

Agricultural Chemical	Planted Acres	Area Applied 1/	Appli-cations	Rate Per Application	Rate Per Crop Year	Total Applied Crop Year 2/
	1,000	*Percent*	*Number*	*Pounds per Acre*	*Pounds per Acre*	*1,000 lbs*
District 50 (Central)	1,343.5					
2,4-D		1.5	1.0	0.29	0.29	4.2
Acetic acid		3/				
Acetochlor		26.0	1.0	1.43	1.43	374.4
Alachlor		3/				
Atrazine		38.7	1.0	0.70	0.70	272.8
Bentazon		3/				
Bromoxynil		3/				
Carfentrazone-ethyl		3/				
Chlorpyrifos		3/				
Clopyralid		11.5	1.0	0.11	0.11	12.9
Dicamba		28.4	1.0	0.24	0.24	69.4
Dicamba, Dimethylamine salt		3.5	1.0	0.17	0.17	6.1
Dicamba, Potassium salt		3/				
Diflufenzopyr-sodium		3.5	1.0	0.07	0.07	2.4
Dimethenamid		8.5	1.0	1.44	1.44	123.2
EPTC		3/				
Fipronil		3/				
Flumetsulam		13.9	1.0	0.04	0.04	6.0
Glufosinate-ammonium		8.6	1.0	0.30	0.30	26.4
Glyphosate		13.3	1.3	0.70	0.90	120.1
Glyphosate, N- (phosphonomethyl)		3/				
Imazapyr		3/				
Imazethapyr		3/				
Mesotrione		3/				
Metolachlor		3/				
Nicosulfuron		26.5	1.0	0.02	0.02	5.3
Pendimethalin		7.1	1.0	0.99	0.99	70.5
Primisulfuron		6.5	1.0	0.03	0.03	2.2
Rimsulfuron		19.9	1.0	0.01	0.01	2.3
S-Metolachlor		7.5	1.0	1.61	1.61	120.8
Thifensulfuron methyl		3/				

TABLE 3 – PESTICIDE APPLICATIONS AND RATES (District 80) BY ACTIVE INGREDIENT

Percent of Acres

Agricultural Chemical	Planted Acres	Area Applied 1/	Appli-cations	Rate Per Application	Rate Per Crop Year	Total Applied Crop Year 2/
	1,000	*Percent*	*Number*	*Pounds per Acre*	*Pounds per Acre*	*1,000 lbs*
District 80 (South Central)	1,486.1					
Acetic acid		3/				
Acetochlor		42.8	1.0	1.65	1.65	990.8
Alachlor		3/				
Atrazine		43.0	1.0	0.62	0.64	388.7
Bentazon		3/				
Bromoxynil		3/				
Bromoxynil octanoid acid ester		3/				
Carbofuran		3/				
Carfentrazone-ethyl		1.9	1.0	0.01	0.01	0.2
Chlorpyrifos		3/				
Clopyralid		27.0	1.0	0.10	0.10	36.5
Cyfluthrin		3/				
Dicamba		19.1	1.0	0.20	0.20	52.4
Dicamba, Dimethylamine salt		3/				
Dicamba, Potassium salt		6.1	1.0	0.35	0.35	30.2
Diflufenzopyr-sodium		3/				
Dimethenamid		9.7	1.0	1.38	1.38	187.8
Dimethenamid-P		3/				
EPTC		3/				
Fipronil		3/				
Flumetsulam		27.0	1.0	0.04	0.04	13.5
Glufosinate-ammonium		4.1	1.2	0.29	0.35	20.0
Glyphosate		4.5	1.2	0.55	0.64	39.8
Imazapyr		3/				
Imazethapyr		3/				
Metolachlor		3.8	1.0	1.74	1.74	92.0
Nicosulfuron		24.1	1.0	0.02	0.02	8.0
Phorate		3/				
Primisulfuron		6.1	1.0	0.02	0.02	1.7
Rimsulfuron		8.5	1.0	0.01	0.01	1.5
S-Metolachlor		4.2	1.0	2.18	2.18	128.4
Sulfosate		3/				
Tebupirimphos		3/				
Terbufos		3/				
Thifensulfuron methyl		3/				
Vernolate		4.4	1.0	1.95	1.95	120.0

TABLE 4 – PESTICIDE APPLICATIONS AND RATES (District 90) BY ACTIVE INGREDIENT

Percent of Acres

Agricultural Chemical	Planted Acres	Area Applied 1/	Appli-cations	Rate Per Application	Rate Per Crop Year	Total Applied Crop Year 2/
	1,000	*Percent*	*Number*	*Pounds per Acre*	*Pounds per Acre*	*1,000 lbs*
District 90 (Southeast)	955.7					
Acetochlor		35.9	1.0	1.14	1.14	632.3
Alachlor		3/				
Atrazine		49.5	1.0	0.74	0.76	579.4
Bifenthrin		3/				
Bromoxynil		3/				
Carbofuran		3/				
Carfentrazone-ethyl		3/				
Chlorpyrifos		3/				
Clopyralid		48.4	1.0	0.12	0.12	92.8
Cyanazine		3/				
Cyfluthrin		3.0	1.0	0.00	0.00	0.2
Dicamba		11.1	1.0	0.13	0.13	22.9
Dicamba, Dimethylamine salt		3/				
Dicamba, Potassium salt		6.9	1.0	0.38	0.38	40.8
Diflufenzopyr-sodium		3/				
Dimethenamid		4.4	1.0	1.34	1.34	90.6
EPTC		3/				
Fipronil		3/				
Flumetsulam		48.4	1.0	0.05	0.05	34.3
Glufosinate-ammonium		2.0	1.0	0.34	0.34	10.9
Glyphosate		13.4	1.0	0.72	0.72	148.6
Imazapyr		3/				
Imazethapyr		3/				
Mesotrione		3/				
Metolachlor		22.2	1.0	2.01	2.01	686.1
Nicosulfuron		22.1	1.0	0.02	0.02	5.6
Pendimethalin		3/				
Permethrin		3/				
Primisulfuron		1.9	1.0	0.02	0.02	0.5
Rimsulfuron		9.0	1.0	0.01	0.01	0.7
S-Metolachlor		6.8	1.0	1.97	1.97	207.2
Tebupirimphos		3.0	1.0	0.10	0.10	4.4
Tefluthrin		12.9	1.0	0.09	0.09	17.3
Terbufos		1.2	1.0	0.98	0.98	18.2
Vernolate		3/				

TABLE 5 – PESTICIDE APPLICATIONS (Other Districts) AND RATES BY ACTIVE INGREDIENT

Percent of Acres

Agricultural Chemical	Planted Acres	Area Applied 1/	Appli-cations	Rate Per Application	Rate Per Crop Year	Total Applied Crop Year 2/
	1,000	*Percent*	*Number*	*Pounds per Acre*	*Pounds per Acre*	*1,000 lbs*
Other Districts	3,014.7					
2,4-D		3/				
Acetic acid		3/				
Acetochlor		51.6	1.0	1.52	1.52	2,229.3
Atrazine		59.6	1.0	0.98	1.02	1,735.4
Bifenthrin		3/				
Bromoxynil		3/				
Chlorpyrifos		3/				
Clopyralid		10.7	1.0	0.09	0.09	27.3
Cyanazine		3/				
Dicamba		15.3	1.0	0.34	0.34	147.1
Dicamba, Dimethylamine salt		10.7	1.0	0.14	0.14	43.9
Dicamba, Potassium salt		7.6	1.0	0.25	0.25	53.7
Dicamba, Sodium Salt		3/				
Diflufenzopyr-sodium		12.3	1.0	0.06	0.06	19.9
Dimethenamid		14.8	1.0	0.90	0.90	378.8
EPTC		13.6	1.0	3.51	3.51	1,356.6
Flumetsulam		10.7	1.0	0.03	0.03	10.1
Glufosinate-ammonium		7.7	1.0	0.35	0.35	76.9
Glyphosate		3.7	1.0	0.75	0.75	78.4
Lambda-cyhalothrin		3/				
Metolachlor		3/				
Nicosulfuron		15.7	1.1	0.02	0.02	10.6
Pendimethalin		3/				
Primisulfuron		3/				
Rimsulfuron		7.1	1.0	0.01	0.01	2.1
S-Metolachlor		9.5	1.0	1.55	1.55	419.4
Vernolate		3/				

TABLE 6 – PESTICIDE APPLICATIONS AND RATES (Statewide) BY ACTIVE INGREDIENT

Percent of Acres

Agricultural Chemical	Planted Acres	Area Applied 1/	Appli-cations	Rate Per Application	Rate Per Crop Year	Total Applied Crop Year 2/
	1,000	*Percent*	*Number*	*Pounds per Acre*	*Pounds per Acre*	*1,000 lbs*
Minnesota	6,800.0					
2,4-D		6.7	1.0	0.23	0.23	104.8
Acetic acid		3/				
Acetochlor		42.4	1.0	1.47	1.47	4,226.8
Alachlor		0.8	1.0	1.67	1.67	85.4
Atrazine		50.8	1.0	0.83	0.86	2,976.3
Bentazon		3/				
Bifenthrin		3/				
Bromoxynil		3.1	1.0	0.16	0.16	33.0
Bromoxynil octanoid acid Ester		3/				
Carbofuran		3/				
Carfentrazone-ethyl		0.6	1.0	0.01	0.01	0.4
Chlorpyrifos		1.1	1.0	0.84	0.84	63.6
Clopyralid		22.8	1.0	0.11	0.11	169.5
Cyanazine		1.6	1.0	0.52	0.52	58.1
Cyfluthrin		0.7	1.0	0.01	0.01	0.2
Dicamba		17.1	1.0	0.25	0.25	291.8
Dicamba, Dimethylamine salt		5.2	1.0	0.15	0.15	51.4
Dicamba, Potassium salt		6.5	1.0	0.30	0.30	131.8
Dicamba, Sodium Salt		3/				
Diflufenzopyr-sodium		5.8	1.0	0.06	0.06	22.9
Dimethenamid		10.4	1.0	1.10	1.10	780.4
Dimethenamid-P		3/				
EPTC		7.5	1.0	3.35	3.35	1,701.9
Fipronil		3/				
Flumetsulam		23.1	1.0	0.04	0.04	63.9
Glufosinate-ammonium		5.8	1.0	0.33	0.34	134.2
Glyphosate		7.5	1.1	0.70	0.76	386.9
Glyphosate, N-(phosphonomethyl)		3/				
Imazapyr		0.8	1.0	0.00	0.00	0.1
Imazethapyr		0.8	1.0	0.01	0.01	0.3
Lambda-cyhalothrin		3/				
Mesotrione		3/				
Metolachlor		6.0	1.0	1.97	1.97	799.6
Nicosulfuron		20.5	1.0	0.02	0.02	29.4

TABLE 6 *(continued)* – PESTICIDE APPLICATIONS AND RATES (Statewide) BY ACTIVE INGREDIENT

Agricultural Chemical	Planted Acres	Area Applied 1/	Appli-cations	Rate Per Application	Rate Per Crop Year	Total Applied Crop Year 2/
	1,000	*Percent*	*Number*	*Pounds per Acre*	*Pounds per Acre*	*1,000 lbs*
		Percent of Acres				
Minnesota	6,800.0					
Pendimethalin		2.8	1.0	1.02	1.02	195.5
Permethrin		3/				
Phorate		3/				
Primisulfuron		3.2	1.0	0.02	0.02	5.3
Rimsulfuron		9.7	1.0	0.01	0.01	6.6
S-Metolachlor		7.5	1.0	1.72	1.72	875.8
Sulfosate		3/				
Tebupirimphos		0.7	1.0	0.10	0.10	4.9
Tefluthrin		2.9	1.0	0.09	0.09	17.3
Terbufos		0.4	1.0	0.93	0.93	23.5
Thifensulfuron methyl		3/				
Vernolate		1.3	1.0	1.71	1.74	155.0

1/ Refers to acres receiving one or more applications of a specific herbicide ingredient.
2/ May not add due to rounding.
3/ Insufficient data to publish.

TABLE 7 – HERBICIDE USE BY METHOD OF APPLICATION

Application Method	Planted Acres	Area Applied Using Indicated Method (can use more than one method) 1/
	1,000	*Percent*
Percent of Acres		
District 50 (Central)	1,343.5	
Broadcast, ground w/o incorporation		86.8
Broadcast, ground with incorporation		15.6
Banded/side dressed in or over rows		5.2
Foliar or direct spray		12.1
District 80 (South Central)	1,486.1	
Broadcast, ground w/o incorporation		84.5
Broadcast, ground with incorporation		23.3
In Seed Furrow		2/
Banded/side dressed in or over rows		11.0
District 90 (Southeast)	955.7	
Broadcast, ground w/o incorporation		98.3
Broadcast, ground with incorporation		11.8
Other Districts	3,014.7	
Broadcast, ground w/o incorporation		45.1
Broadcast, ground with incorporation		27.8
In Seed Furrow		2/
Banded/side dressed in or over rows		6.9
Foliar or direct spray		47.6
Minnesota	6,800.0	
Broadcast, ground w/o incorporation		71.5
Broadcast, ground with incorporation		21.4
Broadcast, by air (Aerial application)		2/
In Seed Furrow		2/
Banded/side dressed in or over row		5.9
Foliar or directed spray		21.7

1/ Refers to acres receiving one or more applications of a specific herbicide ingredient.
2/ Insufficient data to publish.

TABLE 8 – HERBICIDE USE BY TIMING OF APPLICATION

Application Time 1/	Planted Acres	Area Applied at Indicated Application Time 2/
	Percent of Acres	
	1,000	*Percent*
District 50 (Central)	1,343.5	
Before Planting		15.7
At Planting		9.6
After Planting		96.4
District 80 (South Central)	1,486.1	
Before Planting		31.7
At Planting		10.8
After Planting		83.9
District 90 (Southeast)	955.7	
Before Planting		17.7
At Planting		3/
After Planting		98.7
Other Districts	3,014.7	
Before Planting		29.6
At Planting		8.3
After Planting		95.8
Minnesota	6,800.0	
Before Planting		25.3
At Planting		7.2
After Planting		94.1

1/ Refers to acres receiving one or more applications of a specific herbicide ingredient.
2/ May not add due to rounding.
3/ Insufficient data to publish.

TABLE 9 – HERBICIDE USE BY APPLICATOR

Percent of Acres

Applicator	Planted Acres	Area Applied by Indicated Applicator 1/
	1,000	*Percent*
District 50 (Central)	1,343.5	
Operator		67.3
Custom		41.3
Employee		2/
District 80 (South Central)	1,486.1	
Operator		76.6
Custom		35.1
Employee		2/
District 90 (Southeast)	955.7	
Operator		62.8
Custom		41.6
Other Districts	3,014.7	
Operator		69.4
Custom		44.8
Minnesota	6,800.0	
Operator		69.1
Custom		41.6
Employee		2/

1/ Refers to acres receiving one or more applications of a specific herbicide ingredient.
2/ Insufficient data to publish.

TABLE 10 – INSECTICIDE USE BY APPLICATION METHOD

Percent of Acres

Application Method	Planted Acres	Area Applied Using Indicated Method 1/
	1,000	*Percent*
District 50 (Central)	1,343.5	
In Seed Furrow		2/
District 80 (South Central)	1,486.1	
Broadcast, ground w/o incorporation		2/
In Seed Furrow		2/
Banded/side dressed in or over row		1.6
District 90 (Southeast)	955.7	
Broadcast, ground w/o incorporation		4.2
In Seed Furrow		14.8
Banded/side dressed in or over rows		4.3
Other Districts	3,014.7	
Broadcast, ground w/o incorporation		2/
Broadcast, by Air (Aerial application)		2/
Banded/side dressed in or over rows		2/
Minnesota	6,800.0	
Broadcast, ground w/o incorporation		2.2
Broadcast, by Air (Aerial application)		2/
In Seed Furrow		3.6
Banded/side dressed in or over rows		2.0

1/ Refers to acres receiving one or more applications of a specific insecticide ingredient.
2/ Insufficient data to publish.

TABLE 11 – INSECTICIDE USE BY TIMING OF APPLICATION

Application Time 1/	Planted Acres	Area Applied at Indicated Application Time 2/
	Percent of Acres	
	1,000	*Percent*
District 50 (Central)	1,343.5	
At Planting		3/
District 80 (South Central)	1,486.1	
At Planting		3.2
After Planting		3/
District 90 (Southeast)	955.7	
At Planting		19.7
After Planting		3/
Other Districts	3,014.7	
At Planting		3/
After Planting		3/
Minnesota	6,800.0	
At Planting		6.0
After Planting		2.0

1/ Refers to acres receiving one or more applications of a specific insecticide ingredient.
2/ May not add due to rounding.
3/ Insufficient data to publish.

TABLE 12 – INSECTICIDE USE BY APPLICATOR

Applicator	Planted Acres	Area Applied by Indicated Applicator 1/
	Percent of Acres	
	1,000	*Percent*
District 50 (Central)	1,343.5	
Operator		2/
District 80 (South Central)	1,486.1	
Operator		3.2
Custom		2/
District 90 (Southeast)	955.7	
Operator		23.3
Other Districts	3,014.7	
Operator		2/
Custom		2/
Minnesota	6,800.0	
Operator		6.8
Custom		1.2
Employee		2/

1/ Refers to acres receiving one or more applications of a specific insecticide ingredient.
2/ Insufficient data to publish.

TABLE 13 – SCOUTING FOR WEEDS, INSECTS & DISEASES

Percent of Acres

Scouting Performed by:	Scouted by Systematic Method	Scouted for Weeds	Scouted for Insects			Scouted for Diseases
			Corn Borer	Corn Rootworm	Other	
	Percent/1	*Percent/2*	*Percent*	*Percent*	*Percent*	*Percent*
District 50 (Central)	58.0	48.2	19.6	14.1	9.4	8.6
Operator		64.7	76.1	67.4	69.1	
Dealer		27.3	4.0	5.1	5.1	
Indep. Consultant or Scout		8.1	19.8	27.5	25.8	
District 80 (South Central)	31.8	28.4	20.7	16.8	10.4	7.3
Operator		43.3	39.1	24.6	35.9	
Employee		6.0				
Dealer		10.0	2.8	3.5	5.7	
Indep. Consultant or Scout		40.7	58.1	71.9	58.5	
District 90 (Southeast)	46.4	36.8	9.4	3.2	3.0	
Operator		83.3	63.0	3.0	30.2	
Dealer		8.9	6.4	18.5	2.6	
Indep. Consultant or Scout		7.8	30.7	78.4	67.2	
Other **Districts**	49.8	20.3	7.0	6.4	7.3	6.9
Operator		67.5	46.7	29.6	48.2	
Dealer		12.1	4.8	5.3	4.6	
Indep. Consultant or Scout		20.5	48.4	65.1	47.2	
Minnesota	46.5	28.8	10.8	7.9	7.0	5.6
Operator		68.8	55.7	35.3	48.3	
Employee		0.7				
Dealer		14.5	4.5	6.1	4.7	
Indep. Consultant or Scout		16.1	39.8	58.6	47.0	

/1 Percent of all corn acres.

/2 Percent of all corn acres scouted systematically.

TABLE 14 – SCOUTING COSTS FOR WEEDS, INSECTS & DISEASES, RECORD KEEPING, AND DECISION THRESHOLDS

	Percent of Acres					
Scouting Performed by:	**Planted Acres**	**Cost per Acre for Consultant or Commercial Scouts**	**Cost for Insect Scouting (as a portion of the previous column)**	**Scouting Hours Spent by Operator Per Field**	**Scouting Records Kept**	**Scouting Data Compared to University or Extension Infestation Thresholds to Determine When to Take Pest Control Measures**
	1,000	*Av $/Acres*	*Av $/Acres*	*Mean*	*Percent/1*	*Percent/1*
District 50 (Central)	1343.5					
Acres		3.3	0.7	1.3	10.0	16.2
District 80 (South Central)	1486.1					
Acres		4.4	1.9	2.4	15.9	7.7
District 90 (Southeast)	955.7					
Acres		2.8	0.6	1.7	13.9	6.0
Other Districts	3014.7					
Acres		3.3	1.1	3.3	17.9	9.9
Minnesota	6800.0					
Acres		3.5	1.3	2.3	15.4	9.5

/1 Percent of all corn acres or operations scouted systematically.

TABLE 15 – WEEDS MANAGED *BEFORE* EMERGENCE BASED ON EXPECTATIONS OR SCOUTING (by acres)

	Percent of Acres			
Region	**Planted Acres**	**Herbicides Applied BEFORE Weed Emergence**	**Based on Routine Expectations of What Weeds are Usually Present Each Spring**	**Based on Systematic Scouting from Previous Year**
	1,000	*Percent*	*Percent*	*Percent*
District 50 (Central)	1,343.5	35.5	82.1	17.9
District 80 (South Central)	1,486.1	42.6	94.5	5.5
District 90 (Southeast)	955.7	68.8	99.3	0.7
Other Districts	3,014.7	77.7	97.0	3.0
Minnesota	6,800.0	66.0	96.2	3.8

TABLE 16 – WEEDS MANAGED *BEFORE* EMERGENCE BASED ON EXPECTATIONS OR SCOUTING (by operations)

	Percent of Operations		
Region	**Herbicides Applied BEFORE Weed Emergence**	**Based on Routine Expectations of What Weeds are Usually Present Each Spring**	**Based on Systematic Scouting from Previous Year**
	Percent	*Percent*	*Percent*
District 50 (Central)	27.0	89.7	10.3
District 80 (South Central)	47.5	87.9	12.1
District 90 (Southeast)	75.4	96.7	3.3
Other Districts	38.9	79.8	20.2
Minnesota	47.2	88.4	11.6

TABLE 17 – WEEDS MANAGED *AFTER* EMERGENCE BASED ON EXPECTATIONS OR SCOUTING (by acres)

	Percent of Acres			
Region	**Planted Acres**	**Herbicides Applied AFTER Weed Emergence**	**Based on Treatments or Expectations of What Weeds are Usually Present**	**Based on Systematic Scouting about Weeds or Weed Size**
	1,000	*Percent*	*Percent*	*Percent*
District 50 (Central)	1,343.5	69.3	72.3	27.7
District 80 (South Central)	1,486.1	80.2	83.4	16.6
District 90 (Southeast)	955.7	39.7	78.1	21.9
Other Districts	3,014.7	26.4	80.7	19.3
Minnesota	6,800.0	41.2	78.8	21.2

TABLE 18 – WEEDS MANAGED *AFTER* EMERGENCE BASED ON EXPECTATIONS OR SCOUTING (by operations)

	Percent of Operations		
Region	**Herbicides Applied AFTER Weed Emergence**	**Based Treatments or Expectations o What Weeds are Usually Present**	**Based on Systematic Scouting about Weeds or Weed Size**
	Percent	*Percent*	*Percent*
District 50 (Central)	82.5	73.8	26.2
District 80 (South Central)	74.3	82.8	17.2
District 90 (Southeast)	45.1	80.7	19.3
Other Districts	76.1	69.6	30.4
Minnesota	69.7	74.9	25.1

TABLE 19 – INSECTS MANAGED BASED ON EXPECTATIONS OR SCOUTING (by acres)

	Percent of Acres		
Region	**Planted Acres**	**Insecticide Selected or Applied Based on Routine Treatments or Expectations of What Insects are Usually Present**	**Insecticide Selected or Applied Based on Systematic Scouting for Insect Infestation**
	1,000	*Percent*	*Percent*
District 50 (Central)	1,343.5	100.0	
District 80 (South Central)	1,486.1	87.7	12.3
District 90 (Southeast)	955.7	93.8	6.2
Other Districts	3,014.7		100.0
Minnesota	6,800.0	80.0	20.0

TABLE 20 – INSECTS MANAGED BASED ON EXPECTATIONS OR SCOUTING (by operations)

	Percent of Operations	
Region	**Insecticide Selected or Applied Based on Routine Treatments or Expectations of What Insects are Usually Present**	**Insecticide Selected or Applied Based on Systematic Scouting for Insect Infestation**
	Percent	*Percent*
District 50 (Central)	100.0	
District 80 (South Central)	84.5	15.6
District 90 (Southeast)	84.4	15.6
Other Districts		100.0
Minnesota	65.0	35.0

TABLE 21 – ESTIMATED YIELD LOSS DUE TO UNTREATED PESTS

Percent of Acres

Region	Planted Acres	Yield Loss (Bushels per Acre)	
		Due to Untreated Corn Borers	Due to Untreated Corn Rootworms
	1,000	*Bu/Acre*	*Bu/Acre*
District 50 (Central)	1,343.5	6.6	2.9
District 80 (South Central)	1,486.1	2.6	1.0
District 90 (Southeast)	955.7	7.0	6.8
Other Districts	3,014.7	13.6	2.3
Minnesota	6,800.0	8.5	3.2

TABLE 22 – PRIMARY SOURCES OF PEST MANAGEMENT INFORMATION

Percent of Operations

Region	Attendance at Training Sessions on Pest Identification and Management Between 10/2000 and end of 2001	Primary Source of Pest Management Information							
		Extension	Farm Supply or Chemical Dealer	Scouting Service	Crop Consultant	Other Growers	Associations or Print Media	Other	None
	Percent of Operations								
District 50 (Central)	20.6	5.3	70.6		7.2	3.9	4.3	0.9	7.8
District 80 (South Central)	33.3	9.1	68.6	6.2	9.8	1.4	3.7	1.1	
District 90 (Southeast)	44.1	1.1	84.9		2.9	5.7			5.4
Other Districts	10.0	1.2	90.0	0.9	3.7		1.7		2.4
Minnesota	21.8	2.6	83.9	1.2	4.7	2.0	1.9	0.2	3.6

Section 2: Pesticide Management Practices Related to Use of Pesticide- and Pest-Resistant Plants

TABLE 23 – USE OF PESTICIDE- AND PEST-RESISTANT SEED VARIETIES

		Percent of Acres			
Region	**Planted Acres**	**No Resistant Traits**	**Herbicide Resistant**	**Insect Resistant**	**Both Herbicide and Insect Resistant**
	1,000	*Percent*	*Percent*	*Percent*	*Percent*
District 50 (Central)	1,343.5	57.6	10.3	17.2	14.8
District 80 (South Central)	1,486.1	68.6	9.4	18.2	3.9
District 90 (Southeast)	955.7	77.2	15.3	6.2	1.4
Other Districts	3,014.7	39.0	4.9	49.6	6.6
Minnesota	6,800.0	56.4	8.9	28.6	6.1

TABLE 24 – USE OF CORN Bt VARIETIES

Percent of Operations

Region	Product			
	YieldGard	NatureGard	Knockout	Other
	Percent	*Percent*	*Percent*	*Percent*
District 50 (Central)	81.2	0.6	5.2	13.0
District 80 (South Central)	76.6	6.0	1.3	16.2
District 90 (Southeast)	96.7			3.3
Other Districts	100.0			
Minnesota	91.5	1.0	1.5	6.0

TABLE 25 – REASONS FOR NOT PLANTING Bt CORN

Percent of Operations

Region	Did not expect to have enough corn borers	Concerned about finding a market for Bt corn	This field was used as a refuge in 2001	Concerned about the environmental impact of Bt corn	Other
	Percent	*Percent*	*Percent*	*Percent*	*Percent*
District 50 (Central)	45.38	5.42	0.24		48.96
District 80 (South Central)	64.18	1.56	1.57	5.82	26.87
District 90 (Southeast)	54.00	14.97			31.02
Other Districts	6.87	0.40	1.27	0.60	90.87
Minnesota	28.98	4.80	0.86	0.90	64.46

TABLE 26 – MAJOR REASON FOR PLANTING PEST RESISTANT SEED VARIETY (by operations)

Percent of Operations

Region	Reason	Percent
District 50 (Central)	Increase yields through improved pest control.	75.8
	Decrease pesticide input costs.	6.4
	Save management time or labor or improve ease of management.	0.5
	For some other reasons.	17.3
District 80 (South Central)	Increase yields through improved pest control.	74.5
	Decrease pesticide input costs.	13.9
	Save management time or labor or improve ease of management.	6.3
	For some other reasons.	5.4
District 90 (Southeast)	Increase yields through improved pest control.	70.8
	Decrease pesticide input costs.	20.7
	For some other reasons.	8.4
Other Districts	Increase yields through improved pest control.	82.6
	Decrease pesticide input costs.	2.7
	Improve ability or ease of rotating crops.	1.8
	Save management time or labor or improve ease of management.	7.1
	For some other reasons.	5.8
Minnesota	Increase yields through improved pest control.	77.4
	Decrease pesticide input costs.	9.0
	Improve ability or ease of rotating crop.	0.7
	Save management time or labor or improve ease of management	4.0
	For some other reasons.	8.9

TABLE 27 – PERCENT OF FIELD PLANTED AS REFUGE ACRES

Percent of Acres and Percent of Operations

Region	Planted Acres	Percent of surveyed field used as corn borer refuge to comply with Bt resistance management guidelines	Percent of all planted acres in refuge	Percent of all operations w/ refuge acres
	1,000	*Percent*	*Percent*	*Percent*
District 50 (Central)	1,343.5	50.8	13.4	19.0
District 80 (South Central)	1,486.1	48.0	9.4	17.5
District 90 (Southeast)	955.7	16.1	0.3	2.3
Other Districts	3,014.7	32.1	15.3	10.2
Minnesota	6,800.0	36.7	10.4	10.4

TABLE 28 – LIKELIHOOD OF USE OF Bt SEED FOR CORN ROOTWORM

Percent of Operations

Region	If a Corn Rootworm Bt Seed Becomes Available, Would Respondent Plant it?
	Percent
District 50 (Central)	
Very Likely	9.5
Somewhat Likely	12.2
Uncertain	31.9
Somewhat Unlikely	16.8
Very Unlikely	29.5
District 80 (South Central)	
Very Likely	11.1
Somewhat Likely	22.6
Uncertain	36.0
Somewhat Unlikely	15.4
Very Unlikely	14.9
District 90 (Southeast)	
Very Likely	8.7
Somewhat Likely	36.4
Uncertain	15.5
Somewhat Unlikely	23.7
Very Unlikely	15.7
Other Districts	
Very Likely	3.7
Somewhat Likely	9.1
Uncertain	4.8
Somewhat Unlikely	5.2
Very Unlikely	77.2
Minnesota	
Very Likely	6.4
Somewhat Likely	17.2
Uncertain	14.4
Somewhat Unlikely	12.1
Very Unlikely	49.9

Section 3: Pesticide Management Practices Related to Biological, Cultural, Mechanical or Other Control Mechanisms

TABLE 29 – PROTECTION OF BENEFICIAL ORGANISMS AND USE OF BIOLOGICAL CONTROL METHODS

Percent of Operations

Region	Biological Control Management Practice Use			
	Protection of Beneficial Organism was a Factor in Pest Control Decisions	Application or Release of Beneficial Organism for Pest Control	Use of Biological Pest Controls 1/	Use of Topically Applied Biological Pesticides 2/
	Percent	*Percent*	*Percent*	*Percent*
District 50 (Central)	5.8			7.4
District 80 (South Central)	1.8			4.1
District 90 (Southeast)			0.4	1.9
Other Districts	5.0	0.3	0.6	2.0
Minnesota	3.6	0.2	0.4	3.0

1/ Includes beneficial insects, floral lures, attractants or repellant applied to fields, pheromones and pheromone traps.
2/ Includes Bt, insect growth regulators, neem or other natural products.

TABLE 30 – CULTURAL CONTROL PEST MANAGEMENT PRACTICES (part 1)

Percent of Operations

Region	Cultural Control Management Practice					
	Use of Controlled Drainage or Irrigation Scheduling to Control Pests	Selection of Planting Location to Avoid Cross Infestation of Insect or Disease	Cleaning of Equipment and Implements After Work on Field to Reduce Spread of Pests	Treatment of Seed for Insect or Disease Control After Purchase of Seed	Adjustment of Harvest or Planting Dates to Control Pests	Soil Analysis to Detect Presence of Soilborne Pests or Pathogens
	Percent	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
District 50 (Central)	0.3	4.1	30.1	4.0	1.8	0.6
District 80 (South Central)		2.1	49.5	0.9	1.5	4.3
District 90 (Southeast)			19.7			
Other Districts	0.7	2.7	5.2	0.3		1.9
Minnesota	0.4	2.2	16.7	0.8	0.4	1.6

TABLE 31 – CULTURAL CONTROL PEST MANAGEMENT PRACTICES (part 2)

Percent of Acres

Region	Planted Acres	Cultural Control Management Practice						
		Adjustment of Row Spacing or Plant Density to Control Pests	Removal or Plow-down of Crop Residues to Control Pests	Crop Rotation within Last 3 Years to Control Pests	Growth of "Trap Crop" to Help Control Pests	Weather Monitoring to Predict Need for Pesticide Application	Maintenance of Ground Covers, Mulches or Barriers to Reduce Pest Problems	Use of Field Mapping of Previous Weed Problems to Assist in Weed Mgmt. Decisions
	1,000	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*	*Percent*
District 50 (Central)	1,343.5	0.95	22.75	57.49	1.37	2.03	6.18	12.15
District 80 (South Central)	1,486.1		22.09	86.49	0.43	0.63	1.13	7.36
District 90 (Southeast)	955.7		2.57	74.38	1.09	1.09		
Other Districts	3,014.7	0.17	10.16	29.78		3.14	2.77	6.48
Minnesota	6,800.0	0.22	11.49	49.91	0.48	2.25	2.44	5.90

TABLE 32 – MECHANICAL CONTROL or OTHER PEST MANAGEMENT PRACTICES

Percent of Operations

Region	Mechanical Control Management Practice	Other Pest Management Practice	
	Cultivation of Field for Weed Control During Growing Season	Consideration of Pest Resistance when Selecting Seed Variety	Rotation of Chemical Mode of Action to Avoid Resistance Development
	Percent	*Percent*	*Percent*
District 50 (Central)	51.3	34.8	24.6
District 80 (South Central)	61.8	25.5	27.5
District 90 (Southeast)	31.5	15.7	17.0
Other Districts	19.9	19.1	14.9
Minnesota	31.4	21.2	18.1