



Herbicide Selection and Management Practices Associated with Minnesota's 2014 Corn Production

Minnesota Department of Agriculture
USDA, NASS, Minnesota Field Office

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**625 Robert Street North St. Paul, MN 55155-2538 651-201-6000 1-800-967-AGRI
www.mda.state.mn.us**

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For information regarding this report contact:
Denton Bruening
Minnesota Department of Agriculture
Pesticide and Fertilizer Management Division
651-201-6399

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Abstract

The Minnesota Department of Agriculture (MDA) is responsible for the development and promotion of herbicide Best Management Practices (BMPs) which optimize production and profitability while protecting the state's water resources. The MDA is also responsible for monitoring pesticide use and for promoting the adoption of associated BMPs. This survey was designed and conducted in partnership with the National Agricultural Statistics Service (NASS) to specifically assess the status of BMP awareness and adoption in relation to the use of corn herbicides.

In Minnesota, the corn herbicide active ingredients atrazine and acetochlor (and their breakdown products) are detected frequently in groundwater and surface water resources. Atrazine has not exceeded the applicable drinking water standards in groundwater. However, in 2001 and 2005, acetochlor concentrations exceeded surface water quality standards to protect aquatic life in two southern Minnesota watersheds¹. The MDA has invested considerable staff time in water monitoring, development of BMP education programs, and BMP assessment. Atrazine and acetochlor are the main focus of this survey. Phone enumerators located at NASS contacted over 4,000 producers in early 2015. From this pool, approximately 2,100 farmers who raised corn during the 2014 growing season shared valuable information on herbicide selection and management.

The general purpose of this survey was to ask farmers about fundamental herbicide use practices such as record keeping, reading the label, scouting, responsibility for making decisions on product selection and timing, and knowledge about physical characteristics (soil texture, depth to groundwater, use of buffer strips, etc.). More specific questions related to atrazine and acetochlor included the use of split applications, reduced rates, and incorporation.

These types of surveys help MDA understand regulatory compliance, adoption of voluntary practices, need for additional information, and opportunities for future technical assistance.

Every other year, the MDA has partnered with NASS to produce a detailed report on pesticide use and rates used on the state's four major crops. Readers are encouraged to visit the most recent report, "2013 Pesticide Usage on Four Major Minnesota Crops" at <http://www.mda.state.mn.us/chemicals/pesticides/pesticideuse.aspx>

¹ "Monitoring & Assessment for Agricultural Chemicals in the Environment" found on MDA Website at: <http://www.mda.state.mn.us/monitoring>

Acknowledgements

This survey was a cooperative effort by the Minnesota Department of Agriculture (MDA), the United States Department of Agriculture (USDA), National Agricultural Statistics Service (NASS), and the NASS Field Offices in Minnesota. The detailed information about herbicide use practices could not have been collected without the cooperation of the thousands of farmers who voluntarily responded to the survey in the midst of their busy lives, and for this we are extremely grateful. Similarly, the assistance of agricultural chemical dealer and cooperatives is much appreciated. Special thanks go to Dan Lofthus, Director of the NASS Minnesota Field Office and his respective staff for assistance with survey design, data collection and processing. The MDA is ultimately responsible for the representations of data provided in this report and for the design of the survey mechanism used to collect that data. Excellent participation and good record keeping practices by Minnesota farmers and agricultural chemical dealerships played a vital part in providing complete and detailed herbicide information.

2014 Herbicide Use Practices Summary and Highlights

This report summarizes survey results for a number of important practices associated with herbicide use on Minnesota's 2014 corn acres. Over 2,100 producers participated in the telephone survey and herbicide information was collected for 542,570 corn acres, representing 7 percent of Minnesota's 8,200,000 corn acres. Survey questions focused on the 95 percent of the respondents that used herbicides for weed control. The survey targeted a variety of practices including herbicide selection and associated management practices (e.g., MDA's herbicide BMPs). This is the fifth herbicide survey performed by the MDA and NASS to collect information on herbicide management practices on Minnesota corn acres.

Survey Design and Implementation

Ten Pesticide Monitoring Areas (noted as “PMA” throughout the report), were previously developed by MDA staff. Counties were clustered based on similarities in geology, soils, and crops. These areas also define the general boundaries of the monitoring regions used by the MDA water resource monitoring program. More information about PMA designations can be found at

<http://www.mda.state.mn.us/chemicals/pesticides/~//media/Files/chemicals/2009gwmnetdesign.ashx> Regional pesticide use information is used to help design and implement specific water quality monitoring and pesticide educational programs.



NASS developed a sampling population of 7,000 farms by randomly drawing from its entire database of all corn growers in Minnesota. There were 2,103 farmers that raised corn in 2014 and that completed the survey. The definition of “corn” for purposes of this report includes both grain and silage and excludes sweet corn and popcorn. All growers were asked four basic questions regarding herbicide selection and management. The remaining questions were for those farmers who used atrazine or acetochlor.

Due to the low intensity of row crop agriculture in portions of northern Minnesota, survey results for PMA 2 and PMA 3 were not reported or included in this analysis.

Introduction

Data Collection Process and History

The MDA is required by state law to monitor pesticide use on a biennial basis. Minn. Stat. § 18B.064. In pursuit of fulfilling that responsibility, the MDA began exploring the possibility of using the existing framework of the NASS to enhance and broaden pesticide use monitoring efforts. NASS has a long history of providing statewide crop and production statistics. Over the last decade, NASS has also become an important information source for pesticide and fertilizer use. Several joint pilot projects evolved with the financial assistance from Environmental Protection Agency (EPA) and were conducted from 2001-2003. These pilots were essential to the final methodology used in this report.

The first pilot² was conducted in 2001 by expanding the existing Agricultural Resource Management Study (ARMS) developed by NASS. The normal number of participating Minnesota corn farms in an ARMS survey is about 150. The pilot increased the number of personal interviews to approximately 600 and most of the enhancements were focused on the southern third of the state. The pilot provided reliable regionally-enhanced data on pesticide product choices and application rates. Additionally, useful information on primary sources of pesticide management information, scouting, timing, and other pesticide management related information was obtained.

A second pilot³ was developed with the goal of expanding to a statewide scale while reducing costs. In neighboring North Dakota, the USDA, NASS, the North Dakota Field Office, and North Dakota State University Extension had already established a strong tradition in collecting statewide pesticide use by using NASS telephone enumerators. MDA and NASS used many techniques from the North Dakota program, but decided to expand the level of detail by including pesticide application rates. Historically, most mail or telephone style surveys have been unsuccessful at quantifying pesticide rates. Due to the numerous formulations, different application rates and units of measure (i.e. Active Ingredient [a.i.] can be expressed in pounds, ounces, pints or quarts), complications can quickly develop. Another major complicating factor may result due to the farmer using the services of a commercial pesticide applicator. If the farmer did not apply the product, the likelihood that the farmer would be familiar with the product and corresponding rate decreases significantly.

² “Expanded Minnesota Agricultural Statistics Pesticide Use Data”, 2003, by NASS and MDA.

³ Unpublished data. From the September 20, 2003 EPA Report.

The second pilot survey was conducted in 2003 to test two methods of collecting pesticide rate information. “Method One” was conducted in Douglas County with 150 randomly selected farm operators. Operators were interviewed over the phone by the NASS enumerators. If the operator did not know the pesticides and/or rates, no additional follow-up work was conducted and the data was limited to information that was provided. “Method Two” was used in neighboring Grant County, where another 150 farm operators were contacted, and when farm records were incomplete, follow-up calls were made to the pesticide dealer to complete the survey. The number of surveys with complete data sets significantly increased with the additional assistance from the dealerships. Eighty-three percent of the surveys were complete in Grant County, where dealer follow-up calls were made, compared to forty-six percent in Douglas County. Equally impressive was the overall support by the local dealerships.

Subsequently, statewide surveys are conducted using “Method Two” from the pilot project conducted in Douglas and Grant Counties.

Farmers are interviewed over the phone in February. These are “cold calls,” meaning that the farmers did not get any type of notification about the survey prior to the contact. Consequently, all information collected using this approach is based upon either the participant’s memory or information readily available during the interview. The interviews typically last from five to ten minutes.

Survey questions can be found in Appendix 1. Corresponding question numbers (noted as “Q” followed by the survey question number) are incorporated throughout the report and also in the table captions. The reader is encouraged to reference the survey to help interpret the results.

Questions are grouped into four categories including:

1. **General information.** Who applied the product, label and active ingredients, and record-keeping;
2. **Scouting for weeds and related practices.** Scouting, mapping, weed type, density, and herbicide resistant corn varieties;
3. **Water resources.** Physical distances from groundwater, surface water and buffers, and irrigation management plans; and
4. **General practices.** Herbicide rotations and dealer involvement in herbicide management.

After obtaining some very general NASS information, participants were then asked if they grew corn during the 2014 cropping season (Q.1). The interview process ended if they had not produced field or silage corn. Participants were then asked to identify the number of corn acres planted (Q.2). Table 1 includes the number of respondents and associated corn acres by county and Pesticide Monitoring Area. Also, included in Table 1 is the NASS total corn acres for Minnesota (2014) and the percentage of acres surveyed.

Data Reporting and Limitations

The primary purpose of this survey was to obtain an understanding of basic herbicide management practices associated with corn production. Participants were asked to identify the herbicides used in very generic terms. Some knowledge of the herbicides used (i.e. soil applied, post-emergent, etc.) is essential to understand the current management strategies associated with them. It is important to note that the MDA and its partners provide a highly detailed herbicide use and application rate report on a biennial basis⁴.

Due to the simplified method used to collect what is typically considered complex data, it is imperative that the reader understand the limitations of the data sets. Many surveys conducted by NASS employ advanced sampling strategies which are designed to statistically represent a non-homogenous population, thus “weighting” the data to account for sample size, county size, and crop acreage, etc. Such strategies can be very expensive and are not without their own limitations.⁵ This survey did not employ such strategies; rather, corn farmers were randomly selected from across Minnesota. Therefore, weighting across areas or counties was not performed. The MDA can be contacted to further discuss interpretation of the survey data.

⁴ “2013 Pesticide Usage on Four Major Minnesota Crops” found on the MDA website at: <http://www.mda.state.mn.us/chemicals/pesticides/pesticideuse.aspx>

⁵ For an explanation of survey methods and data quality associated with annual county-level data, visit the NASS “Quick Stats” Frequently Asked Questions website at: <http://www.nass.usda.gov/QuickStats/Screens/faqs.htm>

Table 1. Summary of respondents and corresponding corn acres by county and PMAs.

| County | Pesticide Monitoring Area (PMA) | Number of Respondents | 2014 Planted Corn Acres [§] | Surveyed Corn Acres | Percentage of Acres Surveyed |
|-----------------|---------------------------------|-----------------------|--------------------------------------|---------------------|------------------------------|
| Clay | 1 | 19 | 110,000 | 9,174 | 8 |
| Grant | 1 | 9 | 115,500 | 3,932 | 3 |
| Kittson | 1 | ** | ** | ** | ** |
| Mahnomen | 1 | ** | ** | ** | ** |
| Marshall | 1 | 6 | 28,300 | 1,091 | 4 |
| Norman | 1 | 10 | 77,200 | 4,808 | 6 |
| Pennington | 1 | ** | ** | ** | ** |
| Polk | 1 | 13 | 69,200 | 3,133 | 5 |
| Red Lake | 1 | ** | ** | ** | ** |
| Roseau | 1 | ** | ** | ** | ** |
| Traverse | 1 | 14 | 133,000 | 6,904 | 5 |
| Wilkin | 1 | 15 | 95,500 | 6,616 | 7 |
| Totals | 1 | 107 | 665,500 | 38,142 | 6 |
| Becker | 4 | 11 | 54,800 | 2,736 | 5 |
| Benton | 4 | 25 | 70,100 | 2,186 | 3 |
| Cass | 4 | ** | ** | ** | ** |
| Crow Wing | 4 | ** | ** | ** | ** |
| Douglas | 4 | 34 | 57,500 | 6,147 | 11 |
| Hubbard | 4 | ** | ** | ** | ** |
| Kandiyohi | 4 | 28 | 163,000 | 10,145 | 6 |
| Morrison | 4 | 76 | 97,500 | 9,413 | 10 |
| Otter Tail | 4 | 71 | 164,000 | 9,605 | 6 |
| Pope | 4 | 29 | 111,000 | 9,509 | 9 |
| Sherburne | 4 | 8 | 21,800 | 2,998 | 14 |
| Stearns | 4 | 114 | 208,000 | 18,022 | 9 |
| Todd | 4 | 49 | 66,100 | 4,785 | 7 |
| Wadena | 4 | 13 | 22,100 | 739 | 3 |
| Totals | 4 | 473 | 1,035,900 | 77,859 | 8 |
| Chisago | 5 | 12 | 22,300 | 984 | 4 |
| Isanti | 5 | 14 | 25,400 | 3,039 | 12 |
| Kanabec | 5 | 11 | 10,300 | 830 | 8 |
| Mille Lacs | 5 | 11 | 14,600 | 1,257 | 9 |
| Pine | 5 | 18 | 14,500 | 1,892 | 13 |
| Totals | 5 | 66 | 87,100 | 8,002 | 9 |
| Big Stone | 6 | 11 | 102,000 | 3,775 | 4 |
| Chippewa | 6 | 28 | 150,500 | 10,161 | 7 |
| Lac qui Parle | 6 | 28 | 180,000 | 9,099 | 5 |
| Stevens | 6 | 26 | 149,000 | 11,176 | 8 |
| Swift | 6 | 25 | 198,000 | 11,505 | 6 |
| Yellow Medicine | 6 | 30 | 199,000 | 14,155 | 7 |
| Totals | 6 | 148 | 978,500 | 59,871 | 6 |

| County | Pesticide Monitoring Area (PMA) | Number of Respondents | 2014 Planted Corn Acres [§] | Surveyed Corn Acres | Percentage of Acres Surveyed |
|---------------|---------------------------------|-----------------------|--------------------------------------|---------------------|------------------------------|
| Lincoln | 7 | 19 | 123,000 | 5,804 | 5 |
| Lyon | 7 | 29 | 190,500 | 7,486 | 4 |
| Murray | 7 | 35 | 187,000 | 11,649 | 6 |
| Nobles | 7 | 52 | 221,000 | 13,397 | 6 |
| Pipestone | 7 | 24 | 117,000 | 7,526 | 6 |
| Rock | 7 | 23 | 148,500 | 6,480 | 4 |
| Totals | 7 | 182 | 987,000 | 52,342 | 5 |
| Blue Earth | 8 | 46 | 194,000 | 16,662 | 9 |
| Brown | 8 | 51 | 169,500 | 11,555 | 7 |
| Cottonwood | 8 | 34 | 180,000 | 11,272 | 6 |
| Faribault | 8 | 32 | 222,000 | 13,185 | 6 |
| Freeborn | 8 | 47 | 213,500 | 15,081 | 7 |
| Jackson | 8 | 45 | 191,500 | 17,264 | 9 |
| Le Sueur | 8 | 27 | 102,000 | 4,356 | 4 |
| Martin | 8 | 34 | 235,500 | 12,387 | 5 |
| McLeod | 8 | 32 | 91,600 | 8,089 | 9 |
| Meeker | 8 | 30 | 116,000 | 9,045 | 8 |
| Nicollet | 8 | 33 | 123,500 | 12,494 | 10 |
| Redwood | 8 | 61 | 245,500 | 18,011 | 7 |
| Renville | 8 | 46 | 275,500 | 18,675 | 7 |
| Rice | 8 | 33 | 92,000 | 8,123 | 9 |
| Sibley | 8 | 39 | 152,000 | 8,625 | 6 |
| Steele | 8 | 28 | 129,000 | 11,283 | 9 |
| Waseca | 8 | 28 | 121,000 | 8,519 | 7 |
| Watonwan | 8 | 26 | 140,000 | 9,508 | 7 |
| Wright | 8 | 32 | 63,600 | 4,388 | 7 |
| Totals | 8 | 704 | 3,057,700 | 218,522 | 7 |
| Dodge | 9 | 20 | 141,000 | 5,436 | 4 |
| Fillmore | 9 | 54 | 194,000 | 12,902 | 7 |
| Goodhue | 9 | 62 | 161,000 | 14,531 | 9 |
| Houston | 9 | 33 | 61,100 | 3,762 | 6 |
| Mower | 9 | 30 | 225,500 | 11,560 | 5 |
| Olmsted | 9 | 40 | 133,000 | 7,798 | 6 |
| Wabasha | 9 | 42 | 99,700 | 8,022 | 8 |
| Winona | 9 | 54 | 85,500 | 7,875 | 9 |
| Totals | 9 | 335 | 1,100,800 | 71,886 | 7 |
| Anoka | 10 | ** | ** | ** | ** |
| Carver | 10 | 26 | 47,800 | 2,461 | 5 |
| Dakota | 10 | 23 | 94,200 | 6,857 | 7 |
| Hennepin | 10 | ** | ** | ** | ** |
| Scott | 10 | 18 | 34,900 | 3,228 | 9 |
| Washington | 10 | 12 | 21,400 | 2,104 | 10 |
| Totals | 10 | 88 | 215,200 | 15,361 | 7 |
| State | All | 2,103 | 8,127,700 | 542,570 | 7 |

[§] Note: USDA/NASS Minnesota Corn Acreage Planted

** Not reported by NASS

Statewide Herbicide Applications and Management on Corn

Ninety five percent (95%) of the respondents reported using herbicides and those respondents managed 98% of the corn acres reported in this survey (Table 2). As previously stated, if herbicides were not used, the respondent's survey was then concluded.

Tables 3 through 33 contain information from all corn producers that used herbicides. Because, not all farmers answered every question, the sum of total acres and the sum of total respondents are sometimes less than the statewide averages.

Participants were then asked who made the application (Q. 3). Forty-one percent (41%) of the respondents reported self-applied, 47% of the respondents reported custom applied and 12% of the respondents reported both self-applied and custom applied. Table 3 summarizes who applied the application and the responses are grouped by PMAs.

Farmers who applied their own herbicides averaged 340 acres of corn while farmers who had pesticides custom applied averaged 165 acres of corn. Farmers who both self-applied and custom applied herbicides raised an average of 421 acres of corn.

Table 2. Percentage of respondents that used corn herbicides.

| Pesticide Monitoring Area | Do You Use Herbicides? | Percent of All Respondents |
|----------------------------------|-------------------------------|-----------------------------------|
| 1 – Northwest Red River | Yes | 92 |
| 1 – Northwest Red River | No | 8 |
| 4 – Central Sands | Yes | 93 |
| 4 – Central Sands | No | 7 |
| 5 – East Central | Yes | 86 |
| 5 – East Central | No | 14 |
| 6 – West Central | Yes | 97 |
| 6 – West Central | No | 3 |
| 7 – Southwest | Yes | 98 |
| 7 – Southwest | No | 2 |
| 8 – South Central | Yes | 97 |
| 8 – South Central | No | 3 |
| 9 – Southeast | Yes | 93 |
| 9 – Southeast | No | 7 |
| 10 – Metro | Yes | 93 |
| 10 – Metro | No | 7 |
| | | |
| Statewide | Yes | 95 |
| Statewide | No | 5 |

Table 3. “Did you: Apply herbicides yourself? Have herbicides custom applied? Both?” (Q.3)

| Pesticide Monitoring Area | Application Type | Percent of Respondents | Average Corn Acres per Respondent |
|----------------------------------|-------------------------|-------------------------------|--|
| 1 – Northwest Red River | Self-Applied | 60 | 403 |
| 1 – Northwest Red River | Custom Applied | 27 | 218 |
| 1 – Northwest Red River | Both | 13 | 610 |
| 4 – Central Sands | Self-Applied | 43 | 238 |
| 4 – Central Sands | Custom Applied | 52 | 119 |
| 4 – Central Sands | Both | 5 | 164 |
| 5 – East Central | Self-Applied | 47 | 168 |
| 5 – East Central | Custom Applied | 53 | 106 |
| 5 – East Central | Both | 0 | 0 |
| 6 – West Central | Self-Applied | 38 | 538 |
| 6 – West Central | Custom Applied | 44 | 236 |
| 6 – West Central | Both | 18 | 548 |
| 7 – Southwest | Self-Applied | 48 | 335 |
| 7 – Southwest | Custom Applied | 37 | 199 |
| 7 – Southwest | Both | 15 | 375 |
| 8 – South Central | Self-Applied | 40 | 418 |
| 8 – South Central | Custom Applied | 44 | 174 |
| 8 – South Central | Both | 16 | 459 |
| 9 – Southeast | Self-Applied | 30 | 274 |
| 9 – Southeast | Custom Applied | 62 | 181 |
| 9 – Southeast | Both | 8 | 387 |
| 10 – Metro | Self-Applied | 44 | 209 |
| 10 – Metro | Custom Applied | 44 | 134 |
| 10 – Metro | Both | 12 | 248 |
| Statewide | Self-Applied | 41 | 340 |
| Statewide | Custom Applied | 47 | 165 |
| Statewide | Both | 12 | 421 |

Farmers were asked, “Do you know the active ingredients (a.i.) of the herbicides you used in 2014?” (Q.4). Based upon previous surveys, most farmers identified the product name (i.e. “Roundup”, etc.), but identifying the AI (i.e. glyphosate) was considerably more challenging. Of all statewide respondents (self-applicators and those that hired a custom applicator), 46% stated they knew the a.i. in their herbicide applications and 9% stated they knew some of the a.i. (Table 4). Fifty-seven percent of the farmers that applied the products themselves⁶ were able to identify

⁶ Farmers that applied pesticides themselves, referred to as “self-applicators,” includes farmers that self-apply and farmers that self-apply and custom apply (both), but not farmers who only had herbicides custom applied.

the a.i. It must be emphasized that farmers were asked these questions “on the spot” and were not given the opportunity to check their records during the telephone interview.

Table 4. “Do you know the active ingredients of the herbicides you used in 2014?” (Q.4)

| Pesticide Monitoring Area | Knew the Active Ingredients | Percent of All Respondents | Percent of “Self-Applicators” |
|----------------------------------|------------------------------------|-----------------------------------|--------------------------------------|
| 1 – Northwest Red River | Yes | 69 | 75 |
| 1 – Northwest Red River | No | 23 | 17 |
| 1 – Northwest Red River | Some | 8 | 8 |
| 4 – Central Sands | Yes | 47 | 57 |
| 4 – Central Sands | No | 45 | 36 |
| 4 – Central Sands | Some | 8 | 7 |
| 5 – East Central | Yes | 60 | 78 |
| 5 – East Central | No | 33 | 19 |
| 5 – East Central | Some | 7 | 3 |
| 6 – West Central | Yes | 43 | 50 |
| 6 – West Central | No | 49 | 37 |
| 6 – West Central | Some | 8 | 13 |
| 7 – Southwest | Yes | 43 | 54 |
| 7 – Southwest | No | 45 | 37 |
| 7 – Southwest | Some | 12 | 9 |
| 8 – South Central | Yes | 44 | 54 |
| 8 – South Central | No | 45 | 35 |
| 8 – South Central | Some | 11 | 11 |
| 9 – Southeast | Yes | 42 | 59 |
| 9 – Southeast | No | 48 | 34 |
| 9 – Southeast | Some | 10 | 7 |
| 10 – Metro | Yes | 44 | 50 |
| 10 – Metro | No | 50 | 44 |
| 10 – Metro | Some | 6 | 6 |
| | | | |
| Statewide | Yes | 46 | 57 |
| Statewide | No | 45 | 34 |
| Statewide | Some | 9 | 9 |

Producers were asked if they kept pesticide application records on the farm (Q.5). Sixty-eight percent of all statewide respondents kept all their herbicide records on the farm and 3% kept some records on the farm (Table 5). Eighty-four percent of the farmers that applied their own herbicides kept records on the farm.

Table 5. “Do you keep herbicide application records on your farm?” (Q.5)

| Pesticide Monitoring Area | Kept “On Farm” Pesticide Records | Percent of All Respondents | Percent of Self-Applicators |
|----------------------------------|---|-----------------------------------|------------------------------------|
| 1 – Northwest Red River | Yes | 79 | 85 |
| 1 – Northwest Red River | No | 17 | 12 |
| 1 – Northwest Red River | Some | 4 | 3 |
| 4 – Central Sands | Yes | 60 | 74 |
| 4 – Central Sands | No | 37 | 24 |
| 4 – Central Sands | Some | 3 | 2 |
| 5 – East Central | Yes | 61 | 78 |
| 5 – East Central | No | 35 | 22 |
| 5 – East Central | Some | 4 | 0 |
| 6 – West Central | Yes | 73 | 83 |
| 6 – West Central | No | 25 | 13 |
| 6 – West Central | Some | 2 | 4 |
| 7 – Southwest | Yes | 76 | 91 |
| 7 – Southwest | No | 22 | 8 |
| 7 – Southwest | Some | 2 | 1 |
| 8 – South Central | Yes | 74 | 90 |
| 8 – South Central | No | 23 | 8 |
| 8 – South Central | Some | 3 | 2 |
| 9 – Southeast | Yes | 59 | 84 |
| 9 – Southeast | No | 39 | 13 |
| 9 – Southeast | Some | 2 | 3 |
| 10 – Metro | Yes | 62 | 73 |
| 10 – Metro | No | 34 | 19 |
| 10 – Metro | Some | 4 | 8 |
| | | | |
| Statewide | Yes | 68 | 84 |
| Statewide | No | 29 | 14 |
| Statewide | Some | 3 | 2 |

Participants were asked about the practice of reading the label (Q.6) and the results are provided in Table 6. Eighty-seven percent of all statewide respondents who applied herbicide themselves usually read the label. This percentage drops to 64% for all farmers.

Table 6. “Do you usually read the label for pesticide products applied on your farm?” (Q.6)

| Pesticide Management Area | Response to “Reading the Label” | Percent of All Respondents | Percent of Self-Applicators |
|----------------------------------|--|-----------------------------------|------------------------------------|
| 1 – Northwest Red River | Yes | 79 | 86 |
| 1 – Northwest Red River | No | 21 | 14 |
| 4 – Central Sands | Yes | 57 | 85 |
| 4 – Central Sands | No | 43 | 15 |
| 5 – East Central | Yes | 60 | 89 |
| 5 – East Central | No | 40 | 11 |
| 6 – West Central | Yes | 66 | 91 |
| 6 – West Central | No | 34 | 9 |
| 7 – Southwest | Yes | 74 | 88 |
| 7 – Southwest | No | 26 | 12 |
| 8 – South Central | Yes | 66 | 88 |
| 8 – South Central | No | 34 | 12 |
| 9 – Southeast | Yes | 58 | 88 |
| 9 – Southeast | No | 42 | 12 |
| 10 – Metro | Yes | 62 | 75 |
| 10 – Metro | No | 38 | 25 |
| | | | |
| Statewide | Yes | 64 | 87 |
| Statewide | No | 36 | 13 |

Participants were asked if they applied atrazine to their corn acres. A “Yes” response means they did use atrazine on at least **some** of their corn acres. A “No” response means they did not use atrazine on any of their corn acres. Table 7 details the responses to the question of whether atrazine was used and the percentage of farmers who knew if they applied atrazine (answered yes or no). Statewide, thirteen percent of the respondents applied atrazine on some of their acres.

Table 7. “Was Atrazine applied on any of your corn acres in 2014, premixes included?” (Q.7)

| Pesticide Monitoring Area | Atrazine Applied | Percent of All Respondents | Percent of Respondents who Knew[§] |
|----------------------------------|-------------------------|-----------------------------------|--|
| 1 – Northwest Red River | Yes | 10 | 11 |
| 1 – Northwest Red River | No | 86 | 89 |
| 1 – Northwest Red River | Don't Know | 4 | |
| 4 – Central Sands | Yes | 9 | 9 |
| 4 – Central Sands | No | 82 | 91 |
| 4 – Central Sands | Don't Know | 9 | |
| 5 – East Central | Yes | 25 | 29 |
| 5 – East Central | No | 61 | 71 |
| 5 – East Central | Don't Know | 14 | |
| 6 – West Central | Yes | 8 | 9 |
| 6 – West Central | No | 87 | 91 |
| 6 – West Central | Don't Know | 5 | |
| 7 – Southwest | Yes | 15 | 16 |
| 7 – Southwest | No | 78 | 84 |
| 7 – Southwest | Don't Know | 7 | |
| 8 – South Central | Yes | 15 | 16 |
| 8 – South Central | No | 76 | 84 |
| 8 – South Central | Don't Know | 9 | |
| 9 – Southeast | Yes | 23 | 26 |
| 9 – Southeast | No | 66 | 74 |
| 9 – Southeast | Don't Know | 11 | |
| 10 – Metro | Yes | 15 | 16 |
| 10 – Metro | No | 75 | 84 |
| 10 – Metro | Don't Know | 10 | |
| | | | |
| Statewide | Yes | 13 | 16 |
| Statewide | No | 78 | 84 |
| Statewide | Don't Know | 9 | |

[§] Percent was calculated using only those respondents who answered yes or no to the question.

Nine percent (173 farmers) of the producers were not aware whether their herbicide package included atrazine (as an AI). Of this subgroup, 34% (or 59 farmers) knew the product(s) in their package. Of the farmers that knew the product name(s), it was determined that 22% (or 13 farmers) did apply a product within their herbicide package that contained atrazine.

Tables 8-9 pertain to the farmers applying atrazine. Included are those farmers who answered, “Yes”, to the question: “Was atrazine applied on any of your corn acres?” Farmers who answered, “I don’t know”, were included if they were later determined to have applied atrazine through identification of the product name. These farmers were classified through Q.7, Q.8, and Q.9.

Table 8. “Was Atrazine incorporated on any of your corn acres in 2014, premixes included?” (Q.10)

| Pesticide Monitoring Area | Was Atrazine Incorporated | Percent of Respondents |
|----------------------------------|----------------------------------|-------------------------------|
| 1 – Northwest Red River | Yes | 50 |
| 1 – Northwest Red River | No | 50 |
| 4 – Central Sands | Yes | 38 |
| 4 – Central Sands | No | 62 |
| 5 – East Central | Yes | 31 |
| 5 – East Central | No | 69 |
| 6 – West Central | Yes | 27 |
| 6 – West Central | No | 73 |
| 7 – Southwest | Yes | 22 |
| 7 – Southwest | No | 78 |
| 8 – South Central | Yes | 34 |
| 8 – South Central | No | 66 |
| 9 – Southeast | Yes | 28 |
| 9 – Southeast | No | 72 |
| 10 – Metro | Yes | 33 |
| 10 – Metro | No | 67 |
| | | |
| Statewide | Yes | 32 |
| Statewide | No | 68 |

Table 9. “Did you make more than one application of Atrazine to the same corn field in 2014?”⁷ (Q.11)

| Pesticide Monitoring Area | Was Atrazine Applied More Than Once | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 0 |
| 1 – Northwest Red River | No | 100 |
| 4 – Central Sands | Yes | 0 |
| 4 – Central Sands | No | 100 |
| 5 – East Central | Yes | 0 |
| 5 – East Central | No | 100 |
| 6 – West Central | Yes | 0 |
| 6 – West Central | No | 100 |
| 7 – Southwest | Yes | 0 |
| 7 – Southwest | No | 100 |
| 8 – South Central | Yes | 5 |
| 8 – South Central | No | 95 |
| 9 – Southeast | Yes | 3 |
| 9 – Southeast | No | 97 |
| 10 – Metro | Yes | 0 |
| 10 – Metro | No | 100 |
| | | |
| Statewide | Yes | 2 |
| Statewide | No | 98 |

⁷ In previous surveys this question was worded as “Did you make a split application of Atrazine on this field?” Because farmers were answering the question as yes when there was more than one application, but more than one application did not include Atrazine the question was changed to the current status. As a result very few farmers apply more than one application of Atrazine to a field as opposed to the former question of split applying Atrazine.

Participants were asked if they applied acetochlor to their corn acres. A “Yes” response means they did use acetochlor on at least some of their corn acres. A “No” response means they did not use acetochlor on any of their corn acres. Table 10 details the responses to the question of whether acetochlor was used and the percentage of farmers who knew if they applied acetochlor (answered yes or no). Statewide, nine percent of the respondents applied acetochlor on some of their acres.

Table 10. “Was Acetochlor applied on any of your corn acres in 2014, premixes included?” (Q.12)

| Pesticide Monitoring Area | Acetochlor Applied | Percent of All Respondents | Percent of Respondents who Knew[§] |
|----------------------------------|---------------------------|-----------------------------------|--|
| 1 – Northwest Red River | Yes | 6 | 7 |
| 1 – Northwest Red River | No | 84 | 93 |
| 1 – Northwest Red River | Don’t Know | 10 | |
| 4 – Central Sands | Yes | 5 | 7 |
| 4 – Central Sands | No | 71 | 93 |
| 4 – Central Sands | Don’t Know | 24 | |
| 5 – East Central | Yes | 2 | 2 |
| 5 – East Central | No | 70 | 98 |
| 5 – East Central | Don’t Know | 28 | |
| 6 – West Central | Yes | 9 | 12 |
| 6 – West Central | No | 70 | 88 |
| 6 – West Central | Don’t Know | 21 | |
| 7 – Southwest | Yes | 15 | 19 |
| 7 – Southwest | No | 64 | 81 |
| 7 – Southwest | Don’t Know | 21 | |
| 8 – South Central | Yes | 11 | 14 |
| 8 – South Central | No | 63 | 86 |
| 8 – South Central | Don’t Know | 26 | |
| 9 – Southeast | Yes | 13 | 18 |
| 9 – Southeast | No | 57 | 82 |
| 9 – Southeast | Don’t Know | 30 | |
| 10 – Metro | Yes | 4 | 5 |
| 10 – Metro | No | 74 | 95 |
| 10 – Metro | Don’t Know | 22 | |
| | | | |
| Statewide | Yes | 9 | 12 |
| Statewide | No | 66 | 88 |
| Statewide | Don’t Know | 25 | |

[§] Percent was calculated using only those respondents who answered yes or no to the question.

Twenty five percent (495 farmers) of the producers were not aware whether their herbicide package included acetochlor (as an AI). Of this subgroup, 56% (or 278 farmers) knew the product(s) in their package. Of the farmers that knew the product name(s), it was determined that 60% (or 165 farmers) did apply a product within their herbicide package that contained acetochlor.

Tables 11-12 pertain to the farmers applying acetochlor. Included are those farmers who answered, “Yes”, to the question: “Was acetochlor applied on any of your corn acres?” Farmers who answered, “I don’t know”, were included if they were later determined to have applied atrazine through identification of the product name. These farmers were classified through Q.12, Q.13, and Q.14.

Table 11. “Was Acetochlor incorporated on any of your corn acres in 2014, premixes included?” (Q.15)

| Pesticide Monitoring Area | Was Acetochlor Incorporated | Percent of Respondents |
|----------------------------------|------------------------------------|-------------------------------|
| 1 – Northwest Red River | Yes | 67 |
| 1 – Northwest Red River | No | 33 |
| 4 – Central Sands | Yes | 30 |
| 4 – Central Sands | No | 70 |
| 5 – East Central | Yes | 33 |
| 5 – East Central | No | 67 |
| 6 – West Central | Yes | 52 |
| 6 – West Central | No | 48 |
| 7 – Southwest | Yes | 48 |
| 7 – Southwest | No | 52 |
| 8 – South Central | Yes | 57 |
| 8 – South Central | No | 43 |
| 9 – Southeast | Yes | 43 |
| 9 – Southeast | No | 57 |
| 10 – Metro | Yes | 75 |
| 10 – Metro | No | 25 |
| | | |
| Statewide | Yes | 49 |
| Statewide | No | 51 |

Table 12. “Did you make more than one application of Acetochlor to the same corn field in 2014?”⁸ (Q.16)

| Pesticide Monitoring Area | Was Acetochlor Applied More Than Once | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 0 |
| 1 – Northwest Red River | No | 100 |
| 4 – Central Sands | Yes | 6 |
| 4 – Central Sands | No | 94 |
| 5 – East Central | Yes | 0 |
| 5 – East Central | No | 100 |
| 6 – West Central | Yes | 7 |
| 6 – West Central | No | 93 |
| 7 – Southwest | Yes | 2 |
| 7 – Southwest | No | 98 |
| 8 – South Central | Yes | 4 |
| 8 – South Central | No | 96 |
| 9 – Southeast | Yes | 9 |
| 9 – Southeast | No | 91 |
| 10 – Metro | Yes | 20 |
| 10 – Metro | No | 80 |
| | | |
| Statewide | Yes | 5 |
| Statewide | No | 95 |

⁸ In previous surveys this question was worded as “Did you make a split application of Acetochlor on this field?” Because farmers were answering the question as yes when there was more than one application, but more than one application did not include Acetochlor the question was changed to the current status. As a result very few farmers apply more than one application of Acetochlor to a field as opposed to the former question of split applying Acetochlor.

Herbicide Program Decisions

Questions 17-20 were related to herbicide decisions. Only farmers who applied atrazine or acetochlor answered these questions. Of the 2,103 farmers surveyed, 560 (27%) applied either atrazine or acetochlor. The following questions were answered by those 560 farmers who applied atrazine or acetochlor. Not all 560 farmers chose to answer each question.

Table 13. “Who decides what products to apply?” (Q.17)

| Pesticide Monitoring Area | Who Decides What Product to Apply | Percent of All Respondents |
|----------------------------------|--|-----------------------------------|
| 1 – Northwest Red River | Farmer | 50 |
| 1 – Northwest Red River | Dealer/Consultant | 17 |
| 1 – Northwest Red River | Both | 33 |
| 4 – Central Sands | Farmer | 30 |
| 4 – Central Sands | Dealer/Consultant | 30 |
| 4 – Central Sands | Both | 40 |
| 5 – East Central | Farmer | 44 |
| 5 – East Central | Dealer/Consultant | 17 |
| 5 – East Central | Both | 39 |
| 6 – West Central | Farmer | 29 |
| 6 – West Central | Dealer/Consultant | 16 |
| 6 – West Central | Both | 55 |
| 7 – Southwest | Farmer | 35 |
| 7 – Southwest | Dealer/Consultant | 13 |
| 7 – Southwest | Both | 52 |
| 8 – South Central | Farmer | 32 |
| 8 – South Central | Dealer/Consultant | 13 |
| 8 – South Central | Both | 55 |
| 9 – Southeast | Farmer | 21 |
| 9 – Southeast | Dealer/Consultant | 27 |
| 9 – Southeast | Both | 52 |
| 10 – Metro | Farmer | 13 |
| 10 – Metro | Dealer/Consultant | 50 |
| 10 – Metro | Both | 37 |
| | | |
| Statewide | Farmer | 30 |
| Statewide | Dealer/Consultant | 20 |
| Statewide | Both | 50 |

Table 14. “Who decides when to apply the herbicides?” (Q.18)

| Pesticide Monitoring Area | Who Decides When to Apply Herbicides | Percent of All Respondents |
|---------------------------|--------------------------------------|----------------------------|
| 1 – Northwest Red River | Farmer | 61 |
| 1 – Northwest Red River | Dealer/Consultant | 11 |
| 1 – Northwest Red River | Both | 28 |
| 4 – Central Sands | Farmer | 42 |
| 4 – Central Sands | Dealer/Consultant | 31 |
| 4 – Central Sands | Both | 27 |
| 5 – East Central | Farmer | 67 |
| 5 – East Central | Dealer/Consultant | 11 |
| 5 – East Central | Both | 22 |
| 6 – West Central | Farmer | 42 |
| 6 – West Central | Dealer/Consultant | 26 |
| 6 – West Central | Both | 32 |
| 7 – Southwest | Farmer | 58 |
| 7 – Southwest | Dealer/Consultant | 7 |
| 7 – Southwest | Both | 35 |
| 8 – South Central | Farmer | 54 |
| 8 – South Central | Dealer/Consultant | 10 |
| 8 – South Central | Both | 36 |
| 9 – Southeast | Farmer | 45 |
| 9 – Southeast | Dealer/Consultant | 20 |
| 9 – Southeast | Both | 35 |
| 10 – Metro | Farmer | 38 |
| 10 – Metro | Dealer/Consultant | 37 |
| 10 – Metro | Both | 25 |
| | | |
| Statewide | Farmer | 51 |
| Statewide | Dealer/Consultant | 16 |
| Statewide | Both | 33 |

Table 15. “Who scouts your fields?” (Q.19)

| Pesticide Monitoring Area | Who Scouts Your Fields | Percent of All Respondents |
|---------------------------|------------------------|----------------------------|
| 1 – Northwest Red River | Farmer | 56 |
| 1 – Northwest Red River | Dealer/Consultant | 17 |
| 1 – Northwest Red River | Both | 22 |
| 1 – Northwest Red River | Field Not Scouted | 5 |
| 4 – Central Sands | Farmer | 48 |
| 4 – Central Sands | Dealer/Consultant | 35 |
| 4 – Central Sands | Both | 15 |
| 4 – Central Sands | Field Not Scouted | 2 |
| 5 – East Central | Farmer | 56 |
| 5 – East Central | Dealer/Consultant | 11 |
| 5 – East Central | Both | 33 |
| 5 – East Central | Field Not Scouted | 0 |
| 6 – West Central | Farmer | 45 |
| 6 – West Central | Dealer/Consultant | 34 |
| 6 – West Central | Both | 21 |
| 6 – West Central | Field Not Scouted | 0 |
| 7 – Southwest | Farmer | 54 |
| 7 – Southwest | Dealer/Consultant | 16 |
| 7 – Southwest | Both | 29 |
| 7 – Southwest | Field Not Scouted | 1 |
| 8 – South Central | Farmer | 49 |
| 8 – South Central | Dealer/Consultant | 19 |
| 8 – South Central | Both | 32 |
| 8 – South Central | Field Not Scouted | 0 |
| 9 – Southeast | Farmer | 50 |
| 9 – Southeast | Dealer/Consultant | 19 |
| 9 – Southeast | Both | 31 |
| 9 – Southeast | Field Not Scouted | 0 |
| 10 – Metro | Farmer | 56 |
| 10 – Metro | Dealer/Consultant | 19 |
| 10 – Metro | Both | 25 |
| 10 – Metro | Field Not Scouted | 0 |
| | | |
| Statewide | Farmer | 50 |
| Statewide | Dealer/Consultant | 22 |
| Statewide | Both | 27 |
| Statewide | Field Not Scouted | 1 |

Table 16. “Who determines if application setbacks or restrictions are appropriate on your farm?” (Q.20)

| Pesticide Monitoring Area | Who Determines Setbacks | Percent of All Respondents |
|----------------------------------|--------------------------------|-----------------------------------|
| 1 – Northwest Red River | Farmer | 50 |
| 1 – Northwest Red River | Dealer/Consultant | 28 |
| 1 – Northwest Red River | Both | 22 |
| 1 – Northwest Red River | Neither | 0 |
| 4 – Central Sands | Farmer | 41 |
| 4 – Central Sands | Dealer/Consultant | 38 |
| 4 – Central Sands | Both | 20 |
| 4 – Central Sands | Neither | 1 |
| 5 – East Central | Farmer | 56 |
| 5 – East Central | Dealer/Consultant | 22 |
| 5 – East Central | Both | 17 |
| 5 – East Central | Neither | 5 |
| 6 – West Central | Farmer | 34 |
| 6 – West Central | Dealer/Consultant | 37 |
| 6 – West Central | Both | 26 |
| 6 – West Central | Neither | 3 |
| 7 – Southwest | Farmer | 49 |
| 7 – Southwest | Dealer/Consultant | 23 |
| 7 – Southwest | Both | 27 |
| 7 – Southwest | Neither | 1 |
| 8 – South Central | Farmer | 48 |
| 8 – South Central | Dealer/Consultant | 24 |
| 8 – South Central | Both | 27 |
| 8 – South Central | Neither | 1 |
| 9 – Southeast | Farmer | 40 |
| 9 – Southeast | Dealer/Consultant | 34 |
| 9 – Southeast | Both | 22 |
| 9 – Southeast | Neither | 4 |
| 10 – Metro | Farmer | 38 |
| 10 – Metro | Dealer/Consultant | 31 |
| 10 – Metro | Both | 31 |
| 10 – Metro | Neither | 0 |
| | | |
| Statewide | Farmer | 45 |
| Statewide | Dealer/Consultant | 28 |
| Statewide | Both | 25 |
| Statewide | Neither | 2 |

Scouting for Weeds and Related Practices

Table 17. “Has someone mapped weed infestations in any of your fields in the last three years?” (Q.21)

| Pesticide Monitoring Area | Weed Infestations Mapped Last 3 Years | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 17 |
| 1 – Northwest Red River | No | 83 |
| 4 – Central Sands | Yes | 26 |
| 4 – Central Sands | No | 74 |
| 5 – East Central | Yes | 6 |
| 5 – East Central | No | 94 |
| 6 – West Central | Yes | 26 |
| 6 – West Central | No | 74 |
| 7 – Southwest | Yes | 28 |
| 7 – Southwest | No | 72 |
| 8 – South Central | Yes | 19 |
| 8 – South Central | No | 81 |
| 9 – Southeast | Yes | 17 |
| 9 – Southeast | No | 83 |
| 10 – Metro | Yes | 13 |
| 10 – Metro | No | 87 |
| | | |
| Statewide | Yes | 21 |
| Statewide | No | 79 |

Table 18. “Do you choose herbicides based on type of weeds and/or density of weeds?” (Q.22)

| Pesticide Monitoring Area | Herbicide Choice Based on Weeds | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 89 |
| 1 – Northwest Red River | No | 11 |
| 4 – Central Sands | Yes | 86 |
| 4 – Central Sands | No | 14 |
| 5 – East Central | Yes | 89 |
| 5 – East Central | No | 11 |
| 6 – West Central | Yes | 95 |
| 6 – West Central | No | 5 |
| 7 – Southwest | Yes | 97 |
| 7 – Southwest | No | 3 |
| 8 – South Central | Yes | 97 |
| 8 – South Central | No | 3 |
| 9 – Southeast | Yes | 90 |
| 9 – Southeast | No | 10 |
| 10 – Metro | Yes | 81 |
| 10 – Metro | No | 19 |
| | | |
| Statewide | Yes | 93 |
| Statewide | No | 7 |

Water Resources and Soil Resources

Table 19. “Do you know the soil texture of your farm?” (Q.23)

| Pesticide Monitoring Area | Soil Texture Known of Farm Soils | Percent of Respondents |
|----------------------------------|---|-----------------------------------|
| 1 – Northwest Red River | Yes | 89 |
| 1 – Northwest Red River | No | 11 |
| 4 – Central Sands | Yes | 86 |
| 4 – Central Sands | No | 14 |
| 5 – East Central | Yes | 100 |
| 5 – East Central | No | 0 |
| 6 – West Central | Yes | 87 |
| 6 – West Central | No | 13 |
| 7 – Southwest | Yes | 81 |
| 7 – Southwest | No | 19 |
| 8 – South Central | Yes | 83 |
| 8 – South Central | No | 17 |
| 9 – Southeast | Yes | 90 |
| 9 – Southeast | No | 10 |
| 10 – Metro | Yes | 88 |
| 10 – Metro | No | 12 |
| | | |
| Statewide | Yes | 86 |
| Statewide | No | 14 |

Table 20. “Do you know the organic matter level of your farm soils?” (Q.24)

| Pesticide Monitoring Area | Organic Matter Known of Farm Soils | Percent of Respondents |
|----------------------------------|---|-------------------------------|
| 1 – Northwest Red River | Yes | 89 |
| 1 – Northwest Red River | No | 11 |
| 4 – Central Sands | Yes | 66 |
| 4 – Central Sands | No | 34 |
| 5 – East Central | Yes | 72 |
| 5 – East Central | No | 28 |
| 6 – West Central | Yes | 74 |
| 6 – West Central | No | 26 |
| 7 – Southwest | Yes | 78 |
| 7 – Southwest | No | 22 |
| 8 – South Central | Yes | 76 |
| 8 – South Central | No | 24 |
| 9 – Southeast | Yes | 70 |
| 9 – Southeast | No | 30 |
| 10 – Metro | Yes | 75 |
| 10 – Metro | No | 25 |
| | | |
| Statewide | Yes | 74 |
| Statewide | No | 26 |

Table 21. “Do you know the depth to the water table in your field?” (Q.25)

| Pesticide Monitoring Area | Knowledge of Depth to the Water Table | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 44 |
| 1 – Northwest Red River | No | 56 |
| 4 – Central Sands | Yes | 48 |
| 4 – Central Sands | No | 52 |
| 5 – East Central | Yes | 56 |
| 5 – East Central | No | 44 |
| 6 – West Central | Yes | 39 |
| 6 – West Central | No | 61 |
| 7 – Southwest | Yes | 33 |
| 7 – Southwest | No | 67 |
| 8 – South Central | Yes | 37 |
| 8 – South Central | No | 63 |
| 9 – Southeast | Yes | 33 |
| 9 – Southeast | No | 67 |
| 10 – Metro | Yes | 56 |
| 10 – Metro | No | 44 |
| | | |
| Statewide | Yes | 39 |
| Statewide | No | 61 |

Editor’s Note: Respondents that answered, “No” were then asked whether they believed that the depth to groundwater exceeded 30 feet. Table 22 details those responses.

Table 22. “Is the water table at a depth greater than 30 feet?” (Q.26)

| Pesticide Monitoring Area | “Yes” Response Percent of Respondents | “No” Response Percent of Respondents | Don’t Know Response Percent of Respondents |
|---------------------------|---------------------------------------|--------------------------------------|--|
| 1 – Northwest Red River | 56 | 11 | 33 |
| 4 – Central Sands | 49 | 28 | 23 |
| 5 – East Central | 33 | 17 | 50 |
| 6 – West Central | 39 | 24 | 37 |
| 7 – Southwest | 47 | 30 | 23 |
| 8 – South Central | 40 | 26 | 34 |
| 9 – Southeast | 61 | 15 | 24 |
| 10 – Metro | 50 | 31 | 19 |
| Statewide | 46 | 24 | 30 |

Editor’s Note: Respondents who answered, “Yes”, to question 26 were then asked, “How was the depth primarily determined?” Figure 1 details their responses.

Figure 1. Information sources used to determine water table depth (Q.26a)

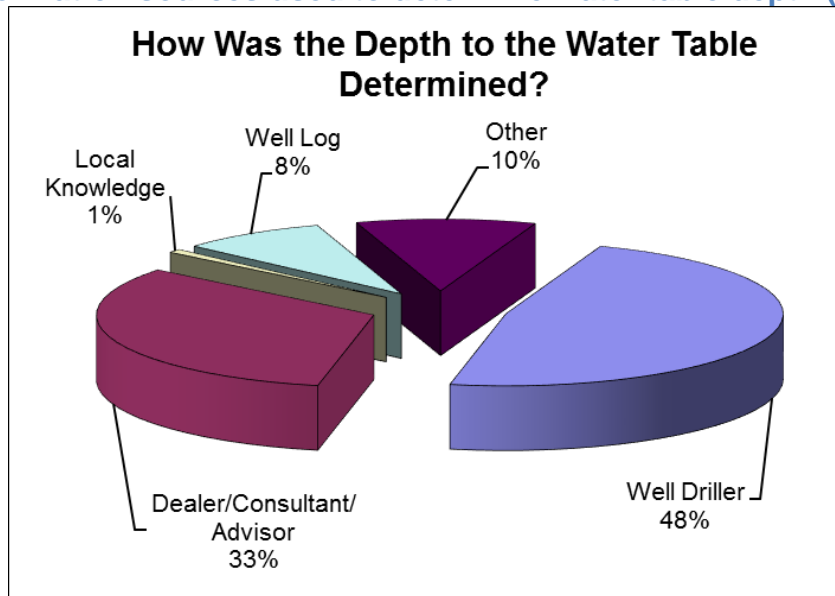


Table 23. “Are any streams, lakes, or other surface waters immediately adjacent to or in your corn fields?” (Q.27)

| Pesticide Monitoring Area | Surface Water Adjacent to or in Field | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 44 |
| 1 – Northwest Red River | No | 56 |
| 4 – Central Sands | Yes | 31 |
| 4 – Central Sands | No | 69 |
| 5 – East Central | Yes | 28 |
| 5 – East Central | No | 72 |
| 6 – West Central | Yes | 50 |
| 6 – West Central | No | 50 |
| 7 – Southwest | Yes | 35 |
| 7 – Southwest | No | 65 |
| 8 – South Central | Yes | 49 |
| 8 – South Central | No | 51 |
| 9 – Southeast | Yes | 24 |
| 9 – Southeast | No | 76 |
| 10 – Metro | Yes | 25 |
| 10 – Metro | No | 75 |
| | | |
| Statewide | Yes | 38 |
| Statewide | No | 62 |

Editor’s Note: Respondents who answered, “Yes” to question 27 were then asked, “Are there filter strips or vegetative buffers on any of these acres?” Table 24 details their responses.

Table 24. “Are there filter strips or vegetative buffers on any of these acres?” (Q.28)

| Pesticide Monitoring Area | Filter Strips or Buffers | Percent of Respondents |
|----------------------------------|---|-----------------------------------|
| 1 – Northwest Red River | Yes | 100 |
| 1 – Northwest Red River | No | 0 |
| 4 – Central Sands | Yes | 91 |
| 4 – Central Sands | No | 9 |
| 5 – East Central | Yes | 80 |
| 5 – East Central | No | 20 |
| 6 – West Central | Yes | 89 |
| 6 – West Central | No | 11 |
| 7 – Southwest | Yes | 83 |
| 7 – Southwest | No | 17 |
| 8 – South Central | Yes | 88 |
| 8 – South Central | No | 12 |
| 9 – Southeast | Yes | 96 |
| 9 – Southeast | No | 4 |
| 10 – Metro | Yes | 100 |
| 10 – Metro | No | 0 |
| | | |
| Statewide | Yes | 90 |
| Statewide | No | 10 |

Editor’s Note: Respondents who answered “Yes” to question 28a in regards to having filter strips or vegetative buffers were then asked, “Were they required as part of a conservation program?” Table 25 details their responses.

Table 25. “Were they required as part of a conservation program?”(Q.28a)

| Pesticide Monitoring Area | Response | Percent of Respondents |
|----------------------------------|-----------------|-------------------------------|
| 1 – Northwest Red River | Yes | 25 |
| 1 – Northwest Red River | No | 75 |
| 4 – Central Sands | Yes | 27 |
| 4 – Central Sands | No | 73 |
| 5 – East Central | Yes | 25 |
| 5 – East Central | No | 75 |
| 6 – West Central | Yes | 18 |
| 6 – West Central | No | 82 |
| 7 – Southwest | Yes | 50 |
| 7 – Southwest | No | 50 |
| 8 – South Central | Yes | 33 |
| 8 – South Central | No | 67 |
| 9 – Southeast | Yes | 38 |
| 9 – Southeast | No | 62 |
| 10 – Metro | Yes | 0 |
| 10 – Metro | No | 100 |
| | | |
| Statewide | Yes | 32 |
| Statewide | No | 68 |

Table 26. “Do you irrigate corn?” (Q.29)

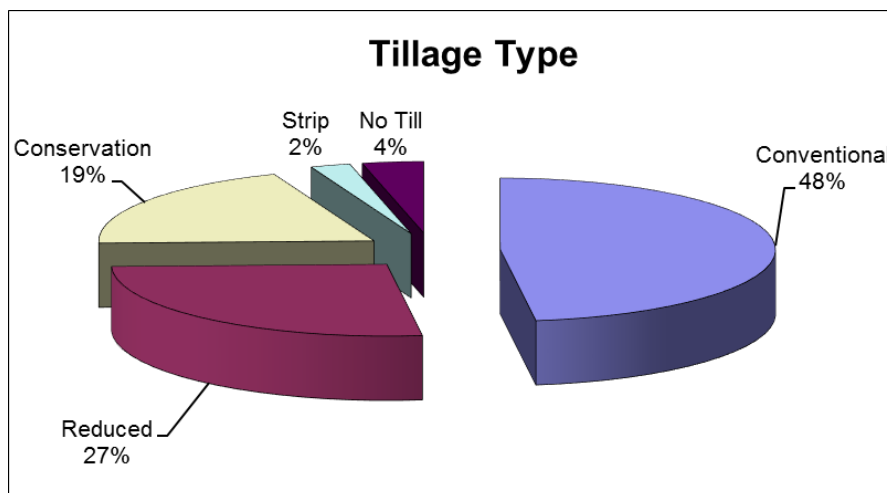
| Pesticide Monitoring Area | Irrigation | Percent of Respondents |
|----------------------------------|-------------------|-------------------------------|
| 1 – Northwest Red River | Yes | 6 |
| 1 – Northwest Red River | No | 94 |
| 4 – Central Sands | Yes | 20 |
| 4 – Central Sands | No | 80 |
| 5 – East Central | Yes | 0 |
| 5 – East Central | No | 100 |
| 6 – West Central | Yes | 11 |
| 6 – West Central | No | 89 |
| 7 – Southwest | Yes | 0 |
| 7 – Southwest | No | 100 |
| 8 – South Central | Yes | 3 |
| 8 – South Central | No | 97 |
| 9 – Southeast | Yes | 3 |
| 9 – Southeast | No | 97 |
| 10 – Metro | Yes | 31 |
| 10 – Metro | No | 69 |
| | | |
| Statewide | Yes | 6 |
| Statewide | No | 94 |

Table 27. “Do you have an irrigation water management plan?” (Q.29a)

| Pesticide Monitoring Area | Irrigation Water Management Plan | Percent of Respondents |
|----------------------------------|---|-------------------------------|
| Statewide | Yes | 80 |
| Statewide | No | 20 |

Editor’s Note. Only six percent (or 35) of the farmers used irrigation on corn acres; due to the small numbers of farmers irrigating, only statewide data is reported. This is 6% of farmers using atrazine or acetochlor.

Figure 2. “What type of tillage did you use before planting on the majority of your corn acres?” (Q.30)



General Practices for Herbicide Application

Table 28. “Do you use precision applications for herbicides (variable rate applications)?” (Q.31)

| Pesticide Monitoring Area | Variable Rate Applications | Percent of Respondents |
|---------------------------|----------------------------|------------------------|
| 1 – Northwest Red River | Yes | 56 |
| 1 – Northwest Red River | No | 44 |
| 4 – Central Sands | Yes | 35 |
| 4 – Central Sands | No | 65 |
| 5 – East Central | Yes | 50 |
| 5 – East Central | No | 50 |
| 6 – West Central | Yes | 37 |
| 6 – West Central | No | 63 |
| 7 – Southwest | Yes | 49 |
| 7 – Southwest | No | 51 |
| 8 – South Central | Yes | 43 |
| 8 – South Central | No | 57 |
| 9 – Southeast | Yes | 42 |
| 9 – Southeast | No | 58 |
| 10 – Metro | Yes | 50 |
| 10 – Metro | No | 50 |
| Statewide | Yes | 43 |
| Statewide | No | 57 |

Table 29. “In general, do you alternate use of herbicide products to keep weeds from becoming resistant to herbicides?” (Q.32)

| Pesticide Monitoring Area | Response to Using Alternative Herbicide | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 89 |
| 1 – Northwest Red River | No | 11 |
| 4 – Central Sands | Yes | 90 |
| 4 – Central Sands | No | 10 |
| 5 – East Central | Yes | 89 |
| 5 – East Central | No | 11 |
| 6 – West Central | Yes | 95 |
| 6 – West Central | No | 5 |
| 7 – Southwest | Yes | 87 |
| 7 – Southwest | No | 13 |
| 8 – South Central | Yes | 94 |
| 8 – South Central | No | 6 |
| 9 – Southeast | Yes | 88 |
| 9 – Southeast | No | 12 |
| 10 – Metro | Yes | 94 |
| 10 – Metro | No | 6 |
| | | |
| Statewide | Yes | 91 |
| Statewide | No | 9 |

Table 30. “Did you reduce from previous applications, the rate per acre of any corn herbicide?” (Q.33)

| Pesticide Monitoring Area | Reduced Rate from Previous Applications | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 44 |
| 1 – Northwest Red River | No | 56 |
| 4 – Central Sands | Yes | 39 |
| 4 – Central Sands | No | 61 |
| 5 – East Central | Yes | 39 |
| 5 – East Central | No | 61 |
| 6 – West Central | Yes | 26 |
| 6 – West Central | No | 74 |
| 7 – Southwest | Yes | 35 |
| 7 – Southwest | No | 65 |
| 8 – South Central | Yes | 31 |
| 8 – South Central | No | 69 |
| 9 – Southeast | Yes | 42 |
| 9 – Southeast | No | 58 |
| 10 – Metro | Yes | 50 |
| 10 – Metro | No | 50 |
| | | |
| Statewide | Yes | 36 |
| Statewide | No | 64 |

Table 31. “Did you select an herbicide with a different mode of action to reduce weed resistance to herbicides?” (Q.34)

| Pesticide Monitoring Area | Selected Herbicide with Different Mode of Action to Reduce Weed Resistance | Percent of Respondents |
|----------------------------------|---|-------------------------------|
| 1 – Northwest Red River | Yes | 100 |
| 1 – Northwest Red River | No | 0 |
| 4 – Central Sands | Yes | 80 |
| 4 – Central Sands | No | 20 |
| 5 – East Central | Yes | 50 |
| 5 – East Central | No | 50 |
| 6 – West Central | Yes | 82 |
| 6 – West Central | No | 18 |
| 7 – Southwest | Yes | 81 |
| 7 – Southwest | No | 19 |
| 8 – South Central | Yes | 91 |
| 8 – South Central | No | 9 |
| 9 – Southeast | Yes | 77 |
| 9 – Southeast | No | 23 |
| 10 – Metro | Yes | 75 |
| 10 – Metro | No | 25 |
| | | |
| Statewide | Yes | 83 |
| Statewide | No | 17 |

Table 32. “Did you choose a particular herbicide to reduce impacts to surface water or groundwater?” (Q.35)

| Pesticide Monitoring Area | Chose Herbicide to Reduce Impact to Surface or Groundwater | Percent of Respondents |
|----------------------------------|---|-------------------------------|
| 1 – Northwest Red River | Yes | 33 |
| 1 – Northwest Red River | No | 67 |
| 4 – Central Sands | Yes | 46 |
| 4 – Central Sands | No | 54 |
| 5 – East Central | Yes | 56 |
| 5 – East Central | No | 44 |
| 6 – West Central | Yes | 39 |
| 6 – West Central | No | 61 |
| 7 – Southwest | Yes | 46 |
| 7 – Southwest | No | 54 |
| 8 – South Central | Yes | 40 |
| 8 – South Central | No | 60 |
| 9 – Southeast | Yes | 46 |
| 9 – Southeast | No | 54 |
| 10 – Metro | Yes | 56 |
| 10 – Metro | No | 44 |
| | | |
| Statewide | Yes | 43 |
| Statewide | No | 57 |

Table 33. “Did you band herbicide applications to reduce use?” (Q.36)

| Pesticide Monitoring Area | Banded Herbicide Applications to Reduce Use | Percent of Respondents |
|----------------------------------|--|-------------------------------|
| 1 – Northwest Red River | Yes | 6 |
| 1 – Northwest Red River | No | 94 |
| 4 – Central Sands | Yes | 14 |
| 4 – Central Sands | No | 86 |
| 5 – East Central | Yes | 11 |
| 5 – East Central | No | 89 |
| 6 – West Central | Yes | 8 |
| 6 – West Central | No | 92 |
| 7 – Southwest | Yes | 9 |
| 7 – Southwest | No | 91 |
| 8 – South Central | Yes | 6 |
| 8 – South Central | No | 94 |
| 9 – Southeast | Yes | 12 |
| 9 – Southeast | No | 88 |
| 10 – Metro | Yes | 19 |
| 10 – Metro | No | 81 |
| | | |
| Statewide | Yes | 9 |
| Statewide | No | 91 |

Appendix 1. Survey Form

Annual Pesticide Survey: Herbicide Applications and Practices on Corn for the 2014 Growing Season

1. Did you grow corn on your operation in 2014?
(Exclude sweet corn and popcorn)

Yes No - conclude interview

2. How many corn acres were planted for field corn in 2014?

General Information

3. On your 2014 corn acres, did you:

Apply herbicides yourself 1

Have herbicides custom applied? 2

Both? 3

Don't use herbicides [conclude interview] 4

4. Do you know the active ingredients of the herbicides you used on corn acres in 2014?

Yes = 1 No = 3 Some = 5

5. Do you keep herbicide application records on your farm?

Yes = 1 No = 3 Some = 5

6. Do you usually read the label for pesticide products applied on your farm?

Yes = 1 No = 3

Atrazine Specific Questions

7. Was Atrazine applied on any of your corn acres in 2014, premixes included?

Yes = 1 (go to 10) No = 3 (go to 12) Don't Know = 5

8. Do you know the products applied to your corn acres in 2014?

Yes = 1 No = 3

9. Were any of the following products applied on your corn acres in 2014?

**Computer list of products used

Yes = 1 No = 3 (go to 12)

10. Was Atrazine incorporated on any of your corn acres in 2014, premixes included?

Yes = 1 No = 3 I Don't Know = 5

11. Did you make more than one application of Atrazine to the same corn field in 2014?

Yes = 1 No = 3 I Don't Know = 5

Acetochlor Specific Questions

12. Was Acetochlor applied on any of your corn acres in 2014, premixes included?

Yes = 1 (go to 15) No = 3 (go to 17) Don't Know = 5

13. Do you know the products applied to your corn acres in 2014?

Yes = 1 No = 3 (go to 17)

14. Were any of the following products applied on your corn acres in 2014?

**Computer list of products used

Yes = 1 No = 3 (go to 17)

15. Was Acetochlor incorporated on any of your corn acres in 2014, premixes included?

Yes = 1 No = 3 Don't Know = 5

16. Did you make more than one application of Acetochlor to the same corn field in 2014?

Yes = 1 No = 3 Don't Know = 5

The Following Questions Ask About how Decisions are Made Regarding Your Herbicide Program.

17. Who decides what products to apply?

- I do (the farmer)? 1
Dealer/Crop consultant? 3 Enter Code
Both together? 5

18. Who decides when to apply the herbicides?

- I do (the farmer)? 1
Dealer/Crop consultant? 3 Enter Code
Both together? 5

19. Who scouts your fields?

- I do (the farmer)? 1
Dealer/Crop consultant? 2 Enter Code
Both together? 3
Fields not scouted? 4

20. Setbacks or restrictions are part of many pesticide labels. Who determines if applications setbacks or restrictions are appropriate on your farm?

- I do (the farmer)? 1
Dealer/Crop consultant? 2 Enter Code
Both together? 3
Neither? 4

Scouting for Weeds and Related Practices

21. Has someone mapped weed infestations in any of your corn fields in the last three years?

- Yes = 1 No = 3

22. Do you choose herbicides based on type of weeds and/or density of weeds?

- Yes = 1 No = 3

Soil and Water Resources

23. Do you know the soil texture of your farm?

Yes = 1 No = 3

24. Do you know the organic matter level of your farm's soils?

Yes = 1 No = 3

25. Do you know the depth to the water table in your fields?

Yes = 1 No = 3

26. Is the water table at a depth greater than 30 feet?

Yes = 1 No = 3 (go to 29) Don't Know = 5 (go to 29)

26 a. If yes, how was the depth primarily determined? (Check one)

| | | | |
|--------------------------------------|---|--------------------------|-------------------|
| Well driller for drinking water | 1 | <input type="checkbox"/> | |
| Local knowledge | 2 | <input type="checkbox"/> | <u>Enter Code</u> |
| A dealer, consultant or crop advisor | 3 | <input type="checkbox"/> | |
| Well log | 4 | <input type="checkbox"/> | |
| None of the above | 5 | <input type="checkbox"/> | |

27. Are any streams, lakes or other surface waters immediately adjacent to or in your corn fields?

Yes = 1 No = 3 (if no go to 29)

28. Are there filter strips or vegetative buffers on any of these acres?

Yes = 1 No = 3 (if no go to 29)

28 a. If YES, were they required as part of a conservation program?

Yes = 1 No = 3

29. Do you irrigate corn?

Yes = 1 No = 3 (if no go to 32)

If, yes,

29 a. Do you have an irrigation water management plan?

Yes = 1 No = 3

30. What type of tillage did you use before planting on the majority of your corn acres? (Fall and Spring)

- Conventional < 15 residue 1
- Reduced Tillage 15 – 30? 2
- Conservation Tillage > 30? 3
- Strip Tillage 4
- No Tillage 5

Enter Code

General Practices for Corn Acres Only

31. Do you use precision applications for herbicides (variable rate applications)?

- Yes = 1 No = 3

32. In general, do you alternate use of herbicide products to keep weeds from becoming resistant to herbicides?

- Yes = 1 No = 3

33. Did you reduce from previous applications, the rate per acre of any corn herbicide?

- Yes = 1 No = 3

34. Did you select an herbicide with a different mode of action to reduce weed resistance to herbicides?

- Yes = 1 No = 3

35. Did you choose a particular herbicide to reduce impacts to surface water or groundwater?

- Yes = 1 No = 3

36. Did you band herbicide applications to reduce use?

- Yes = 1 No = 3