



# Survey Results of Nitrogen Fertilizer BMPs on Minnesota's 2013 Corn Acres

Minnesota Department of Agriculture  
USDA, NASS, Minnesota Field Office

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## Introduction

The Minnesota Department of Agriculture (MDA) is responsible for the development and promotion of nitrogen Best Management Practices (BMPs) which optimize production and profitability while protecting the state's water resources. The MDA is also responsible for monitoring nitrogen 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 nitrogen on corn acres. The focus of this survey is the use of fall application of nitrogen and the sidedress application of nitrogen on corn acres.

In Minnesota, nitrate is detected frequently in groundwater and surface water resources. Nitrate often exceeds the drinking water standard in groundwater, and sometimes exceeds the draft<sup>1</sup> standard in surface water. The MDA has invested considerable staff time in water monitoring, development of BMP education programs, and BMP assessment. Best management practices vary by BMP region across Minnesota.

The MDA has two types of fertilizer surveys for farmers in Minnesota. On the even crop years, Minnesota farmers are surveyed for nitrogen use and rates on corn and other crops for both commercial fertilizer and manure. On odd numbered years, Minnesota farmers are surveyed for BMP adoption such as timing, placement and product use.

NASS developed a sample of over 7,600 farmers in early 2014. From this pool, approximately 1,700 farmers who raised corn during the 2013 growing season shared valuable information on the practice of fall and sidedress applications of nitrogen.

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

Every year, MDA has partnered with NASS to produce a detailed report on nitrogen use or nitrogen management on corn acres in Minnesota. The first nitrogen fertilizer use survey was conducted in 2009 and was designed for commercial nitrogen fertilizer use on corn. Readers are encouraged to visit the reports from this survey and subsequent surveys at:

<http://www.mda.state.mn.us/en/protecting/cleanwaterfund/gwdwprotection/nutrientmgmt/survey.aspx>

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<sup>1</sup> The MPCA has published draft nitrate-nitrogen water quality standards to address aquatic life toxicity.

- 3.1 mg/l nitrate-N for class 2A waters
- 4.9 mg/l nitrate-N for class 2B waters

## **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 Office in Minnesota. The detailed information about fertilizer use 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. Special thanks go to Dan Lofthus, State Statistician of the NASS Upper Midwest Region I Minnesota Field Office, and their respective staff for assistance with survey design, data collection and processing. The MDA is ultimately responsible for the representation 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 played a vital part in providing complete and detailed commercial fertilizer use information.

## **2013 Fertilizer Management Practices Summary and Highlights**

This report summarizes survey results for a number of important practices associated with nitrogen fertilizer use on Minnesota's 2013 corn acres. Over 1,700 farmers participated in the telephone survey and fertilizer information was collected for 461,000 corn acres, representing 5 percent of Minnesota's 8,140,000 harvested corn acres.

Farmers were interviewed over the phone in April. These were "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 ten to thirty minutes, depending on the complexity of the farm.

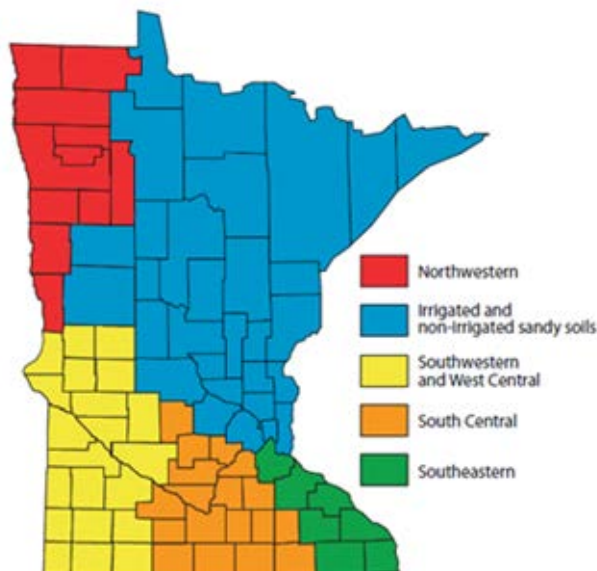
Survey questions focused on the fall application of nitrogen and the sidedress application of nitrogen as per the Nitrogen BMP recommendations. Minnesota farmers in the Northwestern, Southwestern and West Central and South Central regions were surveyed on fall application of nitrogen. Farmers in the Irrigated and non-irrigated sandy soils and Southeastern regions were surveyed on sidedress applications of nitrogen. This is the second nitrogen BMP adoption survey performed by MDA and NASS to collect information on nitrogen management practices for Minnesota corn acres.

## **Survey Design and Implementation**

Five Nitrogen Best Management Practices regions (noted as "BMP Regions" throughout the report), were previously developed by MDA staff. Counties were clustered based on similarities in geology, soils, and crops. More information about BMP regions can be found at: <http://www.mda.state.mn.us/protecting/bmps/nitrogenbmps.aspx> .

Regional nitrogen use information is used to help design and implement specific water quality monitoring and nitrogen educational programs. Nitrogen BMP regions are shown in Figure 1.

## Minnesota Nitrogen Best Management Practices Regions



**Figure 1. Minnesota Nitrogen Best Management Practices Regions.**

For the purpose of this report, regions will be defined as follows: Northwestern as NW, Irrigated and non-irrigated sandy soils as IRR, Southwestern and West Central as SW, South Central as SC, and Southeastern as SE.

### 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, MDA began exploring the possibility of using the existing NASS framework 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 the Environmental Protection Agency (EPA); projects were conducted from 2001-2003. These pilots were essential in developing the final methodology used in this survey.

The first pilot<sup>2</sup> was conducted in 2001 by expanding the existing Agricultural Resource Management Study (ARMS) developed by NASS. The typical 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-

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<sup>2</sup> "Expanded Minnesota Agricultural Statistics Pesticide Use Data", 2003, by NASS and MDA.



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.

In neighboring North Dakota, 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. With the goal of expanding to a statewide scale while reducing costs, a second pilot<sup>3</sup> was developed. 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 use rates. Due to the numerous formulations, different application rates and units of measure (i.e. Active Ingredient [AI] 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 rate decreases significantly.

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 pesticide use surveys were conducted on a yearly basis. Beginning in 2009 nitrogen use was added to the annual surveys.

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<sup>3</sup> Unpublished data. From the September 20, 2003 EPA Report.

## Data Reporting and Limitations

The primary purpose of this survey was to evaluate the use of fall applications and sidedress applications of nitrogen. 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 that 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.<sup>4</sup> This survey did not employ such strategies; rather, corn farmers were randomly selected from across Minnesota. Therefore, weighting across regions or counties was not performed. The MDA can be contacted to further discuss interpretation of the survey data.

The 2013 crop year survey was designed to capture fall applications of nitrogen in the Southwestern and West Central region, South Central region and the Northwestern region of Minnesota. In these three areas fall applications under certain conditions are considered best management practices as detailed in the University of Minnesota’s best management practices that can be found at; <http://www.extension.umn.edu/agriculture/nutrient-management/nitrogen>.

Sidedress applications of nitrogen were the focus of the survey in the Southeastern region and the Irrigated and Non-irrigated Sandy Soils region of Minnesota. Soils in these regions are prone to leaching and sidedress applications of nitrogen are recommended under certain circumstances.

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<sup>4</sup> 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 BMP region for all farmers.**

<b>County</b>	<b>Nitrogen BMP Region</b>	<b>Number of Respondents</b>	<b>Number of Corn Acres</b>	<b>Fall Survey or Sidedress Survey</b>
Clay	NW	18	6,504	Fall Survey
Kittson	NW	21	6,705	Fall Survey
Mahnomen	NW	20	3,771	Fall Survey
Marshall	NW	6	1,385	Fall Survey
Norman	NW	29	11,367	Fall Survey
Pennington	NW	8	1,028	Fall Survey
Polk	NW	17	2,901	Fall Survey
Red Lake	NW	12	4,836	Fall Survey
Roseau	NW	12	3,395	Fall Survey
Wilkin	NW	23	6,617	Fall Survey
<b>Totals</b>	<b>NW</b>	<b>166</b>	<b>48,509</b>	<b>Fall Survey</b>
Big Stone	SW	21	6,546	Fall Survey
Chippewa	SW	29	10,004	Fall Survey
Cottonwood	SW	29	9,386	Fall Survey
Douglas	SW	24	2,277	Fall Survey
Grant	SW	31	12,699	Fall Survey
Jackson	SW	25	8,615	Fall Survey
Kandiyohi	SW	25	4,937	Fall Survey
Lac qui Parle	SW	25	5,855	Fall Survey
Lincoln	SW	23	7,796	Fall Survey
Lyon	SW	21	5,775	Fall Survey
Murray	SW	22	6,596	Fall Survey
Nobles	SW	32	7,252	Fall Survey
Pipestone	SW	27	6,511	Fall Survey
Pope	SW	36	9,242	Fall Survey
Redwood	SW	32	10,412	Fall Survey
Renville	SW	28	9,645	Fall Survey
Rock	SW	17	5,108	Fall Survey
Stevens	SW	34	12,745	Fall Survey
Swift	SW	30	13,011	Fall Survey
Traverse	SW	23	12,300	Fall Survey
Yellow Medicine	SW	27	9,588	Fall Survey
<b>Totals</b>	<b>SW</b>	<b>561</b>	<b>176,300</b>	<b>Fall Survey</b>
Blue Earth	SC	27	6,743	Fall Survey
Brown	SC	31	9,057	Fall Survey
Carver	SC	24	6,788	Fall Survey
Dodge	SC	21	8,833	Fall Survey
Faribault	SC	33	14,561	Fall Survey
Freeborn	SC	28	10,338	Fall Survey
Le Sueur	SC	24	4,259	Fall Survey
Martin	SC	27	13,062	Fall Survey
McLeod	SC	30	8,709	Fall Survey
Meeker	SC	24	6,564	Fall Survey
Mower	SC	21	5,468	Fall Survey
Nicollet	SC	30	8,188	Fall Survey
Rice	SC	31	7,116	Fall Survey
Scott	SC	20	3,398	Fall Survey
Sibley	SC	28	5,821	Fall Survey

<b>County</b>	<b>Nitrogen BMP Region</b>	<b>Number of Respondents</b>	<b>Number of Corn Acres</b>	<b>Fall Survey or Sidedress Survey</b>
Steele	SC	29	5,556	Fall Survey
Waseca	SC	23	5,000	Fall Survey
Watonwan	SC	23	7,232	Fall Survey
<b>Totals</b>	<b>SC</b>	<b>474</b>	<b>136,693</b>	<b>Fall Survey</b>
<b>State</b>	<b>ALL</b>	<b>1,201</b>	<b>361,502</b>	<b>Fall Survey</b>
Aitkin	NE	8	1,106	Sidedress Survey
Anoka	NE	16	1,824	Sidedress Survey
Becker	NE	22	8,357	Sidedress Survey
Benton	NE	20	2,414	Sidedress Survey
Cass	NE	20	2,547	Sidedress Survey
Chisago	NE	22	3,806	Sidedress Survey
Crow Wing	NE	13	1,499	Sidedress Survey
Hubbard	NE	10	3,434	Sidedress Survey
Isanti	NE	22	4,198	Sidedress Survey
Kanabec	NE	16	2,445	Sidedress Survey
Mille Lacs	NE	18	1,495	Sidedress Survey
Morrison	NE	28	3,784	Sidedress Survey
Otter Tail	NE	26	5,960	Sidedress Survey
Pine	NE	21	2,897	Sidedress Survey
Sherburne	NE	15	2,883	Sidedress Survey
Stearns	NE	29	6,087	Sidedress Survey
Todd	NE	24	2,655	Sidedress Survey
Wadena	NE	20	3,333	Sidedress Survey
Washington	NE	20	3,849	Sidedress Survey
Wright	NE	17	2,083	Sidedress Survey
<b>Totals</b>	<b>NE</b>	<b>387</b>	<b>66,656</b>	<b>Sidedress Survey</b>
Dakota	SE	18	4,853	Sidedress Survey
Fillmore	SE	23	5,497	Sidedress Survey
Goodhue	SE	33	7,850	Sidedress Survey
Houston	SE	19	3,122	Sidedress Survey
Olmsted	SE	22	3,575	Sidedress Survey
Wabasha	SE	32	5,400	Sidedress Survey
Winona	SE	24	2,858	Sidedress Survey
<b>Totals</b>	<b>SE</b>	<b>171</b>	<b>33,155</b>	<b>Sidedress Survey</b>
<b>State</b>	<b>ALL</b>	<b>558</b>	<b>99,811</b>	<b>Sidedress Survey</b>
<b>State All Surveys</b>	<b>ALL</b>	<b>1,759</b>	<b>461,313</b>	<b>All Surveys</b>

Table 2 details the respondents and corresponding corn acres by county and BMP region for all farmers in this study who fall applied nitrogen. The percent of acres operated by farmers with fall applied nitrogen is not the actual percent of acres with fall applied nitrogen but the acres operated by the farmers who fall applied nitrogen.

**Table 2. Summary of respondents and corresponding corn acres by county and BMP region for all farmers who fall applied nitrogen.**

County	BMP Region	Number of Respondents Fall Applying Nitrogen	Percent of Respondents Fall Applying Nitrogen	Percent of Acres Operated by Farmers who Fall Applied Nitrogen
Clay	NW	5	28	40
Kittson	NW	6	29	42
Mahnomen	NW	**	**	**
Marshall	NW	**	**	**
Norman	NW	12	41	54
Pennington	NW	**	**	**
Polk	NW	**	**	**
Red Lake	NW	**	**	**
Roseau	NW	**	**	**
Wilkin	NW	5	22	35
<b>Totals</b>	<b>NW</b>	<b>42</b>	<b>25</b>	<b>38</b>
Big Stone	SW	7	33	56
Chippewa	SW	16	55	65
Cottonwood	SW	12	41	39
Douglas	SW	**	**	**
Grant	SW	5	16	20
Jackson	SW	15	60	73
Kandiyohi	SW	7	28	27
Lac qui Parle	SW	9	36	42
Lincoln	SW	11	48	61
Lyon	SW	13	62	62
Murray	SW	8	36	45
Nobles	SW	12	38	36
Pipestone	SW	7	26	35
Pope	SW	8	22	20
Redwood	SW	19	59	71
Renville	SW	16	57	79
Rock	SW	**	**	**
Stevens	SW	14	41	49
Swift	SW	13	43	47
Traverse	SW	9	39	38
Yellow Medicine	SW	14	52	54
<b>Totals</b>	<b>SW</b>	<b>220</b>	<b>39</b>	<b>47</b>
Blue Earth	SC	10	37	39
Brown	SC	22	71	81
Carver	SC	**	**	**
Dodge	SC	7	33	55
Faribault	SC	15	45	44
Freeborn	SC	14	50	51
Le Sueur	SC	9	38	52
Martin	SC	15	56	61

<b>County</b>	<b>BMP Region</b>	<b>Number of Respondents Fall Applying Nitrogen</b>	<b>Percent of Respondents Fall Applying Nitrogen</b>	<b>Percent of Acres Operated by Farmers who Fall Applied Nitrogen</b>
McLeod	SC	8	27	33
Meeker	SC	8	33	67
Mower	SC	9	43	57
Nicollet	SC	13	43	66
Rice	SC	14	45	54
Scott	SC	7	35	51
Sibley	SC	**	**	**
Steele	SC	7	24	26
Waseca	SC	12	52	72
Watonwan	SC	10	43	70
<b>Totals</b>	<b>SC</b>	<b>189</b>	<b>40</b>	<b>51</b>
<b>State</b>	<b>ALL</b>	<b>451</b>	<b>33</b>	<b>56</b>

\*\* Less than five respondents

§ BMP region totals may not add up due to some counties having less than five responses, but are included in the BMP region total

## Fall Applications and Management on Corn Acres

Information on fall nitrogen applications was gathered on a typical corn field for the 2013 growing season. Information on other corn fields was not collected in this survey.

Survey participants who grew corn were asked if they had a field where they applied nitrogen in the fall. If yes, they were then asked the size of the field, the average yield of the field during the past five corn crops and if nitrogen was applied over the whole field.

Table 3 details the percent of respondents that fall applied nitrogen from a major source such as urea or anhydrous ammonia on corn acres.

**Table 3. Fall application of nitrogen for the 2013 crop year. (Q.1)**

Nitrogen Best Management Practices Region	Did You Fall Apply Nitrogen for the 2013 Corn Crop?	Percent of All Respondents
Northwestern	Yes	25
Northwestern	No	75
Southwestern and West Central	Yes	39
Southwestern and West Central	No	61
South Central	Yes	40
South Central	No	60
Statewide	Yes	38
Statewide	No	62

Table 4 details the percent of respondents that fall applied nitrogen and irrigated their corn acres.

**Table 4. Farmers who fall apply nitrogen and irrigate. (Q.2)**

<b>Nitrogen Best Management Practices Region</b>	<b>Do You Irrigate?</b>	<b>Percent of All Respondents</b>
Northwestern	All	2
Northwestern	Some	2
Northwestern	None	96
Southwestern and West Central	All	2
Southwestern and West Central	Some	5
Southwestern and West Central	None	93
South Central	All	2
South Central	Some	3
South Central	None	95
Statewide	All	2
Statewide	Some	4
Statewide	None	94

Table 5 details the percent of respondents that fall applied urea on their corn acres in the past 5 years.

**Table 5. Fall application of urea in the past 5 years. (Q.3)**

<b>Nitrogen Best Management Practices Region</b>	<b>Have You Fall Applied Urea in the Past 5 Years?</b>	<b>Percent of All Respondents</b>
Northwestern	All	4
Northwestern	Some	16
Northwestern	None	80
Southwestern and West Central	All	11
Southwestern and West Central	Some	12
Southwestern and West Central	None	77
South Central	All	3
South Central	Some	5
South Central	None	92
Statewide	All	7
Statewide	Some	10
Statewide	None	83



Table 6 details the percent of respondents who fall applied urea in 2013 for the 2014 corn crop.

**Table 6. Fall application of urea this past fall (2013) for the 2014 corn crop. (Q.4)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply Urea This Past Fall for the 2014 Crop?</b>	<b>Percent of All Respondents</b>
Northwestern	Yes	14
Northwestern	No	86
Southwestern and West Central	Yes	15
Southwestern and West Central	No	85
South Central	Yes	3
South Central	No	97
Statewide	Yes	10
Statewide	No	90

Table 7 details the average date of fall applied urea in 2013 for the 2014 corn crop.

**Table 7. Average date of fall applied urea in 2013 for the 2014 corn crop. (Q.5)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Date of Urea Application for the Fall of 2013</b>
Northwestern	10/28/2013
Southwestern and West Central	11/07/2013
South Central	11/02/2013
Statewide	11/05/2013

Table 8 details the percent of respondents that fall applied urea in 2012 for the 2013 corn crop.

**Table 8. Fall application of urea in the fall of 2012 for the 2013 corn crop. (Q.6)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply Urea Fertilizer in the Fall of 2012 for the 2013 Corn Crop?</b>	<b>Percent of All Respondents</b>
Northwestern	All	5
Northwestern	Some	10
Northwestern	None	85
Southwestern and West Central	All	8
Southwestern and West Central	Some	6
Southwestern and West Central	None	86
South Central	All	1
South Central	Some	2
South Central	None	97
Statewide	All	5
Statewide	Some	5
Statewide	None	90

Table 9 details the percent of respondents that incorporated fall applied urea in 2012 for the 2013 corn crop.

**Table 9. Percentage of farmers incorporating fall applied urea. (Q.7)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Incorporate the Urea Fertilizer?</b>	<b>Percent of All Respondents</b>
Northwestern	All	60
Northwestern	Some	40
Northwestern	None	0
Southwestern and West Central	All	63
Southwestern and West Central	Some	26
Southwestern and West Central	None	11
South Central	All	67
South Central	Some	20
South Central	None	13
Statewide	All	63
Statewide	Some	28
Statewide	None	9

Table 10 details the percent of respondents that fall applied urea using variable rate technology or more than one rate per field, such as using management zones.

**Table 10. Percent of farmers who fall applied urea using variable rate applications. (Q.8)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was Any of the Fall Applied Urea Applied Variable Rate?</b>	<b>Percent of All Respondents</b>
Northwestern	All	32
Northwestern	Some	24
Northwestern	None	44
Southwestern and West Central	All	16
Southwestern and West Central	Some	10
Southwestern and West Central	None	74
South Central	All	27
South Central	Some	13
South Central	None	60
Statewide	All	21
Statewide	Some	13
Statewide	None	66

Table 11 details the percent of respondents that fall applied urea at the same time or with a phosphate source such as MAP or DAP.

**Table 11. Percent of farmers who fall applied urea including a phosphorus source such as MAP/DAP. (Q.9)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did the Fall Application of Urea Include a Phosphorus Source Such as MAP/DAP?</b>	<b>Percent of All Respondents</b>
Northwestern	All	20
Northwestern	Some	56
Northwestern	None	24
Southwestern and West Central	All	54
Southwestern and West Central	Some	20
Southwestern and West Central	None	26
South Central	All	40
South Central	Some	40
South Central	None	20
Statewide	All	45
Statewide	Some	30
Statewide	None	25

Table 12 details the percent of respondents with fall applied urea that use variable rate or more than one rate to fall apply MAP or DAP.

**Table 12. Percent of farmers who used a variable rate to fall apply MAP/DAP with urea. (Q.10)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was the Fall Applied MAP/DAP Applied Using a Variable Rate?</b>	<b>Percent of All Respondents</b>
Northwestern	All	33
Northwestern	Some	33
Northwestern	None	34
Southwestern and West Central	All	22
Southwestern and West Central	Some	6
Southwestern and West Central	None	72
South Central	All	41
South Central	Some	17
South Central	None	42
Statewide	All	27
Statewide	Some	14
Statewide	None	59

Table 13 details the percent of respondents that fall applied urea and fall applied herbicides with or at the same time.

**Table 13. Percent of farmers who applied herbicides with or at the same time as fall applied urea. (Q.11)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was the Fall Applied Urea Applied at the Same Time as an Herbicide?</b>	<b>Percent of All Respondents</b>
Northwestern	All	0
Northwestern	Some	4
Northwestern	None	96
Southwestern and West Central	All	9
Southwestern and West Central	Some	4
Southwestern and West Central	None	87
South Central	All	13
South Central	Some	20
South Central	None	67
Statewide	All	8
Statewide	Some	6
Statewide	None	86

Table 14 details the percent of respondents that fall applied urea and have anhydrous ammonia available at their dealership.

**Table 14. Percent of farmers, who fall apply urea, which have anhydrous ammonia available at their dealership. (Q.12)**

<b>Nitrogen Best Management Practices Region</b>	<b>Is Anhydrous Ammonia Available at Your Dealer?</b>	<b>Percent of All Respondents</b>
Northwestern	Yes	21
Northwestern	No	79
Southwestern and West Central	Yes	68
Southwestern and West Central	No	32
South Central	Yes	93
South Central	No	7
Statewide	Yes	62
Statewide	No	38

Table 15 details the percent of respondents type of tillage used before the fall application of urea.

**Table 15. Type of tillage performed before fall application of urea on the majority of the farmers' fields. (Q.13)**

<b>Nitrogen Best Management Practices Region</b>	<b>What type of Tillage did You do Before the Fall Application of Urea?</b>	<b>Percent of All Respondents</b>
Northwestern	Conventional	24
Northwestern	Mulch	24
Northwestern	Minimum	36
Northwestern	None	12
Northwestern	Ridge	4
Southwestern and West Central	Conventional	25
Southwestern and West Central	Mulch	14
Southwestern and West Central	Minimum	24
Southwestern and West Central	None	34
Southwestern and West Central	Ridge	3
South Central	Conventional	20
South Central	Mulch	40
South Central	Minimum	0
South Central	None	40
South Central	Ridge	0
Statewide	Conventional	24
Statewide	Mulch	19
Statewide	Minimum	24
Statewide	None	30
Statewide	Ridge	3

Table 16 details the percent of respondents type of tillage used to incorporate the fall applied urea on the majority of the fields.

**Table 16. Type of tillage used to incorporate fall applied urea on the majority of the fields. (Q.14)**

<b>Nitrogen Best Management Practices Region</b>	<b>What Type of Tillage did You do Use to Incorporate the Fall Application?</b>	<b>Percent of All Respondents</b>
Northwestern	Conventional	48
Northwestern	Mulch	28
Northwestern	Minimum	12
Northwestern	None	4
Northwestern	Ridge	8
Southwestern and West Central	Conventional	28
Southwestern and West Central	Mulch	27
Southwestern and West Central	Minimum	33
Southwestern and West Central	None	8
Southwestern and West Central	Ridge	4
South Central	Conventional	13
South Central	Mulch	47
South Central	Minimum	0
South Central	None	20
South Central	Ridge	20
Statewide	Conventional	32
Statewide	Mulch	29
Statewide	Minimum	24
Statewide	None	8
Statewide	Ridge	7

Table 17 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with fall applied urea.

**Table 17. Applications of any other commercial nitrogen on corn acres with fall applied urea (Q15).**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply any Other Commercial Nitrogen on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Northwestern Northwestern Northwestern	Yes-Spring	12
	Yes-Side	4
	No	84
Southwestern and West Central Southwestern and West Central Southwestern and West Central	Yes-Spring	10
	Yes-Side	5
	No	85
South Central South Central South Central	Yes-Spring	20
	Yes-Side	0
	No	80
Statewide Statewide Statewide	Yes-Spring	12
	Yes-Side	4
	No	84

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

Table 18 details the percent of respondents that fall applied anhydrous ammonia on their corn acres in the past 5 years.

**Table 18. Fall application of anhydrous ammonia in the past 5 years (Q16).**

<b>Nitrogen Best Management Practices Region</b>	<b>Have You Fall Applied Anhydrous Ammonia in the Past 5 Years?</b>	<b>Percent of All Respondents</b>
Northwestern Northwestern Northwestern	All	3
	Some	4
	None	93
Southwestern and West Central Southwestern and West Central Southwestern and West Central	All	12
	Some	10
	None	78
South Central South Central South Central	All	19
	Some	13
	None	68
Statewide Statewide Statewide	All	14
	Some	10
	None	76

Table 19 details the percent of respondents who fall applied anhydrous ammonia in 2013 for the 2014 corn crop.

**Table 19. Fall application of anhydrous ammonia this past fall (2013) for the 2014 corn crop. (Q.17)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply Anhydrous Ammonia this Past Fall for 2014?</b>	<b>Percent of All Respondents</b>
Northwestern	Yes	4
Northwestern	No	96
Southwestern and West Central	Yes	27
Southwestern and West Central	No	73
South Central	Yes	18
South Central	No	82
Statewide	Yes	20
Statewide	No	80

Table 20 details the average date of fall applied anhydrous ammonia in 2013 for the 2014 corn crop.

**Table 20. Average date of anhydrous ammonia application in 2013 for the 2014 corn crop. (Q.18)**

<b>Nitrogen Management Region</b>	<b>Average Date of Anhydrous Ammonia Application for the Fall of 2013</b>
Northwestern	11/2/2013
Southwestern and West Central	11/5/2013
South Central	11/4/2013
Statewide	11/4/2013



Table 21 details the percent of respondents that fall applied anhydrous ammonia in 2012 for the 2013 corn crop.

**Table 21. Fall application of anhydrous ammonia in the fall of 2012 for the 2013 corn crop. (Q.19)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Fall Apply any Anhydrous Ammonia Fertilizer in the Fall of 2012?</b>	<b>Percent of All Respondents</b>
Northwestern	All	1
Northwestern	Some	2
Northwestern	None	97
Southwestern and West Central	All	11
Southwestern and West Central	Some	8
Southwestern and West Central	None	81
South Central	All	18
South Central	Some	9
South Central	None	73
Statewide	All	12
Statewide	Some	8
Statewide	None	80

Table 22 details the percent of respondents that used N-serve on fall applied anhydrous ammonia in 2012 for the 2013 corn crop.

**Table 22. Nitrogen inhibitor use (N-serve) with fall applied anhydrous ammonia for the 2013 season. (Q.20)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did the Anhydrous Ammonia Application Include N-Serve?</b>	<b>Percent of All Respondents</b>
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Southwestern and West Central	All	24
Southwestern and West Central	Some	9
Southwestern and West Central	None	67
South Central	All	60
South Central	Some	12
South Central	None	28
Statewide	All	43
Statewide	Some	10
Statewide	None	47

Table 23 details the percent of respondents that applied herbicides with or at the same time as the fall applied anhydrous ammonia.

**Table 23. Percent of farmers who applied herbicides with or at the same time as fall applied anhydrous ammonia. (Q.21)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was the Fall Applied Anhydrous Ammonia Applied at the Same Time as an Herbicide?</b>	<b>Percent of All Respondents</b>
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Southwestern and West Central	All	5
Southwestern and West Central	Some	4
Southwestern and West Central	None	91
South Central	All	13
South Central	Some	6
South Central	None	81
Statewide	All	9
Statewide	Some	5
Statewide	None	86

Table 24 details the percent of respondents that fall applied anhydrous ammonia using variable rate technology or more than one rate per field, such as using management zones.

**Table 24. Percent of farmers who fall applied anhydrous ammonia using variable rate applications. (Q.22)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was any of the Fall Applied Anhydrous Ammonia Applied Variable Rate?</b>	<b>Percent of All Respondents</b>
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Southwestern and West Central	All	11
Southwestern and West Central	Some	7
Southwestern and West Central	None	82
South Central	All	10
South Central	Some	13
South Central	None	77
Statewide	All	10
Statewide	Some	10
Statewide	None	80

Table 25 details the percent of respondents that fall applied anhydrous ammonia at the same time or with a phosphate source such as MAP or DAP.

**Table 25. Percent of farmers that fall applied anhydrous ammonia including a phosphorus source such as MAP/DAP. (Q.23)**

Nitrogen Best Management Practices Region	Did You Fall Apply a Phosphorus Source Such as MAP/DAP?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Southwestern and West Central	All	42
Southwestern and West Central	Some	19
Southwestern and West Central	None	39
South Central	All	38
South Central	Some	12
South Central	None	50
Statewide	All	39
Statewide	Some	15
Statewide	None	46

Table 26 details the percent of respondents with fall applied anhydrous ammonia that used variable rate or more than one rate to fall apply MAP or DAP.

**Table 26. Percent of farmers who used a variable rate to fall apply MAP/DAP with anhydrous ammonia. (Q.24)**

Nitrogen Best Management Practices Region	Was Any of the Fall Applied MAP/DAP Applied Variable Rate?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Southwestern and West Central	All	16
Southwestern and West Central	Some	26
Southwestern and West Central	None	58
South Central	All	39
South Central	Some	19
South Central	None	42
Statewide	All	28
Statewide	Some	22
Statewide	None	50

Table 27 details the percent of respondents type of tillage used before the fall application of anhydrous ammonia.

**Table 27. Type of tillage performed before fall application of anhydrous ammonia on the majority of fields. (Q.25)**

<b>Nitrogen Best Management Practices Region</b>	<b>What Type of Tillage did You do Before the Fall Application of Anhydrous Ammonia?</b>	<b>Percent of All Respondents</b>
Northwestern	Conventional	75
Northwestern	Minimum	25
Northwestern	Mulch	0
Northwestern	None	0
Northwestern	Ridge	0
Southwestern and West Central	Conventional	21
Southwestern and West Central	Minimum	23
Southwestern and West Central	Mulch	27
Southwestern and West Central	None	28
Southwestern and West Central	Ridge	1
South Central	Conventional	25
South Central	Minimum	30
South Central	Mulch	25
South Central	None	20
South Central	Ridge	0
Statewide	Conventional	23
Statewide	Minimum	26
Statewide	Mulch	26
Statewide	None	24
Statewide	Ridge	1

Table 28 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with fall applied anhydrous ammonia.

**Table 28. Applications of any other commercial nitrogen on corn acres with fall applied anhydrous ammonia. (Q.26)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply any Other Commercial Nitrogen on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Northwestern	Yes-Spring	0
	Yes-Side	25
	No	75
Southwestern and West Central	Yes-Spring	8
	Yes-Side	12
	No	80
South Central	Yes-Spring	9
	Yes-Side	7
	No	84
Statewide	Yes-Spring	8
	Yes-Side	10
	No	82

Table 29 details the percent of respondents that use starter fertilizer on any of their corn acres with fall applied nitrogen.

**Table 29. Starter fertilizer applications applied in the spring of 2013 along with fall applied nitrogen in 2012. (Q.27)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply a Starter Fertilizer?</b>	<b>Percent of All Respondents</b>
Northwestern	All	52
	Some	19
	None	29
Southwestern and West Central	All	41
	Some	8
	None	51
South Central	All	52
	Some	14
	None	34
Statewide	All	46
	Some	12
	None	42

Table 30 details the percent of respondents type of starter fertilizer used on any of their corn acres with fall applied nitrogen.

**Table 30. Type of starter used by farmers who fall applied nitrogen. (Q.28)**

<b>Nitrogen Best Management Practices Region</b>	<b>What Kind of Starter was It?</b>	<b>Percent of All Respondents</b>
Northwestern	Dry	23
Northwestern	Liquid	77
Southwestern and West Central	Dry	14
Southwestern and West Central	Liquid	86
South Central	Dry	29
South Central	Liquid	71
Statewide	Dry	22
Statewide	Liquid	78

Table 31 details the percent of respondents use of fall applied ESN on any of their corn acres.

**Table 31. Fall application of ESN by farmers who fall applied nitrogen. (Q.29)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Fall Apply ESN?</b>	<b>Percent of All Respondents</b>
Northwestern	All	4
Northwestern	Some	3
Northwestern	None	93
Southwestern and West Central	All	2
Southwestern and West Central	Some	1
Southwestern and West Central	None	97
South Central	All	1
South Central	Some	1
South Central	None	98
Statewide	All	2
Statewide	Some	1
Statewide	None	97

Table 32 details the percent of respondents use of fall applied Agrotain or Super U on any of their corn acres.

**Table 32. Use of Agrotain or Super U by farmers who fall applied nitrogen. (Q.30)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was Agrotain or Super U Used?</b>	<b>Percent of All Respondents</b>
Northwestern	All	1
Northwestern	Some	1
Northwestern	None	98
Southwestern and West Central	All	2
Southwestern and West Central	Some	1
Southwestern and West Central	None	97
South Central	All	0
South Central	Some	2
South Central	None	98
Statewide	All	1
Statewide	Some	1
Statewide	None	98

Table 33 details the percent of respondents manure applications to their corn acres with fall applied nitrogen.

**Table 33. Manure applications on acres to be planted to corn in 2013. (Q.31)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply Manure on Acres to be Planted to Corn in 2013?</b>	<b>Percent of All Respondents</b>
Northwestern	All	2
Northwestern	Some	29
Northwestern	None	69
Southwestern and West Central	All	9
Southwestern and West Central	Some	27
Southwestern and West Central	None	64
South Central	All	6
South Central	Some	29
South Central	None	65
Statewide	All	7
Statewide	Some	28
Statewide	None	65



Table 34 details the percent of respondents average nitrogen rate for corn following soybeans with fall applied nitrogen and no manure applications.

**Table 34. The average total nitrogen rate per acre applied on corn following soybeans without manure. (Q.32)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Soybeans</b>	<b>Percent of All Respondents</b>
Northwestern	149	8
Southwestern and West Central	142	50
South Central	145	42
Statewide	144	100

Table 35 details the percent of respondents average nitrogen rate for corn following corn with fall applied nitrogen and no manure applications.

**Table 35. The average total nitrogen rate per acre applied on corn following corn without manure. (Q.33) (Q.36)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Corn</b>	<b>Percent of All Respondents</b>
Northwestern	136	5
Southwestern and West Central	158	48
South Central	168	47
Statewide	160	100

Table 36 details the percent of respondents average nitrogen rate for corn following alfalfa with fall applied nitrogen and no manure applications.

**Table 36. The average total nitrogen rate per acre applied on corn following alfalfa without manure. (Q.34)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Alfalfa</b>	<b>Percent of All Respondents</b>
Northwestern	100	5
Southwestern and West Central	84	35
South Central	98	60
Statewide	93	100

Table 37 details the percent of respondents use of a tissue test on any of their corn acres with fall applied nitrogen. Tissue tests are conducted on corn plants during the growing season to test if the current corn crop has sufficient nitrogen for maximizing yields.<sup>4</sup>

**Table 37. Farmers that had a tissue test performed on any of their corn acres. (Q.35)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Have a Tissue Test on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Northwestern	All	17
	Some	14
	None	69
Southwestern and West Central	All	8
	Some	11
	None	81
South Central	All	7
	Some	10
	None	83
Statewide	All	8
	Some	11
	None	81

<sup>4</sup> “Plant Analysis Sampling and Interpretation” University of Minnesota Extension 2013

Table 38 details the percent of respondents use of the basal stalk test on any of their corn acres with fall applied nitrogen. The basal stalk test is used to measure the amount of nitrogen in the corn plant at the end of the season.<sup>5</sup> This test provides information on excess or shortage of nitrogen.

**Table 38. Farmers that had a basal stalk test performed on any of their corn acres. (Q.36)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Have a Basal Stalk Test on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Northwestern	All	17
Northwestern	Some	14
Northwestern	None	69
Southwestern and West Central	All	7
Southwestern and West Central	Some	10
Southwestern and West Central	None	83
South Central	All	8
South Central	Some	11
South Central	None	81
Statewide	All	7
Statewide	Some	11
Statewide	None	81

Table 39 details the percent of respondents on whether the corn acres were stressed from a lack of nitrogen.

**Table 39. Corn acres stressed from a lack of nitrogen in 2013. (Q.37)**

<b>Nitrogen Best Management Practices Region</b>	<b>Were Any of Your Corn Acres Stressed from a Lack of Nitrogen?</b>	<b>Percent of All Respondents</b>
Northwestern	Yes	12
Northwestern	Maybe	0
Northwestern	No	88
Southwestern and West Central	Yes	11
Southwestern and West Central	Maybe	7
Southwestern and West Central	No	82
South Central	Yes	17
South Central	Maybe	6
South Central	No	77
Statewide	Yes	14
Statewide	Maybe	6
Statewide	No	80

<sup>5</sup> "Plant Analysis Sampling and Interpretation" University of Minnesota Extension 2013

Table 40 details the percent of respondents use of a deep soil nitrate test on any of their farm fields with fall applied nitrogen.

**Table 40. Farmers that had a deep soil nitrate test (18-24 inches) on any of their corn acres. (Q.38)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Have a Deep Soil Nitrate Test on Any of Your Fields?</b>	<b>Percent of All Respondents</b>
Northwestern	All	29
Northwestern	Some	29
Northwestern	None	42
Southwestern and West Central	All	14
Southwestern and West Central	Some	12
Southwestern and West Central	None	74
South Central	All	3
South Central	Some	4
South Central	None	93
Statewide	All	11
Statewide	Some	10
Statewide	None	79

Table 41 details the percent of respondents in each BMP region and the corresponding average corn yield for farmers who fall apply nitrogen.

**Table 41. Average corn yield for 2013. (Q.39)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Corn Yield in 2013</b>	<b>Percent of All Respondents</b>
Northwestern	140	9
Southwestern and West Central	166	49
South Central	170	42
Statewide	165	100

## Sidedress Applications and Management on Corn Acres

Table 42 details the respondents and corresponding corn acres by county and BMP region for all farmers in this study who sidedressed nitrogen. The percent of acres operated by farmers with sidedressed nitrogen is not the actual percent of acres with sidedressed nitrogen but the acres operated by the farmers who sidedressed nitrogen.

**Table 42. Summary of respondents and corresponding corn acres by county and BMP region for all farmers who sidedressed nitrogen.**

County	BMP Region	Number of Respondents Sidedressing Nitrogen	Percent of Respondents Sidedressing Nitrogen	Percent of Acres Operated by Farmers with Sidedressed Nitrogen
Aitkin	IRR	**	**	**
Anoka	IRR	8	50	67
Becker	IRR	**	**	**
Benton	IRR	5	25	43
Cass	IRR	**	**	**
Chisago	IRR	11	50	74
Crow Wing	IRR	**	**	**
Hubbard	IRR	**	**	**
Isanti	IRR	15	68	85
Kanabec	IRR	**	**	**
Mille Lacs	IRR	9	50	67
Morrison	IRR	10	36	40
Otter Tail	IRR	8	31	24
Pine	IRR	6	29	28
Sherburne	IRR	6	40	62
Stearns	IRR	14	48	67
Todd	IRR	10	42	42
Wadena	IRR	8	40	75
Washington	IRR	5	25	12
Wright	IRR	8	47	20
<b>Totals</b>	<b>IRR</b>	<b>143</b>	<b>37</b>	<b>46</b>
Dakota	SE	5	28	23
Fillmore	SE	5	22	21
Goodhue	SE	7	21	30
Houston	SE	**	**	**
Olmsted	SE	**	**	**
Wabasha	SE	**	**	**
Winona	SE	**	**	**
<b>Totals</b>	<b>SE</b>	<b>28</b>	<b>18</b>	<b>28</b>
<b>State</b>	<b>ALL</b>	<b>171</b>	<b>32</b>	<b>41</b>

\*\* Less than five responses

§ BMP region totals may not add up due to some counties having less than five responses, but are included in the BMP region total

Table 43 details the percent of respondents that sidedressed nitrogen from a major source, such as urea or anhydrous ammonia on their corn acres.

**Table 43. Sidedress application of nitrogen for the 2013 crop year. (Q.40)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Sidedress Apply Nitrogen for the 2013 Corn Crop?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes	37
Irrigated and Non-irrigated Sandy Soils	No	63
Southeastern	Yes	16
Southeastern	No	84
Statewide	Yes	31
Statewide	No	69

Table 44 details the percent of respondents that sidedressed nitrogen and irrigated their corn acres.

**Table 44. Farmers who sidedressed nitrogen and irrigated. (Q.41)**

<b>Nitrogen Best Management Practices Region</b>	<b>Do You Irrigate?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	3
Irrigated and Non-irrigated Sandy Soils	Some	12
Irrigated and Non-irrigated Sandy Soils	None	85
Southeastern	All	0
Southeastern	Some	7
Southeastern	None	93
Statewide	All	3
Statewide	Some	11
Statewide	None	86

Table 45 details the percent of respondents that sidedressed urea nitrogen on their corn acres in the past 5 years.

**Table 45. Sidedress application of urea in the past 5 years. (Q.42)**

<b>Nitrogen Best Management Practices Region</b>	<b>Have You Sidedressed Urea in the Past 5 Years?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	14
Irrigated and Non-irrigated Sandy Soils	Some	10
Irrigated and Non-irrigated Sandy Soils	None	76
Southeastern	All	2
Southeastern	Some	7
Southeastern	None	91
Statewide	All	10
Statewide	Some	9
Statewide	None	81

Table 46 details the percent of respondents that sidedressed urea for the 2013 corn crop.

**Table 46. Sidedress application of urea for the 2013 corn crop. (Q.43)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Sidedress Urea for the 2013 Corn Crop?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	21
Irrigated and Non-irrigated Sandy Soils	Some	1
Irrigated and Non-irrigated Sandy Soils	None	78
Southeastern	All	7
Southeastern	Some	1
Southeastern	None	92
Statewide	All	17
Statewide	Some	1
Statewide	None	82

Table 47 details the percent of respondents that used a nitrogen inhibitor on sidedressed urea for the 2013 corn crop.

**Table 47. Nitrogen stabilizer use with sidedressed urea for the 2013 season. (Q.44)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did the sidedress application include a nitrogen stabilizer such as Agrotain, Super U, ESN or Instinct?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	40
Irrigated and Non-irrigated Sandy Soils	Some	17
Irrigated and Non-irrigated Sandy Soils	None	43
Southeastern	All	17
Southeastern	Some	50
Southeastern	None	33
Statewide	All	37
Statewide	Some	21
Statewide	None	42

Table 48 details the percent of respondents that incorporated sidedressed urea for the 2013 corn crop.

**Table 48. Percent of farmers incorporating sidedressed urea. (Q.45)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Incorporate the Urea Fertilizer?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	31
Irrigated and Non-irrigated Sandy Soils	Some	20
Irrigated and Non-irrigated Sandy Soils	None	49
Southeastern	All	33
Southeastern	Some	42
Southeastern	None	25
Statewide	All	32
Statewide	Some	23
Statewide	None	45



Table 49 details the percent of respondents that sidedressed urea using variable rate technology or more than one rate per field, such as using management zones.

**Table 49. Percent of farmers who sidedressed urea using variable rate applications. (Q.46)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was Any of the Sidedressed Urea Applied Variable Rate?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	7
Irrigated and Non-irrigated Sandy Soils	Some	10
Irrigated and Non-irrigated Sandy Soils	None	83
Southeastern	All	25
Southeastern	Some	42
Southeastern	None	33
Statewide	All	9
Statewide	Some	14
Statewide	None	77

Table 50 details the percent of respondents that applied herbicides with or at the same time as the sidedressed urea.

**Table 50. Percent of farmers who applied herbicides with or at the same time as sidedressed urea. (Q.47)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was the Sidedressed Urea Applied at the Same Time as an Herbicide?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	1
Irrigated and Non-irrigated Sandy Soils	Some	3
Irrigated and Non-irrigated Sandy Soils	None	96
Southeastern	All	8
Southeastern	Some	0
Southeastern	None	92
Statewide	All	2
Statewide	Some	2
Statewide	None	96

Table 51 details the percent of respondents that sidedressed urea and have anhydrous ammonia available at their dealership.

**Table 51. Percent of farmers, who sidedress urea, that have anhydrous ammonia available at their dealership. (Q.48)**

<b>Nitrogen Best Management Practices Region</b>	<b>Is Anhydrous Ammonia Available at Your Dealer?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes	40
Irrigated and Non-irrigated Sandy Soils	No	60
Southeastern	Yes	83
Southeastern	No	17
Statewide	Yes	46
Statewide	No	54

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

Table 52 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with sidedressed urea.

**Table 52. Applications of any other commercial nitrogen on corn acres with sidedressed urea. (Q.49)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply any Other Commercial Nitrogen on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes-Fall	35
Irrigated and Non-irrigated Sandy Soils	Yes-Spring	6
Irrigated and Non-irrigated Sandy Soils	No	59
Southeastern	Yes-Fall	25
Southeastern	Yes-Spring	17
Southeastern	No	58
Statewide	Yes-Fall	34
Statewide	Yes-Spring	7
Statewide	No	59

Table 53 details the percent of respondents that sidedressed anhydrous ammonia for the 2013 corn crop.

**Table 53. Sidedress application of anhydrous ammonia for the 2013 corn crop. (Q.50)**

<b>Nitrogen Best Management Practices Region</b>	<b>What Percentage of Nitrogen was Applied During the Sidedress Anhydrous Ammonia Application?</b>
Irrigated and Non-irrigated Sandy Soils	48
Southeastern	28
Statewide	45

Table 54 details the percent of respondents that sidedressed anhydrous ammonia on their corn acres in the past 5 years.

**Table 54. Sidedress application of anhydrous ammonia in the past 5 years. (Q.51)**

<b>Nitrogen Best Management Practices Region</b>	<b>Have You Sidedressed Anhydrous Ammonia in the Past 5 Years?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	12
Irrigated and Non-irrigated Sandy Soils	Some	6
Irrigated and Non-irrigated Sandy Soils	None	82
Southeastern	All	25
Southeastern	Some	7
Southeastern	None	68
Statewide	All	14
Statewide	Some	6
Statewide	None	80

Table 55 details the percent of respondents that sidedressed anhydrous ammonia in 2013 for the corn crop.

**Table 55. Sidedress application of anhydrous ammonia for the 2013 corn crop. (Q.52)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Sidedress Anhydrous Ammonia Fertilizer for the 2013 Corn Crop?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes	22
Irrigated and Non-irrigated Sandy Soils	No	78
Southeastern	Yes	40
Southeastern	No	60
Statewide	Yes	29
Statewide	No	71

§ Percent calculated using only those respondents who answered yes or no to the question

Table 56 details the percent of respondents that used N-serve on sidedressed anhydrous ammonia for the 2013 corn crop.

**Table 56. Nitrogen inhibitor use (N-serve) with sidedressed anhydrous ammonia for the 2013 season. (Q.53)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did the sidedress Anhydrous Ammonia Application Include N-Serve?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes	22
Irrigated and Non-irrigated Sandy Soils	No	78
Southeastern	Yes	40
Southeastern	No	60
Statewide	Yes	29
Statewide	No	71

Table 57 details the percent of respondents that sidedressed anhydrous ammonia using variable rate technology or more than one rate per field, such as using management zones.

**Table 57. Percent of farmers who sidedressed anhydrous ammonia using variable rate applications. (Q.54)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was any of the Sidedressed Anhydrous Ammonia Applied Variable Rate?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	20
Irrigated and Non-irrigated Sandy Soils	Some	0
Irrigated and Non-irrigated Sandy Soils	None	80
Southeastern	All	20
Southeastern	Some	0
Southeastern	None	80
Statewide	All	20
Statewide	Some	0
Statewide	None	80

Table 58 details the percent of respondents that applied herbicides with or at the same time as the sidedressed anhydrous ammonia.

**Table 58. Percent of farmers who applied herbicides with or at the same time as the sidedressed anhydrous ammonia. (Q.55)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was the Sidedressed Anhydrous Ammonia Applied at the Same Time as an Herbicide?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	10
Irrigated and Non-irrigated Sandy Soils	Some	0
Irrigated and Non-irrigated Sandy Soils	None	90
Southeastern	All	0
Southeastern	Some	0
Southeastern	None	100
Statewide	All	7
Statewide	Some	0
Statewide	None	93

Table 59 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with sidedressed anhydrous ammonia.

**Table 59. Applications of any other commercial nitrogen on corn acres with sidedressed anhydrous ammonia. (Q.56)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply any Other Commercial Nitrogen on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes-Fall	0
Irrigated and Non-irrigated Sandy Soils	Yes-Spring	10
Irrigated and Non-irrigated Sandy Soils	No	90
Southeastern	Yes-Fall	0
Southeastern	Yes-Spring	60
Southeastern	No	40
Statewide	Yes-Fall	0
Statewide	Yes-Spring	27
Statewide	No	73

Table 60 details the percent of respondents that sidedressed 28% or other liquid nitrogen on their corn acres in the past 5 years.

**Table 60. Sidedress application of 28% or other liquid nitrogen in the past 5 years (not anhydrous ammonia). (Q.57)**

<b>Nitrogen Best Management Practices Region</b>	<b>Have You Sidedressed 28% or Other Liquid Nitrogen in the Past 5 Years?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	13
Irrigated and Non-irrigated Sandy Soils	Some	9
Irrigated and Non-irrigated Sandy Soils	None	78
Southeastern	All	25
Southeastern	Some	7
Southeastern	None	68
Statewide	All	15
Statewide	Some	9
Statewide	None	76

Table 61 details the percent of respondents that sidedressed 28% or other liquid nitrogen in 2013 for the corn crop.

**Table 61. Sidedressed 28% or other liquid nitrogen for the 2013 crop year (not anhydrous ammonia). (Q.58)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Sidedress 28% or a Similar Nitrogen For the 2013 crop?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes	6
Irrigated and Non-irrigated Sandy Soils	No	94
Southeastern	Yes	3
Southeastern	No	97
Statewide	Yes	5
Statewide	No	95

Table 62 details the percent of respondents that used a nitrogen inhibitor on sidedressed 28% or other liquid nitrogen to the 2013 corn crop.

**Table 62. Nitrogen stabilizer use, such as Instinct, with sidedressed 28% or other liquid nitrogen for the 2013 season. (Q.59)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did the Liquid Nitrogen Application Include a stabilizer such as Instinct?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	23
Irrigated and Non-irrigated Sandy Soils	Some	9
Irrigated and Non-irrigated Sandy Soils	None	68
Southeastern	All	0
Southeastern	Some	0
Southeastern	None	100
Statewide	All	19
Statewide	Some	7
Statewide	None	74

Table 63 details the percent of respondents that incorporated sidedressed 28% or other liquid nitrogen for the 2013 corn crop.

**Table 63. Percent of farmers incorporating sidedressed liquid 28% or other liquid nitrogen. (Q.60)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did you Incorporate the 28% or Similar Liquid Nitrogen Application?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	59
Irrigated and Non-irrigated Sandy Soils	Some	0
Irrigated and Non-irrigated Sandy Soils	None	41
Southeastern	All	60
Southeastern	Some	0
Southeastern	None	40
Statewide	All	59
Statewide	Some	0
Statewide	None	41

Table 64 details the percent of respondents that sidedressed 28% or other liquid nitrogen using variable rate technology or more than one rate per field, such as using management zones.

**Table 64. Percent of farmers who sidedressed 28% or a similar liquid nitrogen using variable rate applications (Q.61)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was Any of the Sidedressed 28% or Similar Liquid Nitrogen Applied Variable Rate?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	14
Irrigated and Non-irrigated Sandy Soils	Some	18
Irrigated and Non-irrigated Sandy Soils	None	68
Southeastern	All	0
Southeastern	Some	0
Southeastern	None	100
Statewide	All	11
Statewide	Some	15
Statewide	None	74



Table 65 details the percent of respondents that applied herbicides with or at the same time as the sidedressed 28% or other liquid nitrogen.

**Table 65. Percent of farmers who applied herbicides with or at the same time as sidedressed 28% or similar liquid nitrogen. (Q.62)**

<b>Nitrogen Best Management Practices Region</b>	<b>Was the Sidedressed 28% or Similar Liquid Nitrogen Applied at the Same Time as an Herbicide?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	0
Irrigated and Non-irrigated Sandy Soils	Some	9
Irrigated and Non-irrigated Sandy Soils	None	91
Southeastern	All	0
Southeastern	Some	0
Southeastern	None	100
Statewide	All	0
Statewide	Some	7
Statewide	None	93

Table 66 details the percent of respondents that applied any other commercial nitrogen source on their corn with sidedressed 28% or other liquid nitrogen.

**Table 66. Applications of any other commercial nitrogen on corn acres with sidedressed 28% or similar liquid nitrogen. (Q.63)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply any Other Commercial Nitrogen on Corn Acres?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes-Fall	0
Irrigated and Non-irrigated Sandy Soils	Yes-Spring	18
Irrigated and Non-irrigated Sandy Soils	No	82
Southeastern	Yes-Fall	0
Southeastern	Yes-Spring	20
Southeastern	No	80
Statewide	Yes-Fall	0
Statewide	Yes-Spring	19
Statewide	No	81

Table 67 details the percent of respondents who use plant sensors such as Green Seeker, Crop Circle, SPAD meters, or other similar devices on corn acres with sidedressed nitrogen.

**Table 67. Nitrogen applications based on plant sensors such as GreenSeeker, Crop Circle, SPAD meters, or other similar devices. (Q.64)**

<b>Nitrogen BMP Region</b>	<b>Was the Sidedressed Nitrogen Based on Plant Sensors Such as Green Seeker, Crop Circle, SPAD Meters, or Other Similar Devices?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	3
Irrigated and Non-irrigated Sandy Soils	Some	1
Irrigated and Non-irrigated Sandy Soils	None	96
Southeastern	All	0
Southeastern	Some	4
Southeastern	None	96
Statewide	All	2
Statewide	Some	1
Statewide	None	97

Table 68 details the percent of respondents that use starter fertilizer on any of their corn acres with sidedressed nitrogen.

**Table 68. Starter fertilizer applications applied in the spring of 2013 along with sidedressed nitrogen. (Q.65)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply a Starter Fertilizer?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	63
Irrigated and Non-irrigated Sandy Soils	Some	11
Irrigated and Non-irrigated Sandy Soils	None	26
Southeastern	All	57
Southeastern	Some	18
Southeastern	None	25
Statewide	All	62
Statewide	Some	12
Statewide	None	26

Table 68 details the percent of respondents type of starter fertilizer used on any of their corn acres with sidedressed nitrogen.

**Table 69. Type of starter used by farmers who sidedressed nitrogen (Q.66)**

<b>Nitrogen Best Management Practices Region</b>	<b>What Type of Starter Did You Apply?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Liquid	36
Irrigated and Non-irrigated Sandy Soils	Dry	64
Southeastern	Liquid	38
Southeastern	Dry	62
Statewide	Liquid	36
Statewide	Dry	64

Table 70 details the percent of respondents that had manure applications on corn acres with sidedressed nitrogen.

**Table 70. Manure applications on corn acres with sidedressed nitrogen. (Q.67)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Apply Manure on Acres with Sidedressed Nitrogen?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	13
Irrigated and Non-irrigated Sandy Soils	Some	34
Irrigated and Non-irrigated Sandy Soils	None	53
Southeastern	All	25
Southeastern	Some	25
Southeastern	None	50
Statewide	All	15
Statewide	Some	33
Statewide	None	52

Table 71 details the percent of respondents in each region and the corresponding average nitrogen rate for corn following soybeans with sidedressed nitrogen and no manure applications.

**Table 71. On corn acres without manure, the average total nitrogen rate per acre applied on corn following soybeans. (Q.68)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Soybeans</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	132	84
Southeastern	149	16
Statewide	135	100

Table 72 details the percent of respondents in each region and the corresponding average nitrogen rate for corn following corn with sidedressed nitrogen and no manure applications.

**Table 72. On your corn acres without manure, the average total nitrogen rate per acre applied on corn following corn. (Q.69)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Corn</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	145	82
Southeastern	168	18
Statewide	149	100

Table 73 details the percent of respondents in each region and the corresponding average nitrogen rate for corn following alfalfa with sidedressed nitrogen and no manure applications.

**Table 73. On your corn acres without manure, the average total nitrogen rate per acre applied on corn following alfalfa. (Q.70)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Alfalfa</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	104	81
Southeastern	113	19
Statewide	106	100

Table 74 details the percent of respondents use of a tissue test on any of their corn acres with sidedressed nitrogen.

**Table 74. Farmers that had a tissue test performed on any of their corn acres. (Q.71)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Have a Tissue Test on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	5
Irrigated and Non-irrigated Sandy Soils	Some	8
Irrigated and Non-irrigated Sandy Soils	None	87
Southeastern	All	4
Southeastern	Some	7
Southeastern	None	89
Statewide	All	5
Statewide	Some	8
Statewide	None	87

Table 75 details the percent of respondents use of the basal stalk test on any of their corn acres with sidedressed nitrogen.

**Table 75. Farmers that had a basal stalk test performed on any of their corn acres. (Q.72)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Have a Basal Stalk Test on Your Corn Acres?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	All	3
Irrigated and Non-irrigated Sandy Soils	Some	3
Irrigated and Non-irrigated Sandy Soils	None	94
Southeastern	All	0
Southeastern	Some	4
Southeastern	None	96
Statewide	All	2
Statewide	Some	4
Statewide	None	94

Table 76 details the percent of respondents on whether the corn acres were stressed from a lack of nitrogen.

**Table 76. Corn acres stressed from lack of nitrogen in 2013. (Q.73)**

<b>Nitrogen Best Management Practices Region</b>	<b>Were Any of Your Corn Acres Stressed from a Lack of Nitrogen?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	Yes	13
Irrigated and Non-irrigated Sandy Soils	Maybe	6
Irrigated and Non-irrigated Sandy Soils	No	81
Southeastern	Yes	11
Southeastern	Maybe	4
Southeastern	No	85
Statewide	Yes	13
Statewide	Maybe	6
Statewide	No	81

Table 77 details the percent of respondents use of a deep soil nitrate test on any of their farm fields with sidedressed nitrogen.

**Table 77. Farmers that had a deep soil nitrate test (18-24 inches) on any of their corn acres. (Q.74)**

<b>Nitrogen Best Management Practices Region</b>	<b>Did You Have a Deep Soil Nitrate Test?</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils Irrigated and Non-irrigated Sandy Soils Irrigated and Non-irrigated Sandy Soils	All	3
	Some	3
	None	94
Southeastern Southeastern Southeastern	All	4
	Some	18
	None	78
Statewide Statewide Statewide	All	4
	Some	6
	None	90

Table 78 details the percent of respondents in each region and the corresponding average corn yield.

**Table 78. Average corn yield for 2013. (Q.75)**

<b>Nitrogen Best Management Practices Region</b>	<b>Average Corn Yield in 2013</b>	<b>Percent of All Respondents</b>
Irrigated and Non-irrigated Sandy Soils	141	84
Southeastern	172	16
Statewide	146	100

## Appendix 1. Survey Form

# 2013 Fall Fertilizer BMP's Report

## Fall and Sidedress Questions for the 2013 Crop Season

### Fall Questions

**Intro1**, I am going to begin asking some questions about your farming practices on your CORN acres.

**Question1. FIntro1**. Did you fall apply any nitrogen for the 2013 crop year? (1=Yes, 2=do not know, 3=no)

**Question2. F Irrig**. Do you irrigate? (1=all, 2=some, 3=none)

**Question3. Urea\_5year**. Have you fall applied Urea in the past 5 years? (1=all, 2=some, 3=none)

**Question4. Urea\_2012**. Did you apply Urea this past fall for next year's (2014) corn crop? (1=Yes, 2=Do not Know, 3=No).

**Question5. Urea\_ Date**. What was the average date of Urea application this past fall (2013)?

**Question6. Urea\_2013**. Did you apply Urea fertilizer in the fall of 2012 for the 2013 season? (1=all, 2=some, 3=none).

**Intro2**. All questions now focus on the fall Urea application 2012 for the 2013 season.

**Question7. Urea\_Inc**. Did you incorporate the Urea fertilizer? (1=all, 2=some, 3=none).

**Question8. Urea\_var**. Was any of the applied Urea applied variable rate? (Please include fields that were zoned or applied at more than one rate as 'Yes'). (1=all, 2=some, 3=none)

**Question 9. Urea\_MAP**. Did the fall application of Urea include a phosphorus source such as MAP/DAP? (1=all, 2=some, 3=none)

**Question 10. Urea\_MAP\_Var**. Was any of the fall applied MAP/DAP applied variable rate (please include fields that were zoned or applied at more than one rate as "Yes"). (1=all, 2=some, 3=none).



**Question 11. Urea\_Herb.** Did the fall application of Urea include or was applied at the same time as an herbicide application? (1=all, 2=some, 3=none)

**Question 12. Ure\_AA.** Does the location at which you purchased the Urea also have Anhydrous Ammonia available? (1=yes, 2=do not know, 3=no)

**Question 13. Urea\_Till\_1.** What type of tillage did you do before the fall application of Urea on the majority of your fields? (1=conventional, 2=mulch, 3=minimum, 4=none, 5=ridge)

**Question 14. Urea\_till\_2.** What type of tillage did you do use to incorporate the fall application of Urea on the majority of your fields? (1=conventional, 2=mulch, 3=minimum, 4=none, 5=ridge).

**Question 15. Urea\_OtherN.** Did you apply any other commercial nitrogen on corn acres with fall applied Urea? (1=no, 2=yes-spring, 3=yes-side)

**Question 16. AA\_5Yr.** Have you fall-applied Anhydrous Ammonia in the past 5 years? (1=all, 2=some, 3=none).

**Question 17. AA\_PastFall.** Did you fall applied Anhydrous Ammonia this past fall for next year's 2014 corn crop? (1=yes, 2=do not know, 3=no).

**Question 18. AA\_Date.** What was the average date of Anhydrous Ammonia applications this past fall of 2013? (Date of application).

**Question 19. AA\_2012.** Did you fall-apply any Anhydrous Ammonia fertilizer in the fall of 2012 for the 2013 season? (1=all, 2=some, 3=none).

**Intro3.** All questions now focus on the fall application of Anhydrous Ammonia in 2012 for the 2013 season.

**Question 20. AA\_Nserve.** Did the Anhydrous Ammonia application include N-serve? (1=yes, 2=some, 3=no).

**Question 21. AA\_Herb.** Did you fall apply herbicides on corn acres applied with Anhydrous Ammonia? Fields (1=all, 2=some, 3=none).

**Question 22. AA\_Var.** Was any of the fall applied Anhydrous Ammonia applied variable rate? (Please include fields that were zoned or applied at more than one rate as "Yes") Fields DK, RF (1=all, 2=some, 3=none).

**Question 23. AA\_MAP.** Did you fall apply a phosphorus source such as MAP/DAP on corn acres applied with Anhydrous Ammonia? (1=all, 2=some, 3=none).

**Question 24. AA\_MAP\_Var.** Was any of the fall applied MAP/DAP applied variable rate? (Please include fields that were zoned or applied at more than one rate as “Yes”). (1=all, 2=some, 3=none).

**Question 25. AA\_Till.** What type of tillage did you do before the fall application of Anhydrous Ammonia on the majority of your fields? (1=conventional, 2=Mulch, 3=Minimum, 4=none, 5=ridge)

**Question 26. AA\_OtherN.** Did you apply any other commercial nitrogen on corn acres with fall applied Anhydrous Ammonia? (1=no, 2=yes-spring, 3=yes-side)

**Question 27. Starter.** Did you apply a starter fertilizer? (1=all, 2=some, 3=none).

**Question 28. Starter\_Type.** What kind of starter was it? (1=liquid, 2=Dry)

**Question 29. ESN.** Did you fall apply ESN? (1=all, 2=some, 3=none).

**Question 30. Agrotain.** Was Agrotain or Super U used? (1=all, 2=some, 3=none).

**Question 31. Manure.** Did you apply manure on acres to be planted to corn in 2013? (1=all, 2=some, 3=none).

**Question 32. N\_After\_Lb.** On your corn acres without manure, average total nitrogen rate applied on corn acres following soybeans pound per acre. (Average total N)

**Question 33. N\_AfterCN\_Lb.** On your corn acres without manure, average total nitrogen rate applied on corn acres following corn pound per acre. (Average total N)

**Question 34. N\_AfterAF\_Lb.** On your corn acres without manure, average total nitrogen rate applied on corn acres following alfalfa pound per acre. (Average total N).

**Question 35. Tissue.** Did you have a tissue test performed on any of your corn acres? (1=all, 2=some, 3=none).

**Question 36. Basal.** Did you have a Basal stalk test perform on any of your corn acres? (1=all, 2=some, 3=none).

**Question 37. Stress.** Were any of your corn acres stressed from lack of nitrogen this year? (1=Yes, 2=maybe, 3=no).

**Question 38. Nitrate\_Test.** Did you have a deep soil nitrate test (18-24 inches) on any of your fields? (1=all, 2=some, 3=none)

**Question 39. CornYld.** What was your average corn yield for 2013? (Average corn yield)

## Sidedress Questions

**Intro1**, I am going to begin asking some questions about your farming practices on your CORN acres.

Do you irrigate?

**Question40. Sidedress.** Do you sidedress any fertilizer? (1=yes, 2= do not know, 3=no)

**Question41. Sidedress.** Do you irrigate? (1=all, 2=some, 3=none)

**Question42. Sidedress urea\_5Year.** Did you sidedress Urea on your corn acres in the past 5 years? (1=all, 2=some, 3=none)

**Question43. Sidedress urea\_2013.** Did you sidedress Urea for the 2013 crop year? (1=Yes, 2=Do not Know, 3=No).

**Intro2** All questions now focus on the Urea sidedress application for the 2013 season.

**Question44. Sidedress Stab.** Did the sidedress application include a nitrogen stabilizer such as Agrotain, Super U, ESN or Instinct? (1=all, 2=some, 3=none)

**Question45. Sidedress urea\_Inc.** Did you incorporate the sidedress application of urea fertilizer? (1=all, 2=some, 3=none)

**Question46. Sidedress urea\_Var.** Was any of the sidedressed urea applied variable rate? (Please include fields that were zoned or applied at more than one rate as 'yes'). (1=all, 2=some, 3=none)

**Question47. Sidedress urea\_Herb.** Did the sidedress application of urea include or was applied at the same time as an herbicide application? (1=all, 2=some, 3=none)

**Question48. Sidedress\_AA.** Does the location at which you purchased the urea also have Anhydrous Ammonia available? (1=Yes, 2=Do not Know, 3=No).

**Question49. Sidedress\_OtherN.** Did you apply any other commercial nitrogen on corn acres with sidedressed urea? (1=no, 2=yes-fall, 3=yes-spring)

**Question50. Sidedress urea\_Percent.** What percentage of the nitrogen applied to the field was applied in the sidedress application (average)? (Percent average)

**Question51. Sidedress AA\_5yr.** Have you sidedressed Anhydrous Ammonia in the past 5 years? (1=all, 2=some, 3=none)

**Question52. Sidedress AA\_2013.** Did you sidedress Anhydrous Ammonia for the 2013 corn crop?" (1=yes, 2=do not know, 3=no)

**Question53. Sidedress AA\_Stab.** Did the sidedress application include a nitrogen stabilizer such as N-serve? : (1=yes, 2=do not know, 3=no)

**Question54. Sidedress AA\_Var.** Was any of the Anhydrous Ammonia applied variable rate? (Please include fields that were zoned or applied at more than one rate, such as GreenSeeker, as 'yes') (1=all, 2=some, 3=none)

**Question55. Sidedress AA\_Herb.** Did the sidedress application of Anhydrous Ammonia include or was applied at the same time as an herbicide application? (1=all, 2=some, 3=none)

**Question56. Sidedress AA\_OtherN.** Did you apply any another commercial nitrogen on corn acres with sidedressed Anhydrous Ammonia? (1=no, 2=yes-fall, 3=yes spring)

**Question57. Sidedress Liq\_5Yr.** Have you sidedressed 28% or other liquid nitrogen in the past 5 years? (1=all, 2=some, 3=none)

**Question58. Sidedress Liq\_2013.** Did you sidedress any 28% or other liquid nitrogen for the 2013 crop year? (1=yes, 2=do not know, 3=no)

**Question59. Sidedress Liq\_Stab.** Did the sidedress application include a nitrogen stabilizer such as Instinct? (1=all, 2=some, 3=none)

**Question60. Sidedress Liq.** Did you incorporate the sidedress application of 28% or other liquid nitrogen? (1=all, 2=some, 3=none)

**Question61. Sidedress Liq\_Var.** Was any of the sidedressed nitrogen applied variable rate? (Please include fields that were zoned or applied at more than one rate, such as GreenSeeker, as 'yes'.) (1=all, 2=some, 3=none)

**Question62. Sidedress Liq\_Herb.** Did the sidedress application of 28% or other liquid nitrogen include or was applied at the same time as an herbicide application? (1=all, 2=some, 3=none)

**Question63. Sidedress Liq\_OtherN.** Did you apply any other commercial nitrogen on corn acres with sidedressed 28% or other liquid nitrogen?" (1=no, 2=yes-fall, 3=yes spring)

**Question64. Sidedress N\_Sensor.** Was the sidedress application of nitrogen based on a plant sensor such as GreenSeeker, Crop Circle, SPAD meter, or other similar device? (1=all, 2=some, 3=none)

**Question65. Sidedress N\_Starter.** Did you apply a starter or pop-up? (1=all, 2=some, 3=none)

**Question66. Sidedress N\_Starter\_Type.** What kind of starter was it? (1-liquid, 2 dry)

**Question67. Sidedress N\_Manure.** Did you apply manure on acres planted to corn in 2013? (1=all, 2=some, 3=none)

**Question68. Sidedress N\_AfterSB\_Lb.** On your corn acres without manure, what was the average total nitrogen rate applied on corn acres following soybeans? (N rate)

**Question69. Sidedress N\_AfterCN\_Lb.** On your corn acres without manure, what was the average total nitrogen rate per acre applied on corn acres following Corn? (N rate)

**Question70. Sidedress N\_AfterAF\_Lb.** On your corn acres without manure, what was the average total nitrogen rate applied on corn acres following Alfalfa? (N rate)

**Question71. Sidedress\_Tissue.** Did you have a tissue test performed on any of your corn acres? (1=all, 2=some, 3=none)

**Question72. Sidedress\_Basal.** Did you have a Basal stalk test performed on any of your corn acres? (1=all, 2=some, 3=none)

**Question73. Sidedress\_Stress.** Was any of your corn stressed from lack of nitrogen this year? (1=yes, 2=maybe, 3=no)

**Question74. Sidedress Nitrate\_Test.** Did you have a deep soil nitrate test (18-24 inches) on any of your fields? (1=all, 2=some, 3=none)

**Question75. Sidedress\_CornYld.** What was your average corn yield for 2013? (Corn yield)