DEPARTMENT OF AGRICULTURE

Survey Results of Nitrogen Fertilizer BMPs on Minnesota's 2015 Corn Acres

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CLEAN WATER LAND & LEGACY AMENDMENT

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Introduction

The Minnesota Department of Agriculture (MDA) is responsible for the development and promotion of nitrogen fertilizer 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 occasionally exceeds the drinking water standard in groundwater, and sometimes exceeds the draft[i] 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 2016. From this pool, approximately 1,800 farmers who raised corn during the 2015 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/nutrient-management-surveys

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.

2015 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 2015 corn acres. About 1,800 farmers participated in the telephone survey and fertilizer information was collected for 545,000 corn acres, representing 7 percent of Minnesota's 8,050,000 harvested corn acres.

Farmers were interviewed over the phone in April of 2016. 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 first and then on the sidedress application of nitrogen, followed by general questions. This is the third 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/nitrogen-fertilizer-best-management-practices-agricultural-lands

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.

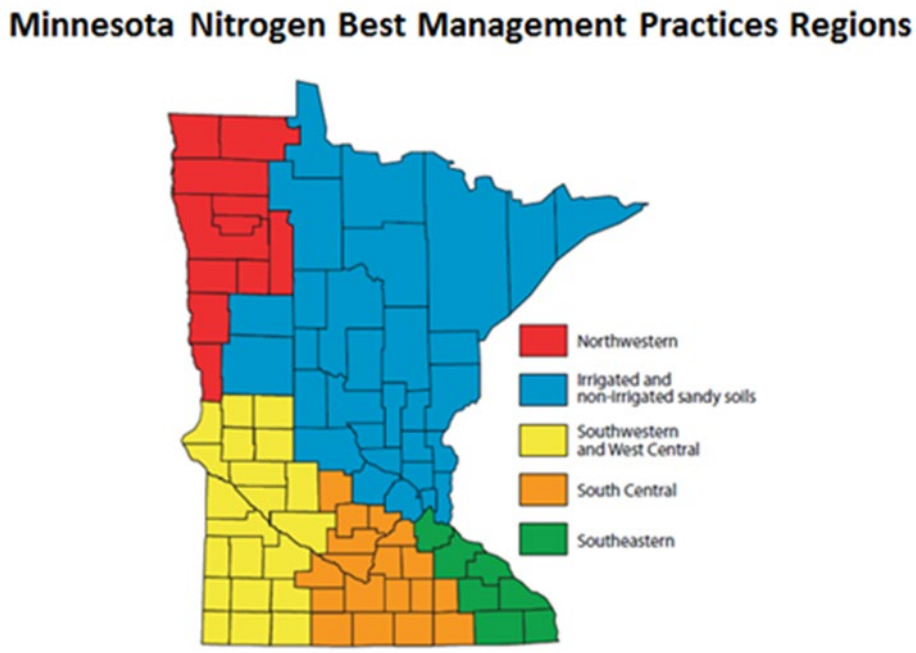

Figure 1. Minnesota Nitrogen Best Management Practices Regions.

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 collects nitrogen BMP data along with pesticide data. 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[ii] was conducted in 2001 by expanding the existing Agricultural Resource Management Study (ARMS) developed by NASS. The typical number of participating The first pilot 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-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[iii] 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.

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.[iv] 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 2015 crop year survey was designed to capture fall applications of nitrogen and sidedress applications of nitrogen.

Table 1 details the respondents and corresponding corn acres by county and BMP region for all farmers in this study. The number of corn acres is the number of corn acres operated by farmers not the actual number of acres with fall applied or sidedressed nitrogen but the acres operated by the farmers who fall applied or sidedressed nitrogen.

Table 1. Summary of respondents and corresponding corn acres by county and BMP region for all farmers.

County	Nitrogen BMP Region	Number of Respondents	Number of Corn Acres
Clay	NW	25	7,608
Kittson	NW	17	3,662
Mahnomen	NW	16	6,780
Norman	NW	22	11,065
Red Lake	NW	18	3,076
Roseau	NW	9	488
Wilkin	NW	29	18,359
Combined Counties	NW	35	9,938
Totals	**NW**	**171**	**60,976**
Aitkin	IRR	11	310
Anoka	IRR	22	3,830
Becker	IRR	18	9,186
Benton	IRR	26	3,678
Chisago	IRR	27	1,836
Crow Wing	IRR	18	2,050
Hennepin	IRR	14	1,779
Isanti	IRR	13	3,306
Mille Lacs	IRR	19	2,486
Morrison	IRR	28	3,500
Otter Tail	IRR	21	3,878
Pine	IRR	19	1,488
Sherburne	IRR	24	3,845
Stearns	IRR	29	3,559
Todd	IRR	19	2,660
Wadena	IRR	19	2,192
Washington	IRR	22	3,423
Wright	IRR	21	4,370
Combined Counties	IRR	70	9,739

County	Nitrogen BMP Region	Number of Respondents	Number of Corn Acres
Totals	**IRR**	**440**	**67,115**
Big Stone	SW	19	7,703
Chippewa	SW	26	17,774
Cottonwood	SW	27	11,216
Douglas	SW	25	2,975
Grant	SW	25	14,455
Jackson	SW	31	10,856
Kandiyohi	SW	23	4,613
Lac qui Parle	SW	21	5,459
Lincoln	SW	24	6,454
Lyon	SW	23	9,139
Murray	SW	25	9,561
Nobles	SW	27	10,816
Pipestone	SW	24	7,905
Pope	SW	28	5,643
Redwood	SW	26	8,802
Renville	SW	30	14,991
Rock	SW	25	5,581
Stevens	SW	30	17,946
Swift	SW	27	16,885
Traverse	SW	28	28,641
Yellow Medicine	SW	24	10,268
Totals	**SW**	**538**	**227,683**
Blue Earth	SC	26	11,342
Brown	SC	27	5,970
Carver	SC	26	3,464
Dodge	SC	26	6,574
Faribault	SC	28	10,923
Freeborn	SC	21	8,204
Le Sueur	SC	29	7,600
Martin	SC	20	7,303
McLeod	SC	35	7,568
Meeker	SC	18	6,234

County	Nitrogen BMP Region	Number of Respondents	Number of Corn Acres
Mower	SC	25	9,379
Nicollet	SC	32	11,126
Rice	SC	26	7,363
Scott	SC	23	2,606
Sibley	SC	30	9,365
Steele	SC	28	6,883
Waseca	SC	28	7,516
Watonwan	SC	32	17,944
Totals	**SC**	**480**	**147,364**
Dakota	SE	26	7,773
Fillmore	SE	29	4,802
Goodhue	SE	33	12,544
Houston	SE	21	3,933
Olmsted	SE	25	5,462
Wabasha	SE	26	4,355
Winona	SE	29	3,363
Totals	**SE**	**189**	**42,232**
State	**ALL**	**1,818**	**545,370**

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 may not be the actual percent of acres with fall applied nitrogen. If a farmer states he fall applies nitrogen, it is extrapolated across all corn acres he operates.

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	Percentage of Respondents Fall Applying Nitrogen	Percentage of Acres Operated by Farmers who Fall Applied Nitrogen
Clay	NW	9	36	38
Wilkin	NW	9	31	39
Combined Counties	NW	23	20	25
Total	**NW**	**41**	**24**	**31**
Chisago	IRR	5	19	43
Otter Tail	IRR	7	33	39
Combined Counties	IRR	54	14	15
Total	**IRR**	**66**	**15**	**18**
Big Stone	SW	7	37	46
Chippewa	SW	11	42	37
Cottonwood	SW	10	37	39
Douglas	SW	5	20	25
Jackson	SW	13	42	50
Kandiyohi	SW	9	39	55
Lac qui Parle	SW	6	29	17
Lincoln	SW	8	33	49
Lyon	SW	9	39	48
Murray	SW	12	48	52
Pope	SW	9	32	38
Redwood	SW	17	65	73
Renville	SW	16	53	74
Rock	SW	5	20	17
Swift	SW	13	48	73
Traverse	SW	7	25	20
Yellow Medicine	SW	11	46	69
Combined Counties	SW	32	30	46

County	BMP Region	Number of Respondents Fall Applying Nitrogen	Percentage of Respondents Fall Applying Nitrogen	Percentage of Acres Operated by Farmers who Fall Applied Nitrogen
Total	**SW**	**200**	**37**	**46**
Blue Earth	SC	15	58	58
Brown	SC	13	48	68
Dodge	SC	8	31	59
Faribault	SC	12	43	53
Freeborn	SC	11	52	52
Le Sueur	SC	10	34	59
Martin	SC	7	35	57
McLeod	SC	11	31	46
Mower	SC	7	28	19
Nicollet	SC	14	44	68
Waseca	SC	17	61	73
Watonwan	SC	19	59	87
Combined Counties	SC	32	21	35
Total	**SC**	**176**	**37**	**54**
Fillmore	SE	5	17	16
Combined Counties	SE	20	13	18
Total	**SE**	**25**	**13**	**18**
State	**ALL**	**508**	**28**	**40**

Fall Applications and Management on Corn Acres

Information on fall nitrogen applications was gathered on a typical corn field for the 2015 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 2015 crop year. (Q.1)

Nitrogen Best Management Practices Region	Did You Fall Apply Nitrogen for the 2015 Corn Crop?	Percent of All Respondents
Northwestern	Yes	24
Northwestern	No	76
Irrigated and non-irrigated Sandy Soils	Yes	15
Irrigated and non-irrigated Sandy Soils	No	85
Southwestern and West Central	Yes	37
Southwestern and West Central	No	63
South Central	Yes	37
South Central	No	63
Southeastern	Yes	13
Southeastern	No	87
Statewide	Yes	28
Statewide	No	72

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)

Nitrogen Best Management Practices Region	Do You Irrigate?	Percent of All Respondents
Northwestern	All	7
Northwestern	Some	5
Northwestern	None	88
Irrigated and non-irrigated Sandy Soils	All	5
Irrigated and non-irrigated Sandy Soils	Some	8
Irrigated and non-irrigated Sandy Soils	None	87
Southwestern and West Central	All	3
Southwestern and West Central	Some	7
Southwestern and West Central	None	90
South Central	All	3
South Central	Some	4
South Central	None	93
Southeastern	All	4
Southeastern	Some	12
Southeastern	None	84
Statewide	All	3
Statewide	Some	6
Statewide	None	91

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)

Nitrogen Best Management Practices Region	Have You Fall Applied Urea in the Past 5 Years?	Percent of All Respondents
Northwestern	All	6
Northwestern	Some	11
Northwestern	None	83
Irrigated and non-irrigated Sandy Soils	All	2
Irrigated and non-irrigated Sandy Soils	Some	2
Irrigated and non-irrigated Sandy Soils	None	96
Southwestern and West Central	All	8
Southwestern and West Central	Some	10
Southwestern and West Central	None	82
South Central	All	4
South Central	Some	5
South Central	None	91
Southeastern	All	2
Southeastern	Some	0
Southeastern	None	98
Statewide	All	5
Statewide	Some	6
Statewide	None	89

Table 6 details the percent of respondents who fall applied urea in 2015 for the 2016 corn crop.

Table 6. Fall application of urea this past fall (2015) for the 2016 corn crop. (Q.4)

Nitrogen Best Management Practices Region	Did You Apply Urea This Past Fall for the 2014 Crop?	Percent of All Respondents
Northwestern	Yes	8
Northwestern	No	92
Irrigated and non-irrigated Sandy Soils	Yes	1
Irrigated and non-irrigated Sandy Soils	No	99
Southwestern and West Central	Yes	13
Southwestern and West Central	No	87
South Central	Yes	5
South Central	No	95
Southeastern	Yes	1
Southeastern	No	99
Statewide	Yes	6
Statewide	No	94

Table 7 details the average date of fall applied urea in 2015 for the 2016 corn crop.

Table 7. Average date of fall applied urea in 2015 for the 2016 corn crop. (Q.5)

Nitrogen Best Management Practices Region	Average Date of Urea Application for the Fall of 2015
Northwestern	10/27/2015
Irrigated and non-irrigated Sandy Soils	**
Southwestern and West Central	11/03/2015
South Central	11/07/2015
Southeastern	**
Statewide	11/02/2015

'**' less than five responses

Table 8 details the percent of respondents that fall applied urea in 2014 for the 2015 corn crop.

Table 8. Fall application of urea in the fall of 2014 for the 2015 corn crop. (Q.6)

Nitrogen Best Management Practices Region	Did You Apply Urea Fertilizer in the Fall of 2014 for the 2015 Corn Crop?	Percent of All Respondents
Northwestern	All	4
Northwestern	Some	6
Northwestern	None	90
Irrigated and non-irrigated Sandy Soils	All	0
Irrigated and non-irrigated Sandy Soils	Some	1
Irrigated and non-irrigated Sandy Soils	None	99
Southwestern and West Central	All	6
Southwestern and West Central	Some	7
Southwestern and West Central	None	87
South Central	All	3
South Central	Some	2
South Central	None	95
Southeastern	All	1
Southeastern	Some	0
Southeastern	None	99
Statewide	All	3
Statewide	Some	3
Statewide	None	94

Table 9 details the percent of respondents that incorporated fall applied urea in 2014 for the 2015 corn crop.

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

Nitrogen Best Management Practices Region	Did You Incorporate the Urea Fertilizer?	Percent of All Respondents
Northwestern	All	71
Northwestern	Some	24
Northwestern	None	5
Irrigated and non-irrigated Sandy Soils	All	60
Irrigated and non-irrigated Sandy Soils	Some	20
Irrigated and non-irrigated Sandy Soils	None	20
Southwestern and West Central	All	77
Southwestern and West Central	Some	19
Southwestern and West Central	None	4
South Central	All	67
South Central	Some	15
South Central	None	18
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	73
Statewide	Some	18
Statewide	None	9

'**' less than 5 responses

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)

Nitrogen Best Management Practices Region	Was Any of the Fall Applied Urea Applied Variable Rate?	Percent of All Respondents
Northwestern	All	6
Northwestern	Some	6
Northwestern	None	88
Irrigated and non-irrigated Sandy Soils	All	0
Irrigated and non-irrigated Sandy Soils	Some	0
Irrigated and non-irrigated Sandy Soils	None	100
Southwestern and West Central	All	28
Southwestern and West Central	Some	18
Southwestern and West Central	None	54
South Central	All	33
South Central	Some	15
South Central	None	52
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	25
Statewide	Some	14
Statewide	None	61

'**' less than 5 responses

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)

Nitrogen Best Management Practices Region	Did the Fall Application of Urea Include a Phosphorus Source Such as MAP/DAP?	Percent of All Respondents
Northwestern	All	50
Northwestern	Some	38
Northwestern	None	12
Irrigated and non-irrigated Sandy Soils	All	40
Irrigated and non-irrigated Sandy Soils	Some	20
Irrigated and non-irrigated Sandy Soils	None	40
Southwestern and West Central	All	58
Southwestern and West Central	Some	31
Southwestern and West Central	None	11
South Central	All	63
South Central	Some	19
South Central	None	18
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	58
Statewide	Some	28
Statewide	None	14

'**' less than 5 responses

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)

Nitrogen Best Management Practices Region	Was the Fall Applied MAP/DAP Applied Using a Variable Rate?	Percent of All Respondents
Northwestern	All	7
Northwestern	Some	7
Northwestern	None	86
Irrigated and non-irrigated Sandy Soils	All	**
Irrigated and non-irrigated Sandy Soils	Some	**
Irrigated and non-irrigated Sandy Soils	None	**
Southwestern and West Central	All	34
Southwestern and West Central	Some	22
Southwestern and West Central	None	44
South Central	All	50
South Central	Some	23
South Central	None	27
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	33
Statewide	Some	20
Statewide	None	47

'**' less than 5 responses

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)

Nitrogen Best Management Practices Region	Was the Fall Applied Urea Applied at the Same Time as an Herbicide?	Percent of All Respondents
Northwestern	All	6
Northwestern	Some	0
Northwestern	None	94
Irrigated and non-irrigated Sandy Soils	All	20
Irrigated and non-irrigated Sandy Soils	Some	0
Irrigated and non-irrigated Sandy Soils	None	80
Southwestern and West Central	All	6
Southwestern and West Central	Some	3
Southwestern and West Central	None	91
South Central	All	15
South Central	Some	4
South Central	None	81
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	8
Statewide	Some	3
Statewide	None	89

'**' less than 5 responses

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

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

Nitrogen Best Management Practices Region	Is Anhydrous Ammonia Available at Your Dealer?	Percent of All Respondents
Northwestern	Yes	47
Northwestern	No	53
Irrigated and non-irrigated Sandy Soils	Yes	**
Irrigated and non-irrigated Sandy Soils	No	**
Southwestern and West Central	Yes	76
Southwestern and West Central	No	24
South Central	Yes	96
South Central	No	4
Southeastern	Yes	**
Southeastern	No	**
Statewide	Yes	76
Statewide	No	24

'**' less than 5 responses

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)

Nitrogen Best Management Practices Region	What type of Tillage did You do Before the Fall Application of Urea?	Percent of All Respondents
Northwestern	Conventional	6
Northwestern	Mulch	35
Northwestern	Minimum	6
Northwestern	None	53
Northwestern	Ridge	0
Irrigated and non-irrigated Sandy Soils	Conventional	**
Irrigated and non-irrigated Sandy Soils	Mulch	**
Irrigated and non-irrigated Sandy Soils	Minimum	**
Irrigated and non-irrigated Sandy Soils	None	**
Irrigated and non-irrigated Sandy Soils	Ridge	**
Southwestern and West Central	Conventional	13
Southwestern and West Central	Mulch	19
Southwestern and West Central	Minimum	19
Southwestern and West Central	None	49
Southwestern and West Central	Ridge	0
South Central	Conventional	21
South Central	Mulch	21
South Central	Minimum	14
South Central	None	37
South Central	Ridge	7
Southeastern	Conventional	**
Southeastern	Mulch	**
Southeastern	Minimum	**
Southeastern	None	**
Southeastern	Ridge	**
Statewide	Conventional	13
Statewide	Mulch	24
Statewide	Minimum	16
Statewide	None	45
Statewide	Ridge	2

'**' less than 5 responses

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)

Nitrogen Best Management Practices Region	What Type of Tillage did You do Use to Incorporate the Fall Application?	Percent of All Respondents
Northwestern	Conventional	18
Northwestern	Mulch	52
Northwestern	Minimum	12
Northwestern	None	18
Northwestern	Ridge	0
Irrigated and non-irrigated Sandy Soils	Conventional	**
Irrigated and non-irrigated Sandy Soils	Mulch	**
Irrigated and non-irrigated Sandy Soils	Minimum	**
Irrigated and non-irrigated Sandy Soils	None	**
Irrigated and non-irrigated Sandy Soils	Ridge	**
Southwestern and West Central	Conventional	20
Southwestern and West Central	Mulch	48
Southwestern and West Central	Minimum	23
Southwestern and West Central	None	9
Southwestern and West Central	Ridge	0
South Central	Conventional	33
South Central	Mulch	22
South Central	Minimum	19
South Central	None	19
South Central	Ridge	7
Southeastern	Conventional	**
Southeastern	Mulch	**
Southeastern	Minimum	**
Southeastern	None	**
Southeastern	Ridge	**
Statewide	Conventional	23
Statewide	Mulch	43
Statewide	Minimum	20
Statewide	None	12
Statewide	Ridge	2

'**' less than 5 responses

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).

Nitrogen Best Management Practices Region	Did You Apply any Other Commercial Nitrogen on Your Corn Acres?	Percent of All Respondents
Northwestern	Yes-Spring	0
Northwestern	Yes-Side	0
Northwestern	No	100
Irrigated and non-irrigated Sandy Soils	Yes-Spring	0
Irrigated and non-irrigated Sandy Soils	Yes-Side	0
Irrigated and non-irrigated Sandy Soils	No	100
Southwestern and West Central	Yes-Spring	10
Southwestern and West Central	Yes-Side	4
Southwestern and West Central	No-	86
South Central	Yes-Spring	11
South Central	Yes-Side	4
South Central	No	85
Southeastern	Yes-Spring	**
Southeastern	Yes-Side	**
Southeastern	No	**
Statewide	Yes-Spring	8
Statewide	Yes-Side	4
Statewide	No	88

'**' less than 5 responses

Table 18 details the percent of respondents that used N-serve on fall applied anhydrous ammonia in 2014 for the 2015 corn crop.

Table 18. Nitrogen inhibitor or stabilizer use with fall applied urea for the 2015 season. (Q.16)

Nitrogen Best Management Practices Region	Did the Urea Application Include a Nitrogen Inhibitor or Stabilizer?	Percent of All Respondents
Northwestern	Yes	6
Northwestern	No	94
Irrigated and non-irrigated Sandy Soils	Yes	20
Irrigated and non-irrigated Sandy Soils	No	80
Southwestern and West Central	Yes	55
Southwestern and West Central	No	45
South Central	Yes	85
South Central	No	15
Southeastern	Yes	**
Southeastern	No	**
Statewide	Yes	54
Statewide	No	46

'**' less than 5 responses

Table 19 details the percent of respondents that fall applied anhydrous ammonia on their corn acres in the past 5 years.

Table 19. Fall application of anhydrous ammonia in the past 5 years (Q17).

Nitrogen Best Management Practices Region	Have You Fall Applied Anhydrous Ammonia in the Past 5 Years?	Percent of All Respondents
Northwestern	All	4
Northwestern	Some	8
Northwestern	None	88
Irrigated and non-irrigated Sandy Soils	All	2
Irrigated and non-irrigated Sandy Soils	Some	1
Irrigated and non-irrigated Sandy Soils	None	97
Southwestern and West Central	All	12
Southwestern and West Central	Some	11
Southwestern and West Central	None	77
South Central	All	15
South Central	Some	14
South Central	None	71
Southeastern	All	3
Southeastern	Some	2
Southeastern	None	95
Statewide	All	9
Statewide	Some	8
Statewide	None	83

Table 20 details the percent of respondents who fall applied anhydrous ammonia in 2015 for the 2016 corn crop.

Table 20. Fall application of anhydrous ammonia this past fall (2015) for the 2016 corn crop. (Q.18)

Nitrogen Best Management Practices Region	Did You Apply Anhydrous Ammonia this Past Fall for 2016?	Percent of All Respondents
Northwestern	Yes	5
Northwestern	No	95
Irrigated and non-irrigated Sandy Soils	Yes	1
Irrigated and non-irrigated Sandy Soils	No	99
Southwestern and West Central	Yes	18
Southwestern and West Central	No	82
South Central	Yes	23
South Central	No	77
Southeastern	Yes	4
Southeastern	No	96
Statewide	Yes	13
Statewide	No	87

Table 21 details the average date of fall applied anhydrous ammonia in 2015 for the 2016 corn crop.

Table 21. Average date of anhydrous ammonia application in 2015 for the 2016 corn crop. (Q.19)

Nitrogen Management Region	Average Date of Anhydrous Ammonia Application for the Fall of 2015
Northwestern	10/28/2015
Irrigated and non-irrigated Sandy Soils	**
Southwestern and West Central	11/04/2015
South Central	11/07/2015
Southeastern	11/14/2015
Statewide	11/06/2015

'**' less than 5 responses

Table 22 details the percent of respondents that fall applied anhydrous ammonia in 2014 for the 2015 corn crop.

Table 22. Fall application of anhydrous ammonia in the fall of 2014 for the 2015 corn crop. (Q.20)

Nitrogen Best Management Practices Region	Did You Fall Apply any Anhydrous Ammonia Fertilizer in the Fall of 2014?	Percent of All Respondents
Northwestern	All	2
Northwestern	Some	5
Northwestern	None	93
Irrigated and non-irrigated Sandy Soils	All	1
Irrigated and non-irrigated Sandy Soils	Some	1
Irrigated and non-irrigated Sandy Soils	None	98
Southwestern and West Central	All	10
Southwestern and West Central	Some	10
Southwestern and West Central	None	80
South Central	All	13
South Central	Some	12
South Central	None	75
Southeastern	All	1
Southeastern	Some	2
Southeastern	None	97
Statewide	All	7
Statewide	Some	7
Statewide	None	86

Table 23 details the percent of respondents that used N-serve on fall applied anhydrous ammonia in 2014 for the 2015 corn crop.

Table 23. Nitrogen inhibitor use (N-serve) with fall applied anhydrous ammonia for the 2015 season. (Q.21)

Nitrogen Best Management Practices Region	Did the Anhydrous Ammonia Application Include N-Serve?	Percent of All Respondents
Northwestern	All	8
Northwestern	Some	8
Northwestern	None	84
Irrigated and non-irrigated Sandy Soils	All	67
Irrigated and non-irrigated Sandy Soils	Some	33
Irrigated and non-irrigated Sandy Soils	None	0
Southwestern and West Central	All	31
Southwestern and West Central	Some	17
Southwestern and West Central	None	52
South Central	All	66
South Central	Some	16
South Central	None	18
Southeastern	All	60
Southeastern	Some	40
Southeastern	None	0
Statewide	All	48
Statewide	Some	17
Statewide	None	35

Table 24 details the percent of respondents that applied herbicides with or at the same time as the fall applied anhydrous ammonia.

Table 24. Percent of farmers who applied herbicides with or at the same time as fall applied anhydrous ammonia. (Q.22)

Nitrogen Best Management Practices Region	Was the Fall Applied Anhydrous Ammonia Applied at the Same Time as an Herbicide?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	17
Northwestern	None	83
Irrigated and non-irrigated Sandy Soils	All	17
Irrigated and non-irrigated Sandy Soils	Some	0
Irrigated and non-irrigated Sandy Soils	None	83
Southwestern and West Central	All	6
Southwestern and West Central	Some	4
Southwestern and West Central	None	90
South Central	All	6
South Central	Some	7
South Central	None	87
Southeastern	All	0
Southeastern	Some	17
Southeastern	None	83
Statewide	All	6
Statewide	Some	6
Statewide	None	88

Table 25 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 25. Percent of farmers who fall applied anhydrous ammonia using variable rate applications. (Q.23)

Nitrogen Best Management Practices Region	Was any of the Fall Applied Anhydrous Ammonia Applied Variable Rate?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Irrigated and non-irrigated Sandy Soils	All	17
Irrigated and non-irrigated Sandy Soils	Some	0
Irrigated and non-irrigated Sandy Soils	None	83
Southwestern and West Central	All	22
Southwestern and West Central	Some	15
Southwestern and West Central	None	63
South Central	All	18
South Central	Some	12
South Central	None	70
Southeastern	All	17
Southeastern	Some	17
Southeastern	None	66
Statewide	All	19
Statewide	Some	12
Statewide	None	69

Table 26 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 26. Percent of farmers that fall applied anhydrous ammonia including a phosphorus source such as MAP/DAP. (Q.24)phosphate source such as MAP or DAP.

Nitrogen Best Management Practices Region	Did You Fall Apply a Phosphorus Source Such as MAP/DAP?	Percent of All Respondents
Northwestern	All	58
Northwestern	Some	17
Northwestern	None	25
Irrigated and non-irrigated Sandy Soils	All	0
Irrigated and non-irrigated Sandy Soils	Some	33
Irrigated and non-irrigated Sandy Soils	None	67
Southwestern and West Central	All	43
Southwestern and West Central	Some	24
Southwestern and West Central	None	33
South Central	All	37
South Central	Some	22
South Central	None	41
Southeastern	All	17
Southeastern	Some	17
Southeastern	None	66
Statewide	All	39
Statewide	Some	23
Statewide	None	38

Table 27 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 27. Percent of farmers who used a variable rate to fall apply MAP/DAP with anhydrous ammonia. (Q.25)

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	11
Northwestern	None	89
Irrigated and non-irrigated Sandy Soils	All	**
Irrigated and non-irrigated Sandy Soils	Some	**
Irrigated and non-irrigated Sandy Soils	None	**
Southwestern and West Central	All	30
Southwestern and West Central	Some	25
Southwestern and West Central	None	45
South Central	All	50
South Central	Some	23
South Central	None	27
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	38
Statewide	Some	23
Statewide	None	39

'**' less than 5 responses

Table 28 details the percent of respondents type of tillage used before the fall application of anhydrous ammonia.

Table 28. Type of tillage performed before fall application of anhydrous ammonia on the majority of fields. (Q.26)

Nitrogen Best Management Practices Region	What Type of Tillage did You do Before the Fall Application of Anhydrous Ammonia?	Percent of All Respondents
Northwestern	Conventional	8
Northwestern	Mulch	42
Northwestern	Minimum	25
Northwestern	None	25
Northwestern	Ridge	0
Irrigated and non-irrigated Sandy Soils	Conventional	17
Irrigated and non-irrigated Sandy Soils	Mulch	50
Irrigated and non-irrigated Sandy Soils	Minimum	33
Irrigated and non-irrigated Sandy Soils	None	0
Irrigated and non-irrigated Sandy Soils	Ridge	0
Southwestern and West Central	Conventional	21
Southwestern and West Central	Mulch	39
Southwestern and West Central	Minimum	15
Southwestern and West Central	None	25
Southwestern and West Central	Ridge	0
South Central	Conventional	14
South Central	Mulch	36
South Central	Minimum	19
South Central	None	30
South Central	Ridge	1
Southeastern	Conventional	0
Southeastern	Mulch	0
Southeastern	Minimum	17
Southeastern	None	83
Southeastern	Ridge	0
Statewide	Conventional	16
Statewide	Mulch	37
Statewide	Minimum	18
Statewide	None	28
Statewide	Ridge	1

Table 29 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with fall applied anhydrous ammonia.

Table 29. Applications of any other commercial nitrogen on corn acres with fall applied anhydrous ammonia. (Q.27)

Nitrogen Best Management Practices Region	Did You Apply any Other Commercial Nitrogen on Your Corn Acres?	Percent of All Respondents
Northwestern	Yes-Spring	0
Northwestern	Yes-Side	17
Northwestern	No	83
Irrigated and non-irrigated Sandy Soils	Yes-Spring	0
Irrigated and non-irrigated Sandy Soils	Yes-Side	0
Irrigated and non-irrigated Sandy Soils	No	100
Southwestern and West Central	Yes-Spring	7
Southwestern and West Central	Yes-Side	8
Southwestern and West Central	No	85
South Central	Yes-Spring	6
South Central	Yes-Side	9
South Central	No	85
Southeastern	Yes-Spring	0
Southeastern	Yes-Side	33
Southeastern	No	67
Statewide	Yes-Spring	6
Statewide	Yes-Side	9
Statewide	No	85

Table 30 details the percent of respondents use of fall applied ESN on any of their corn acres.

Table 30. Percent of farmers who fall applied ESN. (Q.28)

Nitrogen Best Management Practices Region	Did You Fall Apply ESN?	Percent of All Respondents
Northwestern	All	1
Northwestern	Some	0
Northwestern	None	99
Irrigated and non-irrigated Sandy Soils	All	1
Irrigated and non-irrigated Sandy Soils	Some	1
Irrigated and non-irrigated Sandy Soils	None	98
Southwestern and West Central	All	2
Southwestern and West Central	Some	0
Southwestern and West Central	None	98
South Central	All	1
South Central	Some	1
South Central	None	98
Southeastern	All	0
Southeastern	Some	0
Southeastern	None	100
Statewide	All	1
Statewide	Some	1
Statewide	None	98

Table 31 details the percent of respondents use of fall applied Agrotain or Super U on any of their corn acres.

Table 31. Percent of farmers who fall applied Agrotain or Super U. (Q.29)

Nitrogen Best Management Practices Region	Was Agrotain or Super U Fall Applied?	Percent of All Respondents
Northwestern	All	2
Northwestern	Some	0
Northwestern	None	98
Irrigated and non-irrigated Sandy Soils	All	1
Irrigated and non-irrigated Sandy Soils	Some	1
Irrigated and non-irrigated Sandy Soils	None	98
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
Southeastern	All	0
Southeastern	Some	1
Southeastern	None	99
Statewide	All	2
Statewide	Some	1
Statewide	None	97

Sidedress Applications and Management on Corn Acres

Table 32 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 32. 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
Clay	NW	8	32	53
Norman	NW	10	45	42
Wilkin	NW	9	31	32
Combined Counties	NW	26	27	33
Total	**NW**	**53**	**31**	**37**
Anoka	IRR	11	50	62
Benton	IRR	13	50	74
Chisago	IRR	16	59	72
Crow Wing	IRR	8	44	82
Kanabec	IRR	7	39	47
Mille Lacs	IRR	8	42	49
Morrison	IRR	12	43	33
Pine	IRR	6	32	49
Sherburne	IRR	13	54	70
Stearns	IRR	11	38	46
Todd	IRR	9	47	61
Wadena	IRR	11	58	90
Washington	IRR	5	23	52
Wright	IRR	6	29	18
Combined Counties	IRR	42	33	42
Total	**IRR**	**178**	**40**	**50**
Cottonwood	SW	7	26	24
Jackson	SW	7	23	29

County	BMP Region	Number of Respondents Sidedressing Nitrogen	Percent of Respondents Sidedressing Nitrogen	Percent of Acres Operated by Farmers with Sidedressed Nitrogen
Kandiyohi	SW	6	26	40
Lac qui Parle	SW	6	29	27
Lincoln	SW	6	25	24
Murray	SW	7	28	35
Redwood	SW	7	27	34
Renville	SW	8	27	42
Rock	SW	8	32	44
Swift	SW	10	37	54
Combined Counties	SW	59	21	36
Total	**SW**	**131**	**24**	**36**
Blue Earth	SC	6	23	20
Brown	SC	7	26	26
Carver	SC	6	23	21
Dodge	SC	8	31	23
Faribault	SC	9	32	21
Freeborn	SC	11	52	71
Le Sueur	SC	8	28	38
McLeod	SC	8	23	18
Meeker	SC	8	44	44
Mower	SC	8	32	37
Nicollet	SC	7	22	17
Steele	SC	14	50	69
Waseca	SC	8	29	35
Watonwan	SC	9	28	21
Combined Counties	SC	20	20	43
Total	**SC**	**137**	**29**	**33**
Dakota	SE	9	35	51
Winona	SE	7	24	50
Combined Counties	SE	30	22	41
Total	**SE**	**46**	**24**	**43**
State	**ALL**	**545**	**30**	**38**

Table 33 details the percent of respondents that sidedressed nitrogen from a major source, such as urea or anhydrous ammonia on their corn acres.

Table 33. Sidedress application of nitrogen for the 2015 crop year. (Q.30)

Nitrogen Best Management Practices Region	Did You Apply Sidedress Nitrogen for the 2015 Corn Crop?	Percent of All Respondents
Northwestern	Yes	31
Northwestern	No	69
Irrigated and non-irrigated Sandy Soils	Yes	40
Irrigated and non-irrigated Sandy Soils	No	60
Southwestern and West Central	Yes	24
Southwestern and West Central	No	76
South Central	Yes	29
South Central	No	71
Southeastern	Yes	24
Southeastern	No	76
Statewide	Yes	30
Statewide	No	70

Table 34 details the percent of respondents that sidedressed nitrogen and irrigated their corn acres.

Table 34. Farmers who sidedressed nitrogen and irrigated. (Q.31)

Nitrogen Best Management Practices Region	Do You Irrigate?	Percent of All Respondents
Northwestern	All	4
Northwestern	Some	2
Northwestern	None	94
Irrigated and non-irrigated Sandy Soils	All	10
Irrigated and non-irrigated Sandy Soils	Some	11
Irrigated and non-irrigated Sandy Soils	None	79
Southwestern and West Central	All	4
Southwestern and West Central	Some	12
Southwestern and West Central	None	84
South Central	All	4
South Central	Some	3
South Central	None	93
Southeastern	All	9
Southeastern	Some	13
Southeastern	None	78
Statewide	All	6
Statewide	Some	8
Statewide	None	86

Table 35 details the percent of respondents that sidedressed urea nitrogen on their corn acres in the past 5 years.

Table 35. Sidedress application of urea in the past 5 years. (Q.32)

Nitrogen Best Management Practices Region	Have You Sidedressed Urea in the Past 5 Years?	Percent of All Respondents
Northwestern	All	5
Northwestern	Some	8
Northwestern	None	87
Irrigated and non-irrigated Sandy Soils	All	19
Irrigated and non-irrigated Sandy Soils	Some	9
Irrigated and non-irrigated Sandy Soils	None	72
Southwestern and West Central	All	6
Southwestern and West Central	Some	5
Southwestern and West Central	None	89
South Central	All	5
South Central	Some	6
South Central	None	89
Southeastern	All	6
Southeastern	Some	10
Southeastern	None	84
Statewide	All	9
Statewide	Some	7
Statewide	None	84

Table 36 details the percent of respondents that sidedressed urea for the 2015 corn crop.

Table 36. Sidedress application of urea for the 2015 corn crop. (Q.33)

Nitrogen Best Management Practices Region	Did You Sidedress Urea for the 2015 Corn Crop?	Percent of All Respondents
Northwestern	Yes	9
Northwestern	No	91
Irrigated and non-irrigated Sandy Soils	Yes	23
Irrigated and non-irrigated Sandy Soils	No	77
Southwestern and West Central	Yes	9
Southwestern and West Central	No	91
South Central	Yes	8
South Central	No	92
Southeastern	Yes	14
Southeastern	No	86
Statewide	Yes	13
Statewide	No	87

Table 37 details the percent of respondents that used a nitrogen stabilizer on sidedressed urea for the 2015 corn crop.

Table 37. Nitrogen stabilizer use with sidedressed urea for the 2015 season. (Q.34)

Nitrogen Best Management Practices Region	Did the Sidedress Application Include a Nitrogen Stabilizer Such as Agrotain, Super U, ESN or Instinct?	Percent of All Respondents
Northwestern	All	20
Northwestern	Some	20
Northwestern	None	60
Irrigated and non-irrigated Sandy Soils	All	42
Irrigated and non-irrigated Sandy Soils	Some	15
Irrigated and non-irrigated Sandy Soils	None	43
Southwestern and West Central	All	45
Southwestern and West Central	Some	14
Southwestern and West Central	None	41
South Central	All	35
South Central	Some	14
South Central	None	51
Southeastern	All	38
Southeastern	Some	19
Southeastern	None	43
Statewide	All	40
Statewide	Some	16
Statewide	None	44

Table 38 details the percent of respondents that incorporated sidedressed urea for the 2015 corn crop.

Table 38. Percent of farmers incorporating sidedressed urea. (Q.35)

Nitrogen Best Management Practices Region	Did You Incorporate the Urea Fertilizer?	Percent of All Respondents
Northwestern	All	40
Northwestern	Some	7
Northwestern	None	53
Irrigated and non-irrigated Sandy Soils	All	28
Irrigated and non-irrigated Sandy Soils	Some	10
Irrigated and non-irrigated Sandy Soils	None	62
Southwestern and West Central	All	40
Southwestern and West Central	Some	9
Southwestern and West Central	None	51
South Central	All	28
South Central	Some	13
South Central	None	59
Southeastern	All	35
Southeastern	Some	19
Southeastern	None	46
Statewide	All	32
Statewide	Some	11
Statewide	None	57

Table 39 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 39. Percent of farmers who sidedressed urea using variable rate applications. (Q.36)

Nitrogen Best Management Practices Region	Was Any of the Sidedressed Urea Applied Variable Rate?	Percent of All Respondents
Northwestern	All	7
Northwestern	Some	7
Northwestern	None	86
Irrigated and non-irrigated Sandy Soils	All	10
Irrigated and non-irrigated Sandy Soils	Some	5
Irrigated and non-irrigated Sandy Soils	None	85
Southwestern and West Central	All	16
Southwestern and West Central	Some	7
Southwestern and West Central	None	77
South Central	All	15
South Central	Some	5
South Central	None	80
Southeastern	All	12
Southeastern	Some	4
Southeastern	None	84
Statewide	All	12
Statewide	Some	5
Statewide	None	83

Table 40 details the percent of respondents that applied herbicides with or at the same time as the sidedressed urea.

Table 40. Percent of farmers who applied herbicides with or at the same time as sidedressed urea. (Q.37)

Nitrogen Best Management Practices Region	Was the Sidedressed Urea Applied at the Same Time as an Herbicide?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	0
Northwestern	None	100
Irrigated and non-irrigated Sandy Soils	All	1
Irrigated and non-irrigated Sandy Soils	Some	1
Irrigated and non-irrigated Sandy Soils	None	98
Southwestern and West Central	All	7
Southwestern and West Central	Some	0
Southwestern and West Central	None	93
South Central	All	0
South Central	Some	0
South Central	None	100
Southeastern	All	0
Southeastern	Some	4
Southeastern	None	96
Statewide	All	2
Statewide	Some	1
Statewide	None	97

Table 41 details the percent of respondents that sidedressed urea and have anhydrous ammonia available at their dealership.

Table 41. Percent of farmers, who sidedress urea, that have anhydrous ammonia available at their dealership. (Q.38)

Nitrogen Best Management Practices Region	Is Anhydrous Ammonia Available at Your Dealer?	Percent of All Respondents
Northwestern	Yes	21
Northwestern	No	79
Irrigated and non-irrigated Sandy Soils	Yes	54
Irrigated and non-irrigated Sandy Soils	No	46
Southwestern and West Central	Yes	70
Southwestern and West Central	No	30
South Central	Yes	97
South Central	No	3
Southeastern	Yes	96
Southeastern	No	4
Statewide	Yes	68
Statewide	No	32

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

Table 42 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with sidedressed urea.

Table 42. Applications of any other commercial nitrogen on corn acres with sidedressed urea. (Q.39)

Nitrogen Best Management Practices Region	Did You Apply any Other Commercial Nitrogen on Your Corn Acres with sidedressed urea?	Percent of All Respondents
Northwestern	Yes-Fall	0
Northwestern	Yes-Spring	33
Northwestern	No	67
Irrigated and non-irrigated Sandy Soils	Yes-Fall	1
Irrigated and non-irrigated Sandy Soils	Yes-Spring	21
Irrigated and non-irrigated Sandy Soils	No	78
Southwestern and West Central	Yes-Fall	2
Southwestern and West Central	Yes-Spring	16
Southwestern and West Central	No	82
South Central	Yes-Fall	3
South Central	Yes-Spring	23
South Central	No	74
Southeastern	Yes-Fall	4
Southeastern	Yes-Spring	23
Southeastern	No	73
Statewide	Yes-Fall	2
Statewide	Yes-Spring	21
Statewide	No	77

Table 43 details the percent of nitrogen that was sidedressed as urea for the 2015 corn crop.

Table 43. Sidedress application of urea for the 2015 corn crop. (Q.40)

Nitrogen Best Management Practices Region	What Percent of Nitrogen was Applied During the Sidedress Urea Application?
Northwestern	34
Irrigated and non-irrigated Sandy Soils	60
Southwestern and West Central	39
South Central	36
Southeastern	41
Statewide	47

Table 44 details the percent of respondents that sidedressed anhydrous ammonia on their corn acres in the past 5 years.

Table 44. Sidedress application of anhydrous ammonia in the past 5 years. (Q.41)

Nitrogen Best Management Practices Region	Have You Sidedressed Anhydrous Ammonia in the Past 5 Years?	Percent of All Respondents
Northwestern	All	4
Northwestern	Some	2
Northwestern	None	94
Irrigated and non-irrigated Sandy Soils	All	5
Irrigated and non-irrigated Sandy Soils	Some	2
Irrigated and non-irrigated Sandy Soils	None	93
Southwestern and West Central	All	3
Southwestern and West Central	Some	4
Southwestern and West Central	None	93
South Central	All	5
South Central	Some	3
South Central	None	92
Southeastern	All	2
Southeastern	Some	2
Southeastern	None	92
Statewide	All	4
Statewide	Some	3
Statewide	None	93

Table 45 details the percent of respondents that sidedressed anhydrous ammonia in 2015 for the corn crop.

Table 45. Sidedress application of anhydrous ammonia for the 2015 corn crop. (Q.42)

Nitrogen Best Management Practices Region	Did You Sidedress Anhydrous Ammonia Fertilizer for the 2015 Corn Crop?	Percent of All Respondents
Northwestern	Yes	6
Northwestern	No	94
Irrigated and non-irrigated Sandy Soils	Yes	6
Irrigated and non-irrigated Sandy Soils	No	94
Southwestern and West Central	Yes	5
Southwestern and West Central	No	95
South Central	Yes	5
South Central	No	95
Southeastern	Yes	**
Southeastern	No	**
Statewide	Yes	5
Statewide	No	95

§ Percent calculated using only those respondents who answered yes or no to the question
'**' less than 5 responses

Table 46 details the percent of respondents that used N-serve on sidedressed anhydrous ammonia for the 2015 corn crop.

Table 46. Nitrogen stabilizer use (N-serve) with sidedressed anhydrous ammonia for the 2015 season. (Q.43)

Nitrogen Best Management Practices Region	Did the sidedress Anhydrous Ammonia Application Include N-Serve?	Percent of All Respondents
Northwestern	Yes	0
Northwestern	No	100
Irrigated and non-irrigated Sandy Soils	Yes	27
Irrigated and non-irrigated Sandy Soils	No	73
Southwestern and West Central	Yes	15
Southwestern and West Central	No	85
South Central	Yes	8
South Central	No	92
Southeastern	Yes	**
Southeastern	No	**
Statewide	Yes	18
Statewide	No	82

'**' less than 5 responses

Table 47 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 47. Percent of farmers who sidedressed anhydrous ammonia using variable rate applications. (Q.44)

Nitrogen Best Management Practices Region	Was any of the Sidedressed Anhydrous Ammonia Applied Variable Rate?	Percent of All Respondents
Northwestern	All	17
Northwestern	Some	0
Northwestern	None	83
Irrigated and non-irrigated Sandy Soils	All	13
Irrigated and non-irrigated Sandy Soils	Some	4
Irrigated and non-irrigated Sandy Soils	None	83
Southwestern and West Central	All	11
Southwestern and West Central	Some	15
Southwestern and West Central	None	74
South Central	All	24
South Central	Some	0
South Central	None	76
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	17
Statewide	Some	6
Statewide	None	77

'**' less than 5 responses

Table 48 details the percent of respondents that applied herbicides with or at the same time as the sidedressed anhydrous ammonia.

Table 48. Percent of farmers who applied herbicides with or at the same time as the sidedressed anhydrous ammonia. (Q.45)

Nitrogen Best Management Practices Region	Was the Sidedressed Anhydrous Ammonia Applied at the Same Time as an Herbicide?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	25
Northwestern	None	75
Irrigated and non-irrigated Sandy Soils	All	4
Irrigated and non-irrigated Sandy Soils	Some	0
Irrigated and non-irrigated Sandy Soils	None	96
Southwestern and West Central	All	0
Southwestern and West Central	Some	4
Southwestern and West Central	None	96
South Central	All	4
South Central	Some	0
South Central	None	96
Southeastern	All	**
Southeastern	Some	**
Southeastern	None	**
Statewide	All	2
Statewide	Some	1
Statewide	None	97

'**' less than 5 responses

Table 49 details the percent of respondents timing of any other commercial nitrogen source on their corn acres with sidedressed anhydrous ammonia.

Table 49. Applications of any other commercial nitrogen on corn acres with sidedressed anhydrous ammonia. (Q.46)

Nitrogen Best Management Practices Region	Did You Apply any Other Commercial Nitrogen on Your Corn Acres?	Percent of All Respondents
Northwestern	Yes-Fall	0
Northwestern	Yes-Spring	0
Northwestern	No	100
Irrigated and non-irrigated Sandy Soils	Yes-Fall	4
Irrigated and non-irrigated Sandy Soils	Yes-Spring	13
Irrigated and non-irrigated Sandy Soils	No	83
Southwestern and West Central	Yes-Fall	4
Southwestern and West Central	Yes-Spring	26
Southwestern and West Central	No	70
South Central	Yes-Fall	0
South Central	Yes-Spring	8
South Central	No	92
Southeastern	Yes-Fall	**
Southeastern	Yes-Spring	**
Southeastern	No	**
Statewide	Yes-Fall	2
Statewide	Yes-Spring	15
Statewide	No	83

'**' less than 5 responses

Table 50 details the percent of respondents that sidedressed 28% or other liquid nitrogen on their corn acres in the past 5 years.

Table 50. Sidedress application of 28% or other liquid nitrogen in the past 5 years (not anhydrous ammonia). (Q.47)

Nitrogen Best Management Practices Region	Have You Sidedressed 28% or Other Liquid Nitrogen in the Past 5 Years?	Percent of All Respondents
Northwestern	All	9
Northwestern	Some	12
Northwestern	None	79
Irrigated and non-irrigated Sandy Soils	All	4
Irrigated and non-irrigated Sandy Soils	Some	2
Irrigated and non-irrigated Sandy Soils	None	94
Southwestern and West Central	All	8
Southwestern and West Central	Some	6
Southwestern and West Central	None	86
South Central	All	10
South Central	Some	4
South Central	None	86
Southeastern	All	5
Southeastern	Some	2
Southeastern	None	93
Statewide	All	7
Statewide	Some	5
Statewide	None	88

Table 51 details the percent of respondents that sidedressed 28% or other liquid nitrogen in 2015 for the corn crop.

Table 51. Sidedressed 28% or other liquid nitrogen for the 2015 crop year (not anhydrous ammonia). (Q.48)

Nitrogen Best Management Practices Region	Did You Sidedress Any 28% or Other Liquid Nitrogen for the 2015 crop?	Percent of All Respondents
Northwestern	Yes	16
Northwestern	No	84
Irrigated and non-irrigated Sandy Soils	Yes	5
Irrigated and non-irrigated Sandy Soils	No	95
Southwestern and West Central	Yes	11
Southwestern and West Central	No	89
South Central	Yes	11
South Central	No	89
Southeastern	Yes	5
Southeastern	No	95
Statewide	Yes	9
Statewide	No	91

Table 52 details the percent of respondents that used a nitrogen inhibitor on sidedressed 28% or other liquid nitrogen to the 2015 corn crop.

Table 52. Nitrogen stabilizer use, such as Instinct, with sidedressed 28% or other liquid nitrogen for the 2015 season. (Q.49)

Nitrogen Best Management Practices Region	Did the Liquid Nitrogen Application Include an Inhibitor or Stabilizer?	Percent of All Respondents
Northwestern	All	7
Northwestern	Some	0
Northwestern	None	93
Irrigated and non-irrigated Sandy Soils	All	30
Irrigated and non-irrigated Sandy Soils	Some	5
Irrigated and non-irrigated Sandy Soils	None	65
Southwestern and West Central	All	23
Southwestern and West Central	Some	12
Southwestern and West Central	None	65
South Central	All	15
South Central	Some	4
South Central	None	81
Southeastern	All	10
Southeastern	Some	10
Southeastern	None	80
Statewide	All	19
Statewide	Some	6
Statewide	None	75

Table 53 details the percent of respondents that incorporated sidedressed 28% or other liquid nitrogen for the 2015 corn crop.

Table 53. Percent of farmers incorporating sidedressed liquid 28% or other liquid nitrogen. (Q.50)

Nitrogen Best Management Practices Region	Did you Incorporate the Sidedress Application of 28% or Other Liquid Nitrogen Application?	Percent of All Respondents
Northwestern	All	45
Northwestern	Some	22
Northwestern	None	33
Irrigated and non-irrigated Sandy Soils	All	60
Irrigated and non-irrigated Sandy Soils	Some	5
Irrigated and non-irrigated Sandy Soils	None	35
Southwestern and West Central	All	60
Southwestern and West Central	Some	13
Southwestern and West Central	None	27
South Central	All	56
South Central	Some	20
South Central	None	24
Southeastern	All	50
Southeastern	Some	0
Southeastern	None	50
Statewide	All	56
Statewide	Some	15
Statewide	None	29

Table 54 details the percent of respondents that sidedressed 28% or other liquid nitrogen fertilizer using variable rate technology or more than one rate per field, such as using management zones.

Table 54. Percent of farmers who sidedressed 28% or a similar liquid nitrogen using variable rate applications (Q.51)

Nitrogen Best Management Practices Region	Was Any of the Sidedressed 28% or Similar Liquid Nitrogen Applied Variable Rate?	Percent of All Respondents
Northwestern	All	11
Northwestern	Some	11
Northwestern	None	78
Irrigated and non-irrigated Sandy Soils	All	20
Irrigated and non-irrigated Sandy Soils	Some	5
Irrigated and non-irrigated Sandy Soils	None	75
Southwestern and West Central	All	22
Southwestern and West Central	Some	5
Southwestern and West Central	None	73
South Central	All	16
South Central	Some	13
South Central	None	71
Southeastern	All	10
Southeastern	Some	0
Southeastern	None	90
Statewide	All	17
Statewide	Some	8
Statewide	None	75

Table 55 details the percent of respondents that applied herbicides with or at the same time as the sidedressed 28% or other liquid nitrogen fertilizer.

Table 55. Percent of farmers who applied herbicides with or at the same time as sidedressed 28% or similar liquid nitrogen. (Q.52)

Nitrogen Best Management Practices Region	Was the Sidedressed 28% or Similar Liquid Nitrogen Applied at the Same Time as an Herbicide?	Percent of All Respondents
Northwestern	All	0
Northwestern	Some	4
Northwestern	None	96
Irrigated and non-irrigated Sandy Soils	All	16
Irrigated and non-irrigated Sandy Soils	Some	0
Irrigated and non-irrigated Sandy Soils	None	84
Southwestern and West Central	All	5
Southwestern and West Central	Some	7
Southwestern and West Central	None	88
South Central	All	9
South Central	Some	0
South Central	None	91
Southeastern	All	10
Southeastern	Some	0
Southeastern	None	90
Statewide	All	7
Statewide	Some	3
Statewide	None	90

Table 56 details the percent of respondents that applied any other commercial nitrogen source on their corn with sidedressed 28% or other liquid nitrogen fertilizer.

Table 56. Applications of any other commercial nitrogen on corn acres with sidedressed 28% or similar liquid nitrogen. (Q.53)

Nitrogen Best Management Practices Region	Did You Apply any Other Commercial Nitrogen on Corn Acres?	Percent of All Respondents
Northwestern	Yes-Fall	7
Northwestern	Yes-Spring	41
Northwestern	No	52
Irrigated and non-irrigated Sandy Soils	Yes-Fall	0
Irrigated and non-irrigated Sandy Soils	Yes-Spring	40
Irrigated and non-irrigated Sandy Soils	No	60
Southwestern and West Central	Yes-Fall	7
Southwestern and West Central	Yes-Spring	18
Southwestern and West Central	No	75
South Central	Yes-Fall	5
South Central	Yes-Spring	16
South Central	No	79
Southeastern	Yes-Fall	0
Southeastern	Yes-Spring	30
Southeastern	No	70
Statewide	Yes-Fall	5
Statewide	Yes-Spring	24
Statewide	No	71

Table 57 details the percent of nitrogen that was sidedressed as 28% or similar liquid nitrogen fertilizer for the 2015 corn crop.

Table 57. Sidedress application of sidedressed 28% for the 2015 corn crop. (Q.54)

Nitrogen Best Management Practices Region	What Percent of Nitrogen was Applied During the Sidedress 28% or Similar Liquid Nitrogen Application?
Northwestern	27
Irrigated and non-irrigated Sandy Soils	39
Southwestern and West Central	34
South Central	38
Southeastern	25
Statewide	34

Table 58 details the percent of respondents who use plant sensors such as Green Seeker, Crop Circle, SPAD meter, or other similar devices on corn acres with sidedressed nitrogen. This question was for all farmers who applied sidedress nitrogen.

Table 58. Nitrogen applications based on plant sensors such as GreenSeeker, Crop Circle, SPAD meter, or other similar devices. (Q.55)

Nitrogen BMP Region	Was the Sidedressed Nitrogen Based on a Plant Sensor Such as Green Seeker, Crop Circle, SPAD Meter, or Other Similar Device?	Percent of All Respondents
Northwestern	All	9
Northwestern	Some	4
Northwestern	None	87
Irrigated and non-irrigated Sandy Soils	All	4
Irrigated and non-irrigated Sandy Soils	Some	5
Irrigated and non-irrigated Sandy Soils	None	91
Southwestern and West Central	All	6
Southwestern and West Central	Some	4
Southwestern and West Central	None	90
South Central	All	7
South Central	Some	4
South Central	None	89
Southeastern	All	7
Southeastern	Some	4
Southeastern	None	89
Statewide	All	6
Statewide	Some	4
Statewide	None	90

Nitrogen Management on Corn Acres by All Farmers

The respondents in this survey were asked the following questions in regards to their nitrogen management. These questions were asked to all participating farmers regardless of whether the farmer fall applied nitrogen, side dressed nitrogen, or did neither.

Table 59 details the percent of respondents that use starter fertilizer on any of their corn acres.

Table 59. Starter fertilizer applications applied in the spring of 2015. (Q.56)

Nitrogen Best Management Practices Region	Did You Apply a Starter or Pop Up Fertilizer?	Percent of All Respondents
Northwestern	All	61
Northwestern	Some	6
Northwestern	None	33
Irrigated and non-irrigated Sandy Soils	All	63
Irrigated and non-irrigated Sandy Soils	Some	8
Irrigated and non-irrigated Sandy Soils	None	29
Southwestern and West Central	All	42
Southwestern and West Central	Some	4
Southwestern and West Central	None	54
South Central	All	65
South Central	Some	3
South Central	None	32
Southeastern	All	71
Southeastern	Some	6
Southeastern	None	23
Statewide	All	58
Statewide	Some	5
Statewide	None	37

Table 60 details the percent of respondents by the type of starter fertilizer used on corn acres.

Table 60. Type of starter used by farmers who applied a starter with nitrogen. (Q.57)

Nitrogen Best Management Practices Region	What Kind of Type of Starter was it?	Percent of All Respondents
Northwestern	Liquid	71
Northwestern	Dry	29
Irrigated and non-irrigated Sandy Soils	Liquid	31
Irrigated and non-irrigated Sandy Soils	Dry	69
Southwestern and West Central	Liquid	81
Southwestern and West Central	Dry	19
South Central	Liquid	75
South Central	Dry	25
Southeastern	Liquid	43
Southeastern	Dry	57
Statewide	Liquid	60
Statewide	Dry	40

Table 61 details the percent of respondents that had manure applications on corn acres with nitrogen fertilizer.

Table 61. Manure applications on corn acres for the 2015 growing season. (Q.58)

Nitrogen Best Management Practices Region	Did You Apply Manure on Acres Planted to Corn in 2015?	Percent of All Respondents
Northwestern	All	16
Northwestern	Some	13
Northwestern	None	71
Irrigated and non-irrigated Sandy Soils	All	28
Irrigated and non-irrigated Sandy Soils	Some	30
Irrigated and non-irrigated Sandy Soils	None	42
Southwestern and West Central	All	11
Southwestern and West Central	Some	28
Southwestern and West Central	None	61
South Central	All	16
South Central	Some	32
South Central	None	52
Southeastern	All	26
Southeastern	Some	40
Southeastern	None	34
Statewide	All	18
Statewide	Some	29
Statewide	None	53

Table 62 details the percent of respondents in each region and the corresponding average nitrogen rate for corn following soybeans with nitrogen fertilizer and no manure applications.

Table 62. On corn acres without manure, the average total nitrogen rate per acre applied on corn following soybeans. (Q.59)

Nitrogen Best Management Practices Region	Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Soybeans	Percent of All Respondents
Northwestern	131	10
Irrigated and non-irrigated Sandy Soils	136	15
Southwestern and West Central	137	37
South Central	145	29
Southeastern	135	9
Statewide	139	100

Table 63 details the percent of respondents in each region and the corresponding average nitrogen rate for corn following corn with nitrogen fertilizer and no manure applications.

Table 63. On your corn acres without manure, the average total nitrogen rate per acre applied on corn following corn. (Q.60)

Nitrogen Best Management Practices Region	Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Corn	Percent of All Respondents
Northwestern	136	8
Irrigated and non-irrigated Sandy Soils	147	26
Southwestern and West Central	145	22
South Central	163	28
Southeastern	163	16
Statewide	153	100

Table 64 details the percent of respondents in each region and the corresponding average nitrogen rate for corn following alfalfa with nitrogen fertilizer and no manure applications.

Table 64. On your corn acres without manure, the average total nitrogen rate per acre applied on corn following alfalfa. (Q.61)

Nitrogen Best Management Practices Region	Average Total Nitrogen Rate in Pounds per Acre Applied on Corn Following Alfalfa	Percent of All Respondents
Northwestern	122	7
Irrigated and non-irrigated Sandy Soils	120	35
Southwestern and West Central	87	20
South Central	99	16
Southeastern	105	22
Statewide	107	100

Table 65 details the percent of respondents use of a tissue test on any of their corn acres. Tissue tests are conducted on corn plants during the growing season to test if the current corn crop has sufficient nitrogen for maximizing yields.[v]

Table 65. Farmers that had a tissue test performed on any of their corn acres. (Q.62)

Nitrogen Best Management Practices Region	Did You Have a Tissue Test Performed on Any Your Corn Acres?	Percent of All Respondents
Northwestern	All	7
Northwestern	Some	9
Northwestern	None	84
Irrigated and non-irrigated Sandy Soils	All	5
Irrigated and non-irrigated Sandy Soils	Some	8
Irrigated and non-irrigated Sandy Soils	None	87
Southwestern and West Central	All	12
Southwestern and West Central	Some	11
Southwestern and West Central	None	77
South Central	All	6
South Central	Some	8
South Central	None	86
Southeastern	All	7
Southeastern	Some	10
Southeastern	None	83
Statewide	All	8
Statewide	Some	9
Statewide	None	83

Table 66 details the percent of respondents use of the basal stalk test on any of their corn acres. The basal stalk test is used to measure the amount of nitrogen in the corn plant at the end of the season. This test provides information on excess or shortage of nitrogen.[vi]

Table 66. Farmers that had a basal stalk test performed on any of their corn acres. (Q.63)

Nitrogen Best Management Practices Region	Did You Have a Basal Stalk Test Performed on Any of Your Corn Acres?	Percent of All Respondents
Northwestern	All	7
Northwestern	Some	9
Northwestern	None	84
Irrigated and non-irrigated Sandy Soils	All	5
Irrigated and non-irrigated Sandy Soils	Some	8
Irrigated and non-irrigated Sandy Soils	None	87
Southwestern and West Central	All	12
Southwestern and West Central	Some	11
Southwestern and West Central	None	77
South Central	All	6
South Central	Some	8
South Central	None	86
Southeastern	All	7
Southeastern	Some	10
Southeastern	None	83
Statewide	All	8
Statewide	Some	9
Statewide	None	83

Table 67 details the percent of respondents on whether the corn acres were stressed from a lack of nitrogen for the 2015 growing season.

Table 67. Corn acres stressed from lack of nitrogen in 2015. (Q.64)

Nitrogen Best Management Practices Region	Was Any of Your Corn Stressed from a Lack of Nitrogen this Year?	Percent of All Respondents
Northwestern	All	12
Northwestern	Some	10
Northwestern	None	78
Irrigated and non-irrigated Sandy Soils	All	8
Irrigated and non-irrigated Sandy Soils	Some	6
Irrigated and non-irrigated Sandy Soils	None	86
Southwestern and West Central	All	7
Southwestern and West Central	Some	4
Southwestern and West Central	None	89
South Central	All	7
South Central	Some	5
South Central	None	88
Southeastern	All	3
Southeastern	Some	5
Southeastern	None	92
Statewide	Yes	7
Statewide	Maybe	6
Statewide	No	87

Table 68 details the percent of respondents use of a deep soil nitrate test on any of their farm fields.

Table 68. Farmers that had a deep soil nitrate test (18-24 inches) on any of their corn acres. (Q.65)

Nitrogen Best Management Practices Region	Did You Have a Deep Soil Nitrate Test on Any of Your Fields?	Percent of All Respondents
Northwestern	All	26
Northwestern	Some	9
Northwestern	None	65
Irrigated and non-irrigated Sandy Soils	All	3
Irrigated and non-irrigated Sandy Soils	Some	4
Irrigated and non-irrigated Sandy Soils	None	93
Southwestern and West Central	All	13
Southwestern and West Central	Some	9
Southwestern and West Central	None	78
South Central	All	5
South Central	Some	5
South Central	None	90
Southeastern	All	4
Southeastern	Some	2
Southeastern	None	94
Statewide	All	9
Statewide	Some	6
Statewide	None	85

Table 69 details the percent of respondents in each region and the corresponding average corn yield.

Table 69. Average corn yield for 2015. (Q.66)

Nitrogen Best Management Practices Region	Average Corn Yield in 2015	Percent of All Respondents
Northwestern	150	9
Irrigated and non-irrigated Sandy Soils	151	24
Southwestern and West Central	185	31
South Central	194	26
Southeastern	187	10
Statewide	176	100

Appendix 1. Survey Form

Fall and Sidedress Questions for the 2015 Crop Season

Fall Questions

Intro1. I am will be asking some questions about your farming practices on your CORN acres.

Question1. FIntro1. Did you fall apply any nitrogen? (1=Yes, 2= do not know, 3=no)

Question2. FIrrig. 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_2015. Did you apply Urea this past fall for next year's (2016) corn crop? (1=yes, 2=do not know, 3=no).

Question5. Urea_ Date. What was the average date of Urea application this past fall (2015)?

Question6. Urea_2015. Did you apply Urea fertilizer in the fall of 2014 for the 2015 season? (1=all, 2=some, 3=none).

Intro2. The next questions now focus on the fall application of urea in 2014 for the 2015 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. Urea_Nit. Did the Urea application include a nitrogen inhibitor or stabilizer? (1=yes, 3=no).

Question 17. AA_5Yr. Have you fall-applied Anhydrous Ammonia in the past 5 years? (1=all, 2=some, 3=none).

Question 18. AA_PastFall. Did you fall applied Anhydrous Ammonia this past fall for next year's 2016 corn crop? (1=yes, 2=do not know, 3=no).

Question 19. AA_Date. What was the average date of Anhydrous Ammonia applications this past fall of 2015 for the 2016 corn crop? (Date of application).

Question 20. AA_2014. Did you fall apply any Anhydrous Ammonia fertilizer in the fall of 2014 for the 2015 season? (1=all, 2=some, 3=none).

Intro3. The next questions now focus on the fall application of Anhydrous Ammonia in 2014 for the past 2015 season.

Question 21. AA_Nserve. Did the Anhydrous Ammonia application include N-serve? (1=yes, 2=do not know, 3=no).

Question 22. AA_Herb. Did you fall apply herbicides on corn acres applied with Anhydrous Ammonia? Fields (1=all, 2=some, 3=none).

Question 23. 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") (1=all, 2=some, 3=none).

Question 24. 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 25. 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 26. 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 27. 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 28. ESN. Did you fall apply ESN? (1=all, 2=some, 3=none).

Question 29. Agrotain. Was Agrotain or Super U used? (1=all, 2=some, 3=none).

Question XX. Other source. Did you apply any other nitrogen source? (1=yes, 2=don't know, 3=no). Unclear question, should have been other "fall" applied source. Did not analyze.

Sidedress Questions

Sidedress_Intro1. I will be asking some questions about your sidedress applied nitrogen and associated practices.

Question 30. Sidedress. Do you sidedress any fertilizer? (1=yes, 2= do not know, 3=no)
Question 31. Sidedress. Do you irrigate? (1=all, 2=some, 3=none)

Question 32. Sidedress urea_5Year. Did you sidedress Urea on your corn acres in the past 5 years? (1=all, 2=some, 3=none)

Question 33. Sidedress urea_2015. Did you sidedress Urea for the 2015 crop year? (1=yes, 2=do not know, 3=no).

Sidedress_Intro2. The next questions now focus on the Urea sidedress application for the 2015 season.

Question 34. Sidedress Stab. Did the sidedress application include a nitrogen stabilizer such as Agrotain, Super U, ESN or Instinct? (1=all, 2=some, 3=none)

Question 35. Sidedress urea_Inc. Did you incorporate the sidedress application of urea fertilizer? (1=all, 2=some, 3=none)

Question 36. 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)

Question 37. 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)

Question 38. Sidedress_AA. Does the location at which you purchased the urea also have Anhydrous Ammonia available? (1=yes, 2=do not know, 3=no).

Question 39. Sidedress_OtherN. Did you apply any other commercial nitrogen on corn acres with sidedressed urea? (1=no, 2=yes-fall, 3=yes-spring)

Question 40. Sidedress urea_Percent. What percentage of the nitrogen applied to the field was applied in the sidedress application (average)? (Percent average)

Question 41. Sidedress AA_5yr. Have you sidedressed Anhydrous Ammonia in the past 5 years? (1=all, 2=some, 3=none)

Question 42. Sidedress AA_2015. Did you sidedress Anhydrous Ammonia for the 2015 corn crop?" (1=yes, 2=do not know, 3=no)

Question 43. Sidedress AA_Stab. Did the sidedress application include a nitrogen stabilizer such as N-serve? : (1=yes, 2=do not know, 3=no)

Question 44. 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) (1=all, 2=some, 3=none)

Question 45. 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)

Question 46. 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)

Question XX. Sidedress AA_Percent. What percentage of the nitrogen applied to the field was applied in the sidedress application (average)? (Percent) *Question was removed due to incorrect coding of survey instrument.*

Question 47. Sidedress Liq_5Yr. Have you sidedressed 28% or other liquid nitrogen in the past 5 years? (1=all, 2=some, 3=none)

Question 48. Sidedress Liq_2015. Did you sidedress any 28% or other liquid nitrogen for the 2015 crop year? (1=yes, 2=do not know, 3=no)

Question 49. Sidedress Liq_Stab. Did the sidedress application include a nitrogen inhibitor or stabilizer? (1=all, 2=some, 3=none)

Question 50. Sidedress Liq. Did you incorporate the sidedress application of 28% or other liquid nitrogen? (1=all, 2=some, 3=none)

Question 51. 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)

Question 52. 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)

Question 53. 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)

Question 54. Sidedress Liq_Percent. What percentage of the nitrogen applied to the field was applied in the sidedress application (average)? (Percent average)

Question 55. 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)

All Farmer Questions

Question 56. All Farmers N_Starter. Did you apply a starter or pop-up? (1=all, 2=some, 3=none)

Question 57. All Farmers N_Starter_Type. What kind of starter was it? (1-liquid, 2 dry)

Question 58. All Farmers N_Manure. Did you apply manure on acres planted to corn in 2015? (1=all, 2=some, 3=none)

Question 59. All Farmers N_AfterSB_Lb. On your corn acres without manure, what was the average total nitrogen rate applied on corn acres following soybeans? (N rate)

Question 60. All Farmers 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)

Question 61. All Farmers N_AfterAF_Lb. On your corn acres without manure, what was the average total nitrogen rate applied on corn acres following Alfalfa? (N rate)

Question 62. All Farmers Tissue. Did you have a tissue test performed on any of your corn acres? (1=all, 2=some, 3=none)

Question 63. All Farmers Basal. Did you have a Basal stalk test performed on any of your corn acres? (1=all, 2=some, 3=none)

Question 64. All Farmers Stress. Was any of your corn stressed from lack of nitrogen this year? (1=yes, 2=maybe, 3=no)

Question 65. All Farmers 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 66. All Farmers_CornYld. What was your average corn yield for 2015? (corn yield)

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[i] 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

[ii] "Expanded Minnesota Agricultural Statistics Pesticide Use Data", 2003, by NASS and MDA.

[iii] Unpublished data. From the September 20, 2003 EPA Report.

[iv] 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://usda.mannlib.cornell.edu/usda/AgCensusImages/1997/01/38/1601/Appd-01.pdf

[v] "Plant Analysis Sampling and Interpretation" University of Minnesota Extension 2013

[vi] "Plant Analysis Sampling and Interpretation" University of Minnesota Extension 2013