



# Appendix A

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NASS Survey Results

## **Acknowledgements**

The National Agricultural Statistics Service (NASS) would like to thank the University of Illinois Extension Service for all of their efforts in this project. They have been an excellent client to work with throughout the process of designing and executing this survey. In particular, NASS would like to thank Laura Christianson and George Czapar. Their leadership and assistance has been invaluable to NASS.

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There is also a long list of industry stakeholders that have been extremely helpful with the development and implementation of the Nutrient Loss Reduction Survey:

American Farmland Trust, Association of Illinois Soil & Water Conservation Districts, Certified Crop Advisers, Growmark, Illinois Corn Growers Association, Illinois Council on Best Management Practices, Illinois Department of Natural Resources, Illinois Association of Drainage Districts, Illinois Farm Bureau, Illinois Fertilizer and Chemical Association, Illinois Land Improvement Contractors Association, Illinois Pork Producers Association, Illinois Society of Professional Farm Managers and Rural Appraisers, Illinois Soybean Association, Illinois Stewardship Alliance, Nutrient Research and Education Council, The Nature Conservancy, Prairie Rivers Network, University of Illinois at Urbana-Champaign, University of Illinois Extension, USDA Natural Resources Conservation Service, the Illinois Environmental Protection Agency, and USDA Farm Service Agency.

Finally, NASS would like to thank Warren Goetsch, and the Illinois Department of Agriculture, for their efforts at coordinating and planning meetings of the Agriculture Water Quality Partnership Forum.

## **Background and Purpose of Survey**

The state of Illinois developed a long-range plan, called the Nutrient Loss Reduction Strategy, to reduce loss of nutrients from agricultural fields (non-point sources) and also to address urban runoff (point sources). The agricultural portion of that plan was focused on reducing loss of nitrogen and phosphorous through leaching and runoff. The plan recommends a list of cultural practices that producers are encouraged to adopt, or expand, in order to preserve nutrients in their fields and reduce loss of those nutrients.

NASS was asked to design and conduct a survey that would establish a baseline set of statistics for some cultural practices in the 2011 crop season. In addition, the survey was designed to measure those same cultural practices for the 2015 crop season. Finally, the survey was designed to measure the level of knowledge that producers have on some Nutrient Loss Reduction Strategies.

## **Sample Design**

The sampling frame for the study includes all Illinois operations on the official NASS database of farms and ranches with at least 100 acres of land in field crops. Two subpopulations of this universe are defined: those operations with land drained by tile, and operations without land drained by tile or unknown tiled area.

For the first subpopulation, four strata will be defined by ranking Illinois counties with operations in the sampling frame by county level tiled area, and forming four subsets of counties each corresponding to 25% of the state level tiled area. One fourth of the overall sample for this subpopulation will be allocated to each of these four strata. The sampling will follow a stratified Probability Proportional to Size (PPS) design, with tiled area as the measure of size, except that operations with at least 3,000 tiled acres will be selected with certainty.

For the second subpopulation, four strata are defined by ranking Illinois counties with operations in the sampling frame by calculated land in field crops, and forming four subsets of counties corresponding to 25% of the state level calculated field crop acres. One fourth of the overall sample for this subpopulation will be allocated to each of these four strata. The units within each stratum will be sampled with equal probability, except that operations with at least 4,000 calculated land in field crops will be selected with certainty.

The overall sample size is 1,900 operations.

## **Survey Methodology**

Questionnaires were mailed to all 1,900 operations on July 1. The mailing included a cover letter and a postage paid business reply envelope. On August 1, a second mailing was sent to the non-respondents from the first mailing.

In the middle of August, non-respondents were called from the NASS calling center in St. Louis. Additional phoning was conducted in late September.

All reports were examined by statisticians and edited for internal consistency. In addition, computer programs were used to identify unusual data and make adjustments where appropriate.

Data were tabulated and totals were adjusted to account for non-response, by size of farm. Ratios from the survey data were applied to previously published NASS statistics and rounded for publication.

## **Survey Results**

The Maximum Return To Nitrogen (MRTN) strategy is a university-recommended method that producers can use to determine an optimal amount of nitrogen to apply to a field, given a specified target yield. Producers that use this strategy will not be over-applying or under-applying the primary nutrient used in corn production.

The survey shows an increase of more than 600,000 acres, between 2011 and 2015, where this strategy was used. Consider that there were 12.6 million acres planted to corn in Illinois in 2011 and 11.7 million acres planted to corn in Illinois in 2015. Therefore 70% of corn acres followed the MRTN method in 2011 and that grew to 81% in 2015. In spite of the sizeable reduction in total acres planted to corn between 2011 and 2015, the area following the recommended MRTN method increased.

<b>Nitrogen Management Strategy</b>	Acres in 2011	Acres in 2015
Acres where an MRTN (Maximum Return To Nitrogen) strategy was used to determine application rates	8,820,000	9,430,000
NASS corn planted acres	12,600,000	11,700,000
Percentage of NASS corn planted acres	70%	81%

Producers use a number of different timing strategies for applying fertilizer, and the Illinois Nutrient Loss Reduction Strategy calls for improved timing of N applications on all tile-drained corn acres. These survey results show a general trend toward more spring and in-season N applications on tile-drained acres planted to corn.

The table below shows an increase of nearly 200,000 acres of corn on tiled acres that were only fertilized in the spring. There was an even larger increase in acres where producers apply less than 50% of nitrogen in the fall or winter, then split the rest of the Nitrogen applications between spring pre-plant and side-dress applications after the crop has emerged.

The survey results also show a decline in acres where Nitrogen was applied in the fall or winter with a nitrification inhibitor. There may be several reasons for this decline including the following reasons:

- Producers were reducing costs by not adding nitrification inhibitors
- More acres were fertilized in the spring, leaving fewer acres to be fertilized in the fall.
- Some other, unknown, factor.

<b>Fertilizer Application Strategies for corn on tiled acres</b>	Acres in 2011	Acres in 2015
Fall / Winter nitrogen was applied with a nitrification inhibitor	3,240,000	2,970,000
Fall / Winter nitrogen was 50% or less of total Nitrogen	940,000	950,000
Fall / Winter nitrogen was 0% of total Nitrogen (all Spring applications)	2,480,000	2,660,000
Less than 50% FALL / WINTER applications, with remaining Nitrogen applications split between pre-plant and side-dress applications	1,730,000	2,220,000

## **Cover Crops and Pattern Tiling**

Cover crops can significantly reduce nitrate losses by taking up water and nitrate from the soil after the main crop is harvested in the fall, and before the main crop starts to use significant amounts of water and nitrogen in the following spring. As these are times when nitrate losses in subsurface drains can be very high, the reduction in nitrate loss can be considerable. By extending the season of active water and nutrient uptake beyond that of annual grain crops, nitrate losses to drains can be reduced (Christianson

et al., 2016). The Illinois Nutrient Loss Reduction Strategy recommends a cover crop on all tilled and non-tilled drained acres in the state, since this is one of the most effective in-field practices to reduce nutrient loss. Total cover crop acres in the state nearly doubled between 2011 and 2015, with a 223% increase in the usage of cover crops on tile-drained ground and a 166% increase on non-tilled ground.

<b>Cover Crop questions (tilled and non-tilled acres)</b>	Acres
Corn / Soybean acres planted to cover crops after the 2011 crop season on tilled ground.	220,000
Corn / Soybean acres planted to cover crops after the 2011 crop season on non-tilled ground.	380,000
Acres where pattern tiling was installed after the 2011 crop was harvested and before the 2012 crop was planted.	310,000
Corn / Soybean acres planted to cover crops after the 2015 crop season on tilled ground.	490,000
Corn / Soybean acres planted to cover crops after the 2015 crop season on non-tilled ground.	630,000
Acres where pattern tiling was installed after the 2015 crop was harvested	110,000

## Edge of Field Practices

A bioreactor is a trench filled with wood chips and is typically located at the end of a tile system, just before the tile flow enters a drainage ditch or leaves the property. Sometimes called a “woodchip bioreactor,” this practice treats the water by enhancing the natural, biological process of denitrification. Most bioreactors use control structures to manage how the drainage water moves within the trench. The Illinois Nutrient Loss Reduction Strategy recommends bioreactors be placed on half of all tile-drained acres in the state. However, the “(D)” indication here reflects the fact that very few tile-drainage systems in Illinois have bioreactors installed on them.

Constructed wetlands are typically built at the end of a tile system. A portion of any nitrate reaching the wetland will be used by the vegetation present in the constructed wetland and may be removed by the process of denitrification, thus further reducing nitrate losses.

The Illinois Nutrient Strategy calls for perennials or energy crops to be planted on 10% of tile-drained land by the year 2025.

<b>Edge of Field Practices and perennial crops</b>	Acres
Tiled acres draining into Bioreactors during 2015	(D)
Tiled acres draining into Constructed Wetlands during 2015	160,000
Tiled acres planted to perennial crops, including CRP plantings, hay, and miscanthus, during 2015	230,000

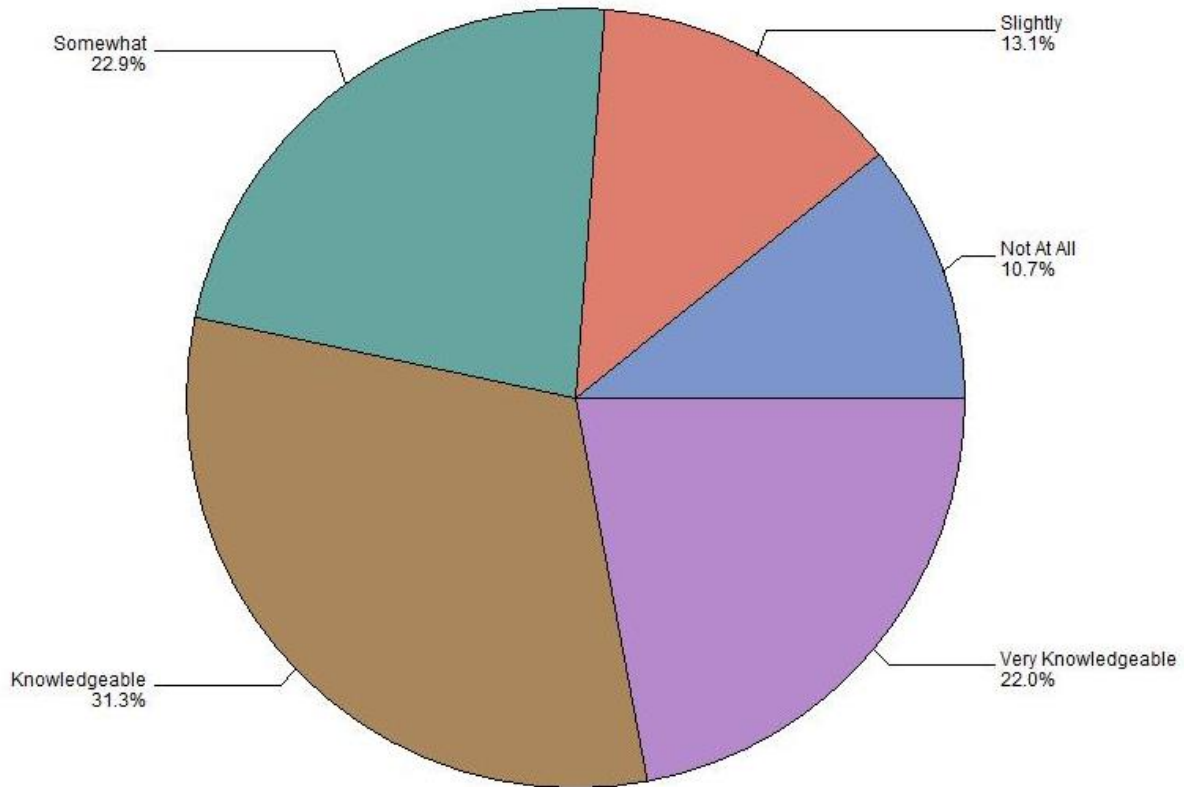
(D) – Number withheld to avoid disclosing data for individual farms.

## Knowledge of Nitrogen management strategies

Producers were asked to assess their level of knowledge on several topics using a five-point scale ranging from Not at all knowledgeable to Very knowledgeable.

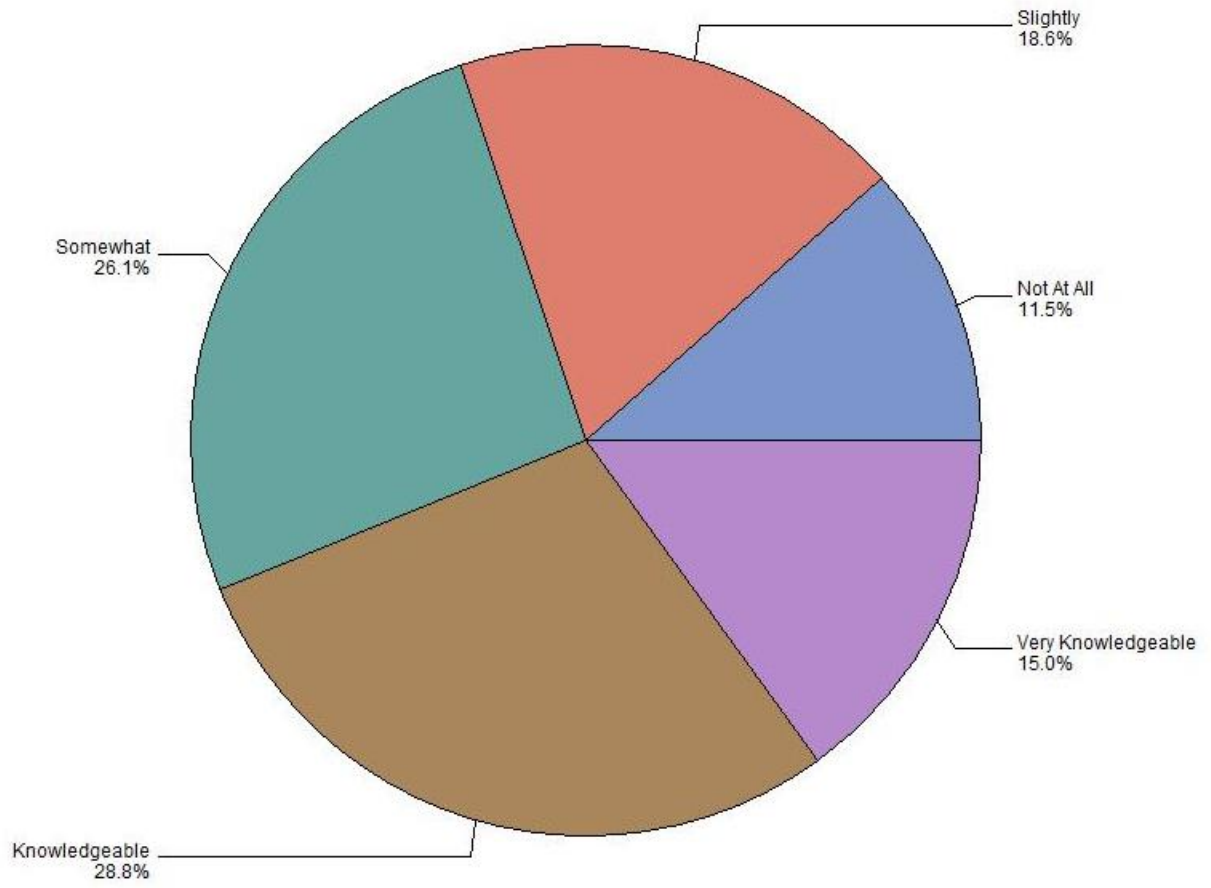
<b>Percent of Farms reporting</b>	Not at all knowledgeable	Slightly knowledgeable	Somewhat knowledgeable	Knowledgeable	Very knowledgeable
Four R strategy	10.7	13.1	22.9	31.3	22.0
MRTN strategy	11.5	18.6	26.1	28.8	15.0
Drainage water management	8.1	20.6	35.8	22.2	13.3
Bioreactors	43.1	22.3	24.8	7.9	1.9

**Knowledge of 4R Nutrient Management Strategy**



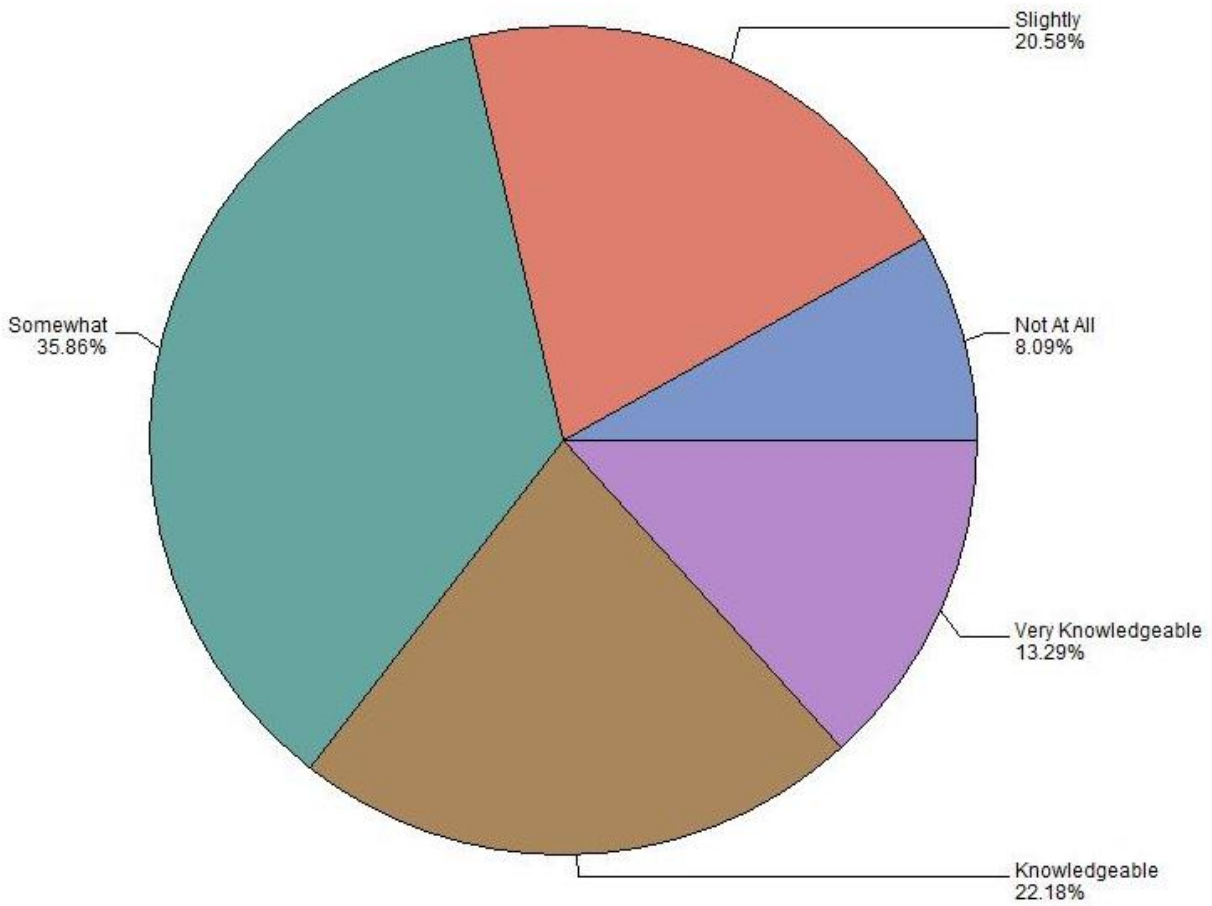
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**Knowledge of Maximum Return to Nitrogen Strategy**



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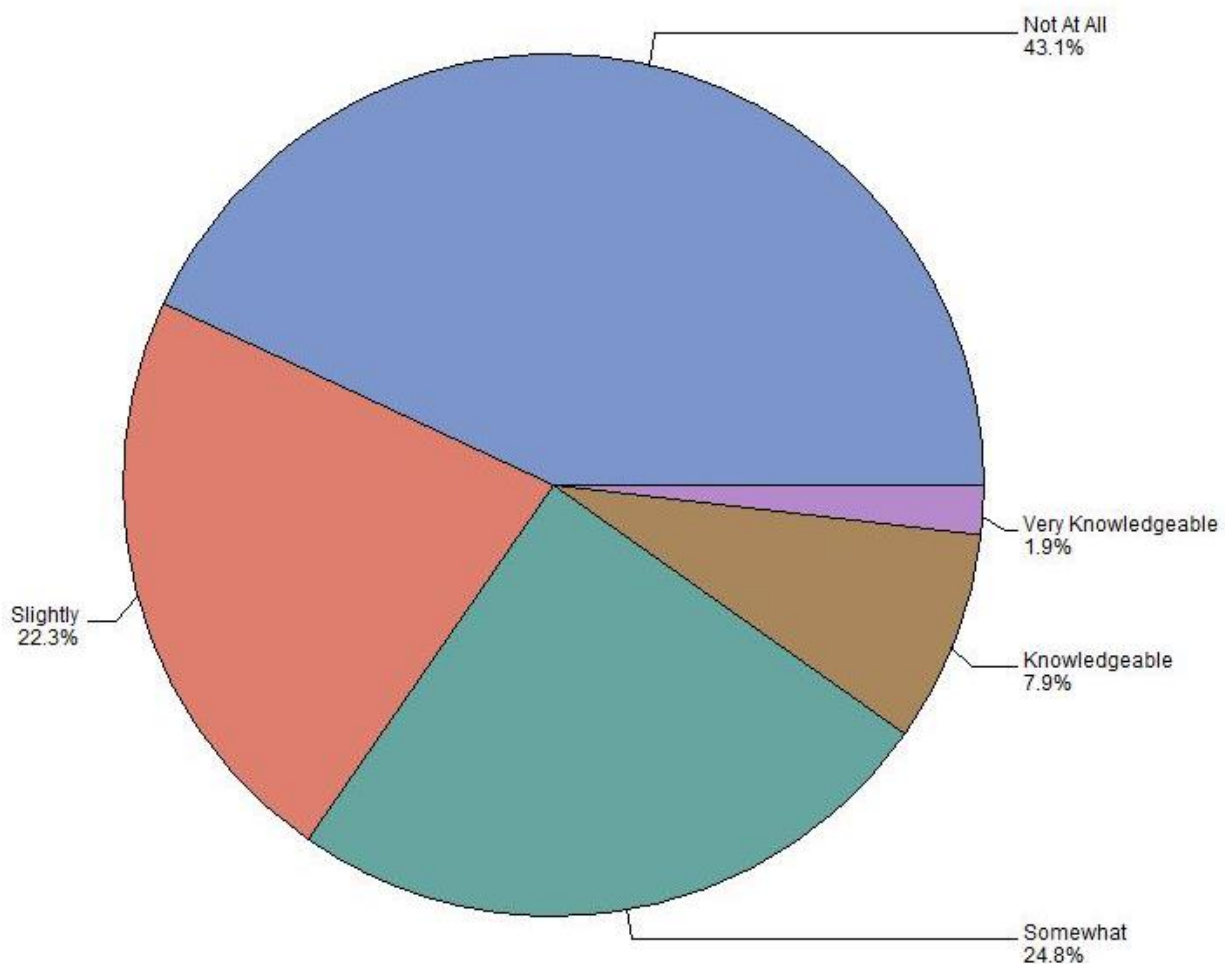
### Knowledge of Drain Water Mngmnt





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### Knowledge of Bioreactors

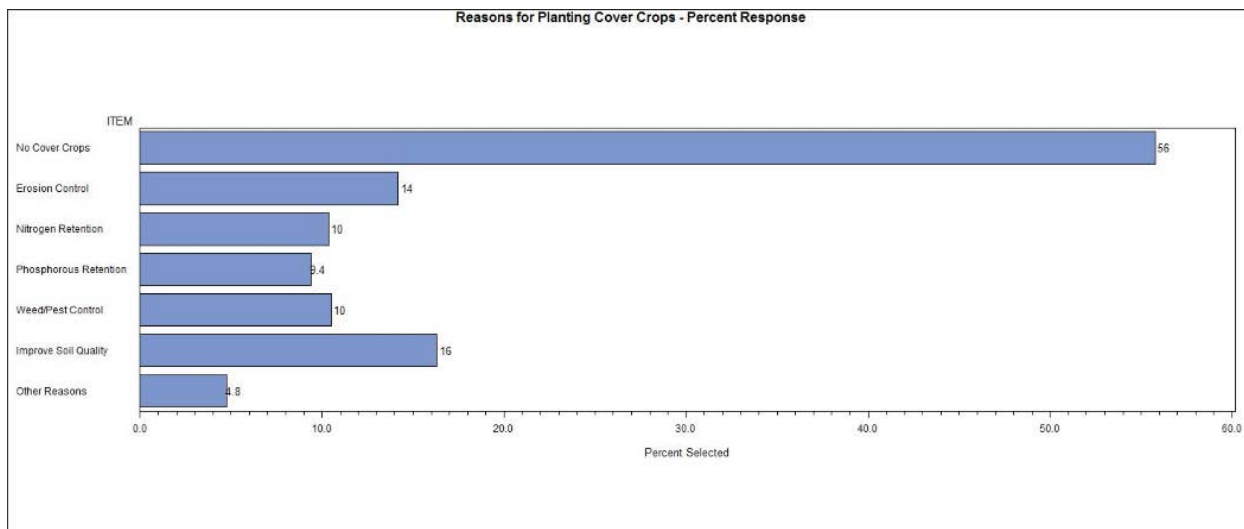



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### Reasons for Planting Cover Crops

Producers that planted cover crops after the 2015 crop season were asked to list their reasons. Producers were asked to check all that apply, so the percentages will not add to 100%.

Reasons for planting cover crops	Percent of farms
Did not plant cover crops	56
Erosion Control	14
Nitrogen Preservation	10
Phosphorous Preservation	9
Control of weeds or other pests	10
To improve soil quality	16
Other reasons	5



## Soil Erosion and Soil Testing

Soil erosion is a pathway for phosphorous to leave fields and enter Illinois waterways. The Illinois Nutrient Loss Reduction Strategy has a goal of reducing erosion to preserve phosphorous in Illinois farmland. Reduced tillage techniques and cover crops can help to achieve that goal. The Illinois Strategy calls for reduced tillage strategies to be implemented on 1.8 million acres that are eroding above acceptable levels by 2025.

These survey results indicate that soil testing is done on approximately half of all cropland in Illinois. Reduction of P application rates due to soil testing climbed nearly 700,000 acres between 2011 and 2015.

<b>Soil Erosion and Soil Testing</b>	2011	Percent of Cropland	2015	Percent of Cropland
Cropland that was converted to reduced tillage strategies due to perceived excessive soil erosion	6,525,000	28%	7,051,000	31%
Cropland planted to cover crops after the crop season due to perceived excessive soil erosion	492,000	2%	815,000	4%
Cropland where phosphorous applications were reduced because of soil test results.	4,483,000	20%	5,162,000	23%
Cropland where soil tests were conducted prior to fertilizer applications	12,509,000	55%	12,600,000	56%
NASS Principal Crop Acres	22,949,000	100%	22,616,000	100%