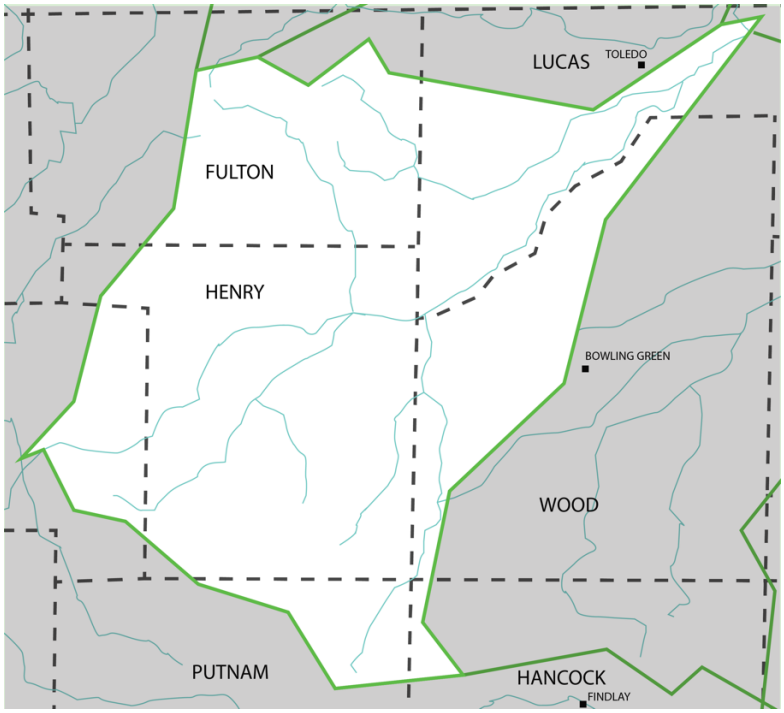
Ohio Agriculture Conservation Initiative 2021 Assessment Survey Report

In 2021, the Ohio Agriculture Conservation Initiative (OACI) conducted a randomized sampling of 450 crop production fields within the HUC8 Lower Maumee watershed (HUC8-04100009). A statistical approach was implemented to determine what practices are being used by farmers within this watershed to manage water and nutrients.

In the field survey process, all the cropped fields within the watershed were considered in the randomized selection process regardless of farm and field size. However, only parcels that were greater than 20 acres were selected for the survey; the average size of the fields surveyed was 48.4 acres. A trained Soil and Water Conservation District employee interviewed the landowner or farm manager for each field surveyed. The Ohio State University and the Center for Survey Statistics and Methodology at Iowa State University helped in designing the sampling strategy and data analysis.

These survey results establish a baseline of current adoption of agricultural best management practices (BMPs). A follow-up assessment in the HUC8 Lower Maumee is planned for 2024, methodology may change.



Lower Maumee watershed map

County	Completed Fields
Defiance	34
Fulton	51
Hancock	3
Henry	272
Lucas	13
Putnam	28
Wood	39
Total	**450**

Fields surveyed per county

Key Findings

- Approximately 64% of the fields surveyed were currently enrolled in a cost share conservation program, including both state and federal level programs.

- The assessment found that most farmers were testing their soil, with 83% of the surveyed fields being sampled at least once every 3 years. The vast majority of soil samples (87%) were being done using precision agriculture, via grid or zone methods.

- 40% of fields surveyed had phosphorus applied using variable-rate technology (VRT); 13% of fields had nitrogen applied using VRT.

- Nearly 50% of the fields were either no tilled or minimally tilled.

- The assessment found that 48% of the farmland assessed was owned by the farmer and 52% was in a lease.

- Farm familiarity is very high as 95% of the fields had been managed by the farmer for 3 years or longer with only 5% being farmed less than 3 years.

- 42% of fields surveyed had water management practices installed and 9% used multiple water management practices.

Cost Share Program Enrollment

Approximately, 66% of the fields surveyed in the watershed at the time they were surveyed were enrolled in a cost-share conservation program, including local, state and federal level programs. Due to the timing of the survey, these numbers represent fields that were enrolled in a program but may *not have implemented* practices yet as it related to H2Ohio or recent enrollment in other programs. Therefore, the information in this survey represented by Figure 1 includes intent to participate in practices, but not necessarily implemented practices in some areas at the time of the survey. No participants indicated enrollment in Private NGO Cost Share programs.

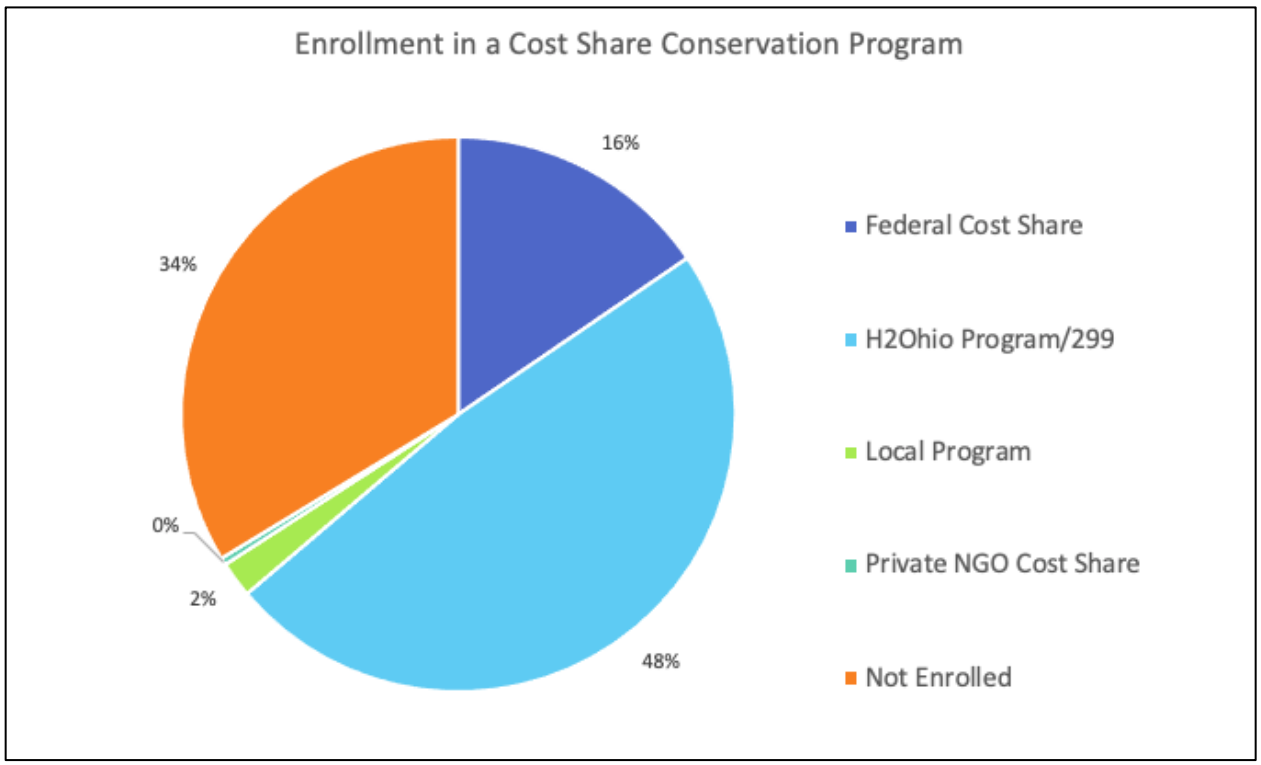


Figure 1. Summary of fields enrolled in conservation cost-shared programs

Acres Farmed and Ownership Status

The results indicated that the fields surveyed were being managed by farmers with a wide range of operation sizes (Figure 2). The fields surveyed were being managed by farmers broken down into the size categories of 0-500, 500-1,000, 1,000-2,500, 2,500-5,000 and 5,000-10,000 acres. The average size of the fields surveyed was 48.4 acres.

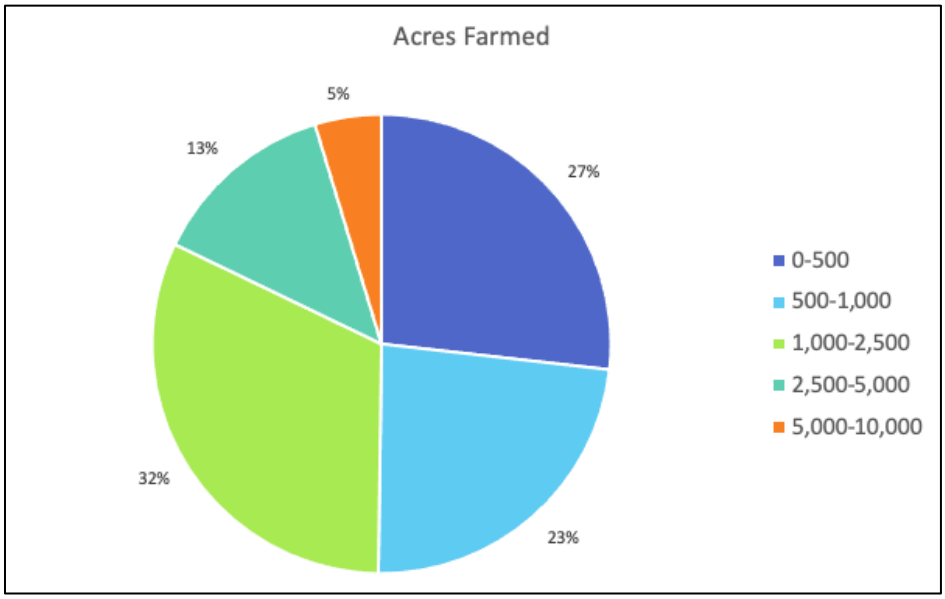


Figure 2. Distribution of number of acres farmed by farmers managing the fields surveyed

Figure 3 summarizes the ownership status of the fields with 48% being owned by the farmer and 52% being leased, either in a long term (>1 year) or short term (year-to-year) lease. Farm ownership status is an important factor in the in-field decisions a farmer makes throughout the growing season. Farmers are often times reluctant to make conservation decisions that require large investments or physical changes to the field without knowing they will be farming the field for a long period.

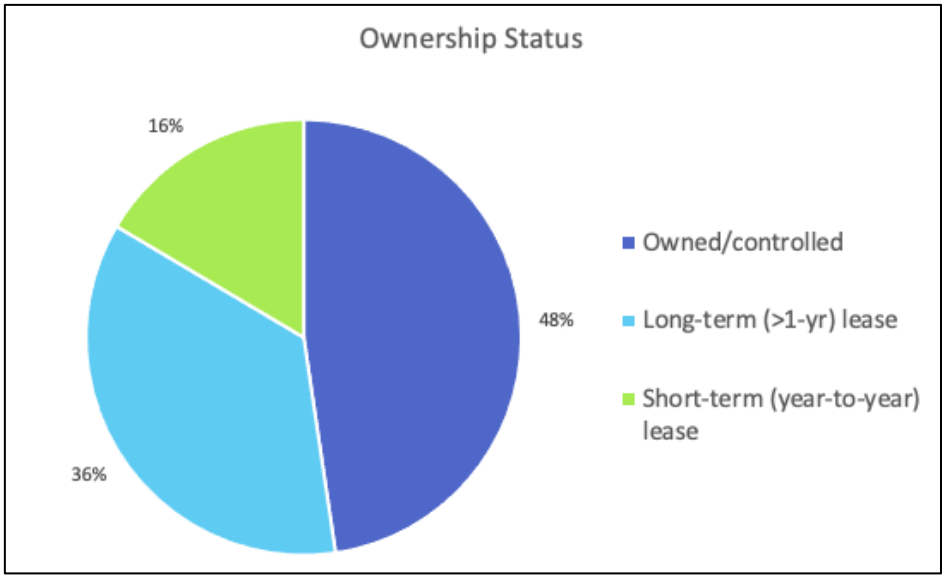


Figure 3. Percentage of surveyed fields that were leased versus owned

Figure 4 indicates 95% of the fields had been managed by the farmer for three years or longer with only 5% being managed by the farmer for less than three years.

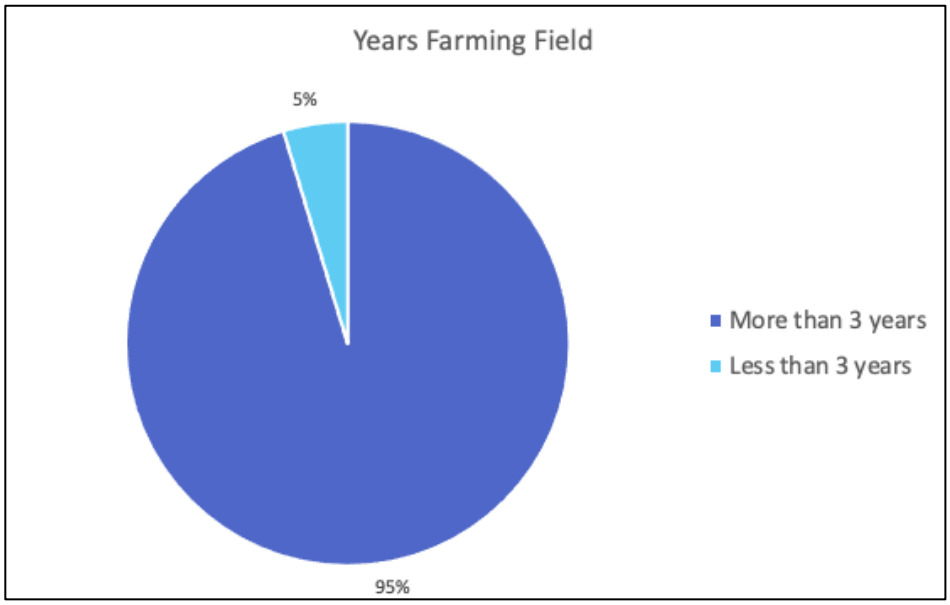


Figure 4. Summary of how long surveyed fields had been managed by the same farmer

Tillage Type

Figure 5 notes the type of tillage being used on fields surveyed within the Lower Maumee watershed with farmers using rotational tillage on 41% of fields. Approximately 50% of the fields were no-tilled, minimally tilled or strip tilled (Figure 5).

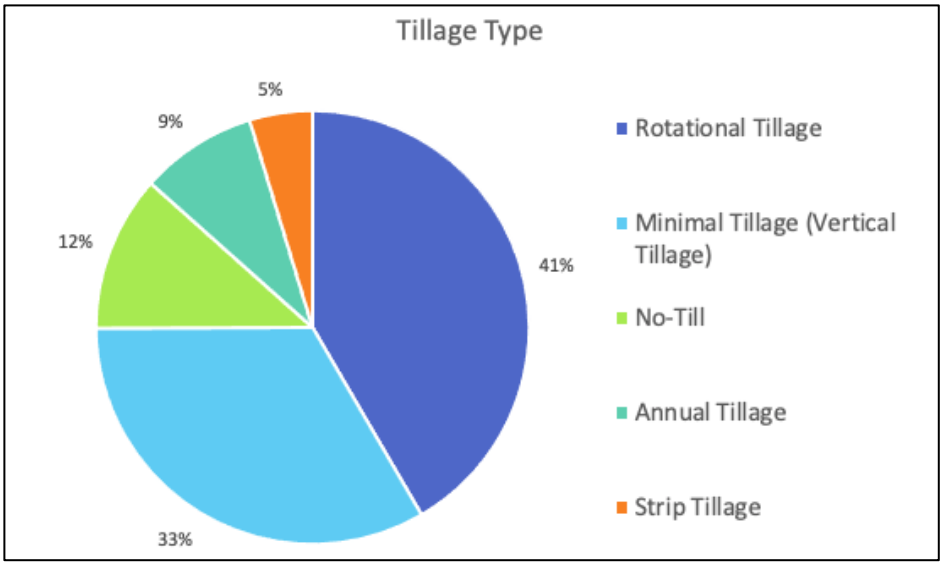


Figure 5. Type of tillage being used by farmers on surveyed fields

Nutrient Management and Recommendations

As other surveys and studies have concluded, commercial fertilizer is the majority nutrient source (86%) used in this region, noted in Figure 6.

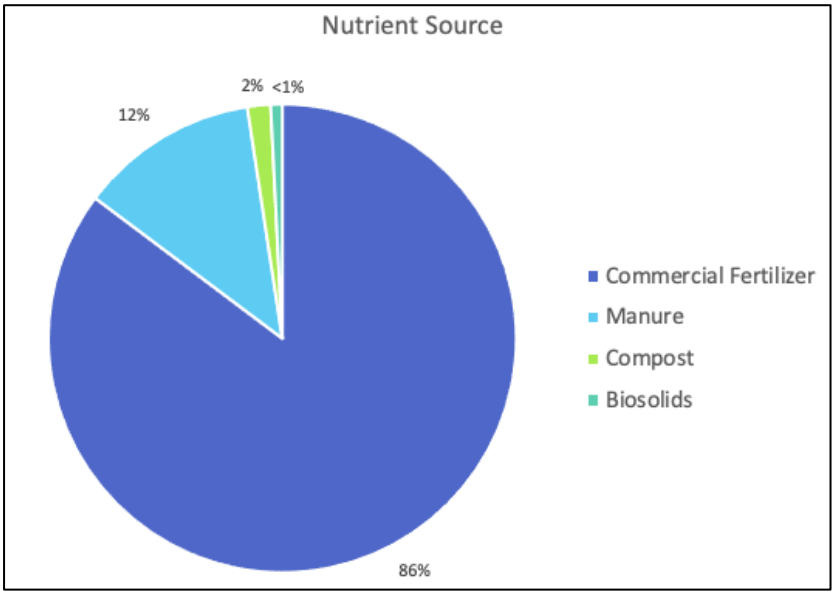


Figure 6. Distribution of nutrient sources across surveyed fields

In the Lower Maumee watershed, 53% of fields surveyed were sampled every three years (Figure 7). Soil testing helps farmers determine the level of nutrients in their soil and make decisions about what nutrients need to be applied to achieve an optimal crop. In order to develop a nutrient management plan, farmers must test their soil at least every 3-4 years, according to Tri-State recommendations.

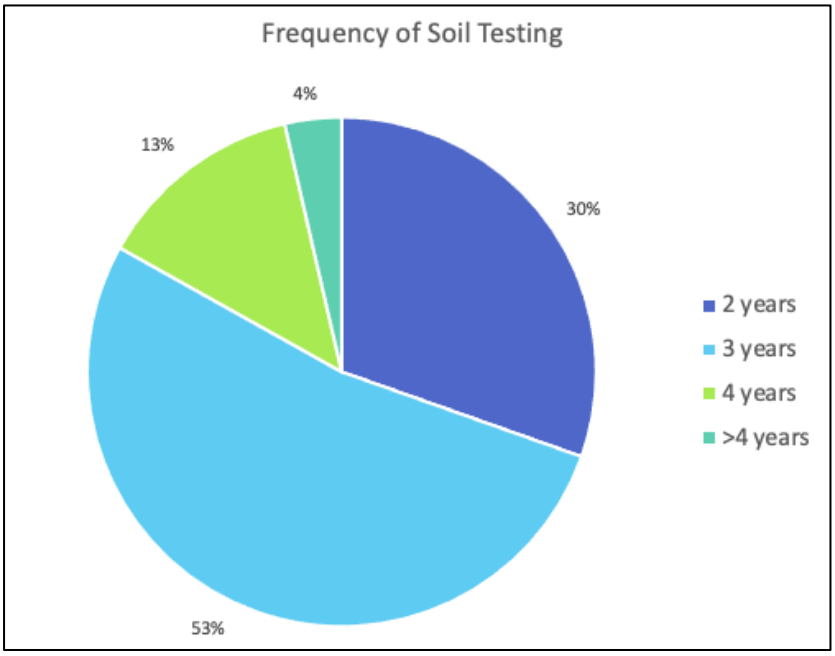


Figure 7. Distribution of soil testing frequency on surveyed fields

Grid and zone sampling are types of precision agriculture sampling strategies (Figure 8).

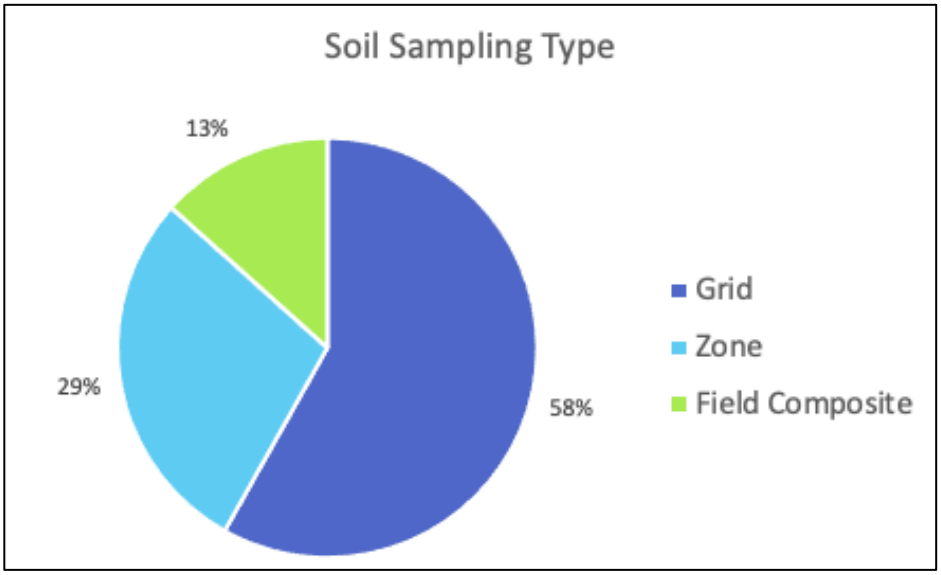


Figure 8. Distribution of soil sampling methods used on surveyed fields

For fertilizer recommendations, farmers utilized fertilizer retailers for 66% of fields surveyed and crop consultants on 24% of fields surveyed. Farmers used their own knowledge regarding fertilizer on 9% of fields surveyed.

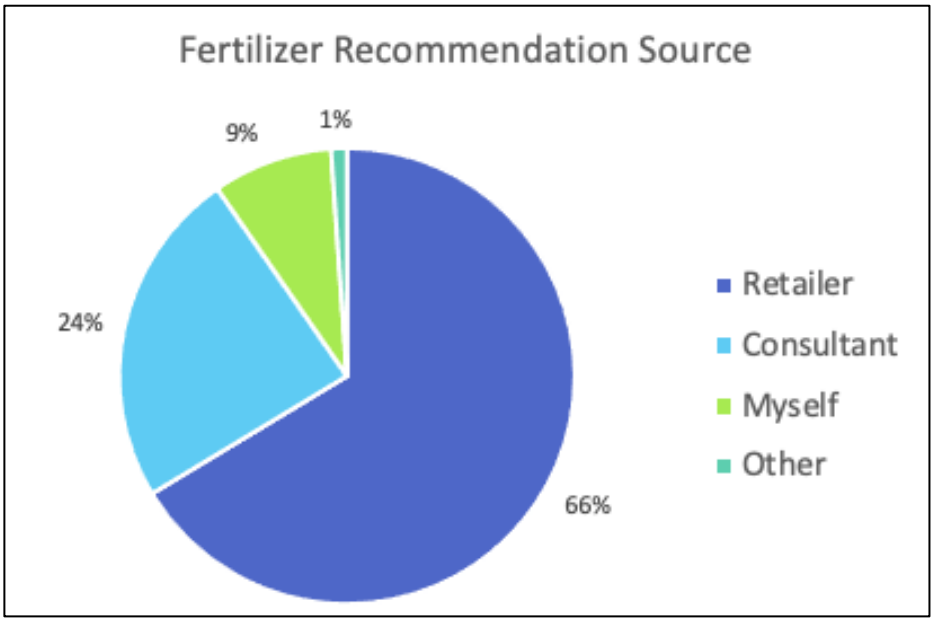


Figure 9. Distribution of fertilizer recommendation sources used for surveyed fields

Nutrient Applications

Approximately 54% of fields surveyed were covered by an approved voluntary nutrient management plan (VNMP) with 44% not covered with a VNMP, as noted in Figure 10. These plans were completed either by their local Soil and Water Conservation District (SWCD) or Natural Resources Conservation Service (NRCS). Assessment respondents indicated using the Tri-State Fertilizer Recommendations on 98% of the fields surveyed for determining the amount of commercial phosphorus (P) fertilizer to apply.

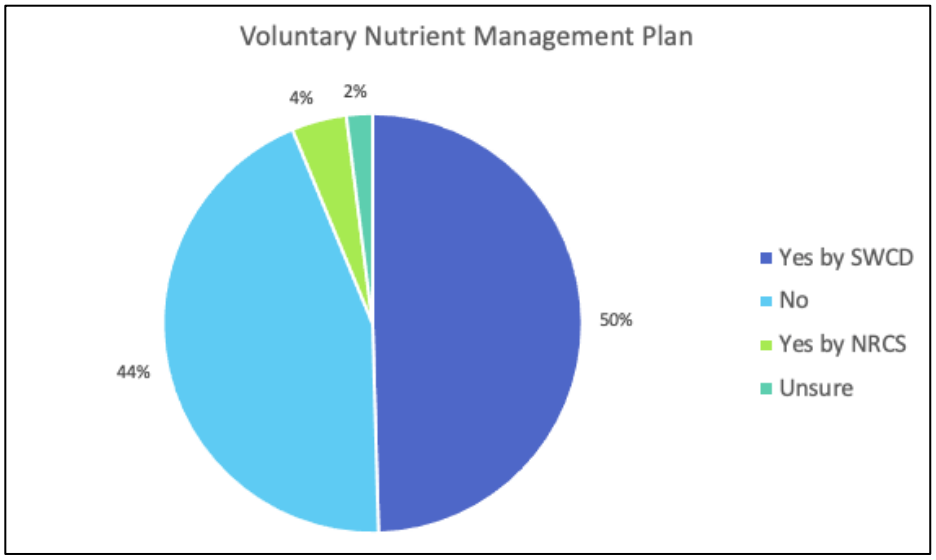


Figure 10. Percentage of surveyed fields that had a voluntary nutrient management plan (VNMP)

Approximately 89% of phosphorus applied is for the 1-2 year crop need (Figure 11). Various methods were used to apply P to the field surveyed, with 34% using surface application, 28% placed with planter and 15% using injection (Figure 12).

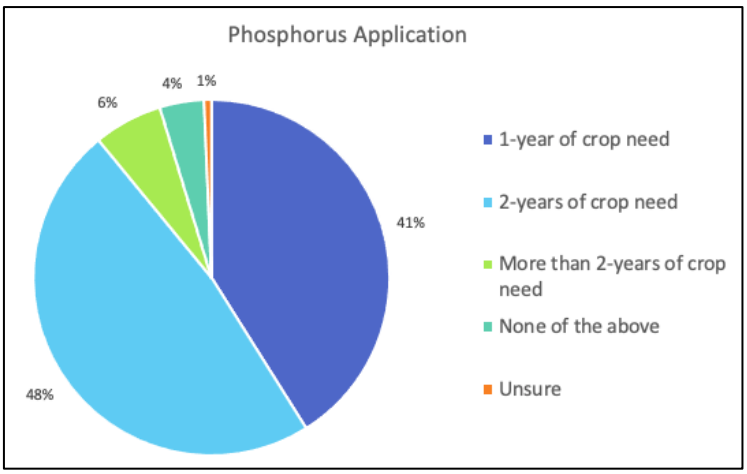


Figure 11. Distribution of amount of phosphorus applied on surveyed fields

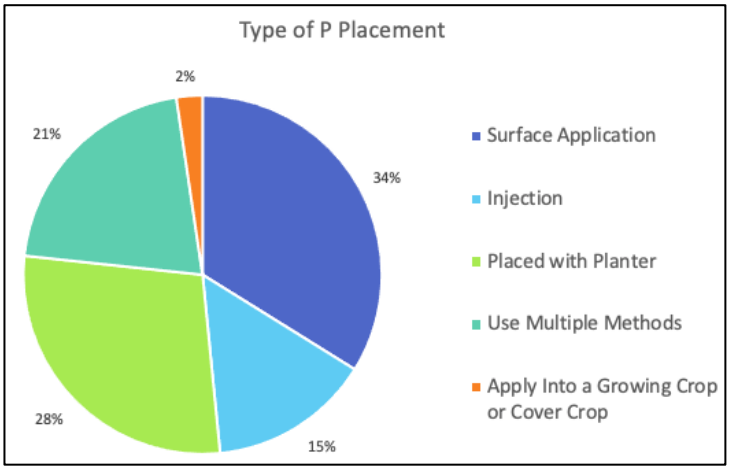


Figure 12. Distribution of P placement methods in surveyed fields

To determine the amount of nitrogen (N) to apply, farmers used adaptive management strategy on 20% of fields surveyed, Maximum Return to Nitrogen (MRTN) Model (Ohio State University recommended N tool) on 57% of fields surveyed and weather/soil modeling service on 42% of fields surveyed.

Farmers used N stabilizers on 61% of fields surveyed versus 36% of surveyed fields where N stabilizers were not used. N stabilizers or inhibitors help keep nitrogen in forms that are less likely to leave the field. N stabilizers are widely available to farmers for use with N fertilizers; however, they are not readily available for P and potassium (K) inorganic fertilizers.

On the fields surveyed, injection was the most popular method of nitrogen placement. Methods using a nitrogen starter during planting were also utilized to place the nutrient near the seed, making it accessible to a young root system (Figure 13).

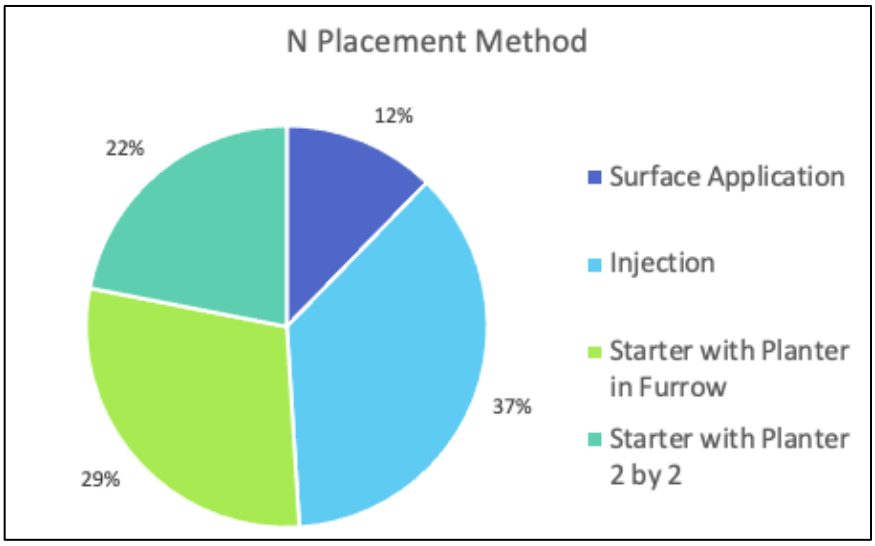


Figure 13. Distribution of N placement methods on fields

The vast majority of farmers surveyed (70%) side-dressed most of their nitrogen in-season (Figure 14).

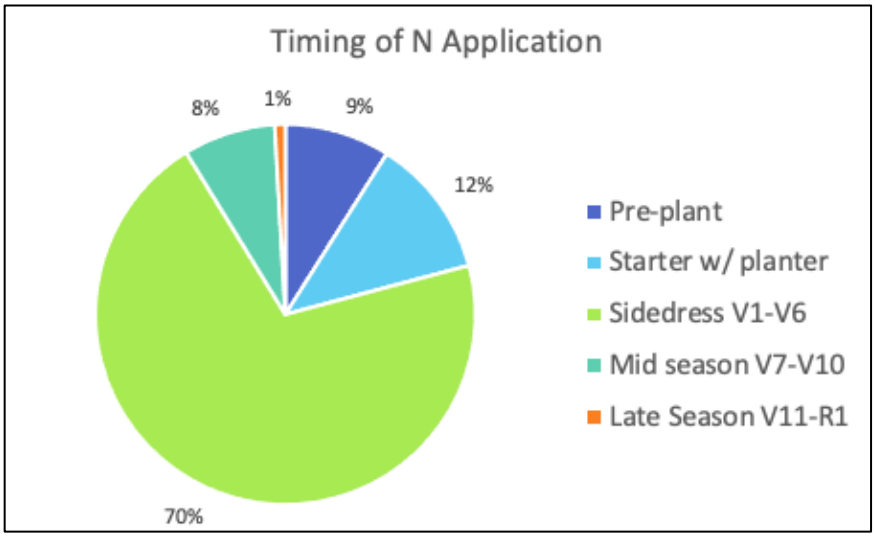


Figure 14. Distribution of N placement timing on surveyed fields

Other Nutrient Management Strategies

Variable Rate Technology (VRT) Application

- 40% of fields surveyed had been using variable-rate P application versus 60% using fixed-rate application
- 13% of fields surveyed had been using variable-rate N application versus 87% using fixed-rate application
- 31% have VRT capabilities that exist on farm versus 69% that are through a supplier

Manure Application

- 91% of fields surveyed were fertilized using appropriate setback distances to critical areas for manure application, according to USDA-NRCS 590 standards
- 20% of fields surveyed were using subsurface manure application
- 77% of fields surveyed incorporated the manure
- 26% of fields surveyed had subsurface manure applied into vegetative cover or an actively growing crop, which helps keep nutrients in the field

Water Management Structures

42% of fields surveyed had a water management structure installed and 9% used multiple water management structures (Figure 15). Water management structures and drainage improvement help to minimize soil erosion. In the Lower Maumee watershed, 90% of the fields surveyed had no visible sign of soil erosion.

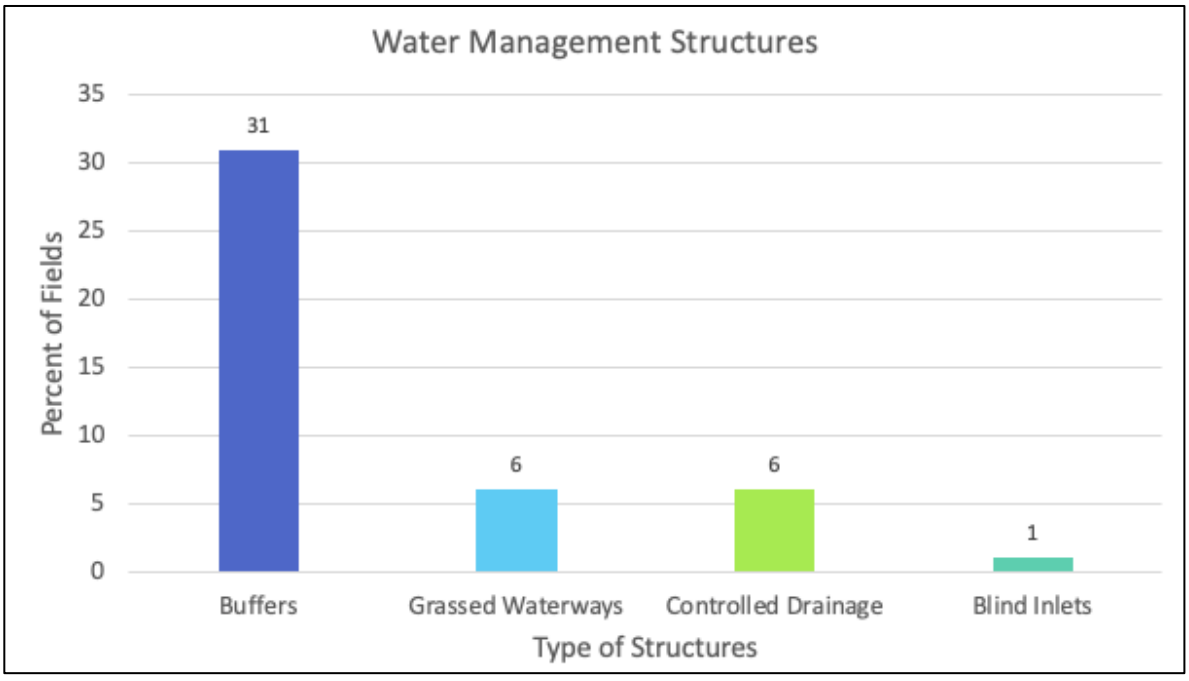


Figure 15. Percent of surveyed fields that had water management structures in-field or at the edge of field

Water Management Practices Examples and Associated Costs

Figure 16. Buffers – $100-$200 per acre

Figure 17. Controlled Drainage – $2,000-$4,000

Figure 18. Grassed Waterways – $4-5 per linear foot

Figure 19. Blind Inlets – $3,000-$4,000

Conclusion

This survey was completed in the first quarter of 2021, prior to the implementation of H2Ohio practices. The assessment results establish a baseline of adoption for various farming practices in the Lower Maumee watershed. This information allows for a more targeted approach to increase best management practice adoption. Demonstrated by data, certain practices are elevated to yield optimal results. We will continue to assess more watersheds around the state in the coming years, revisiting previously assessed watersheds in a few years to determine levels of change. We encourage Ohio's farmers to get involved in the OACI's Farmer Certification program, H2Ohio and any other conservation focused program to learn about new practices, share information and become better stewards of the land.

OACI 2021 Assessment Survey White Paper

This white paper highlights key results and adds contextual information to the Ohio Agriculture Conservation Initiative (OACI) 2021 Assessment Report. The report represents a snapshot of adoption levels of field-level farming practices being used by farmers in the Lower Maumee watershed during the 2020 farming season. Although there are many watersheds in the Western Lake Erie Basin (WLEB), OACI felt the Lower Maumee was important as it is a HUC8 (hydrologic unit code) located entirely in Ohio.

The assessment results serve as a baseline of practice adoption for this watershed and highlight conservation efforts and potential areas for improvement. OACI anticipates using the data from this first-of-its-kind report to show practice adoption trends over time that will enable OACI and partners to create opportunities for a more targeted approach to farmer education, localized programing and helps show neighboring farmers how they compare to their peers.

Assessment Methods

The OACI Assessment Subcommittee created a field-level survey consisting of 30 questions. Assessment surveys were completed in the first quarter of 2021, prior to the implementation of H2Ohio practices and reflecting the 2020 growing season. A minimum of 450 fields, 20 acres in size or larger, would need to be surveyed to represent a statistically valid sample size. The Ohio State University randomly selected farm fields from CAUV lists obtained or each county within the Lower Maumee HUC 8 watershed.

Assessment Background

The assessment was conducted through a randomized sampling of 450 crop production fields within the Lower Maumee watershed, which is contained in portions of Defiance, Fulton, Hancock, Lucas, Putnam and Wood Counties. A statistical approach was implemented to determine what practices are being used by farmers to manage water and nutrients. A trained Soil and Water Conservation District employee interviewed the landowner or farm manager for each field surveyed. The fields surveyed were being managed by farmers with a wide range of operation sizes, ranging from below 500 acres up to 10,000 acres. The average size of the fields surveyed was 48.4 acres.

The Center for Survey Statistics and Methodology at Iowa State University and The Ohio State University helped in designing the sampling strategy and data analysis.

Cost Share Program Enrollment

Approximately 66% of the fields surveyed were currently enrolled in a cost share conservation program, including both state and federal level programs (Figure 2). These programs, such as Ohio's H2Ohio and the United States Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) Environmental Quality Incentives Program (EQIP), allow for farmers to receive financial assistance to

introduce new conservation practices to help improve water quality and nutrient management. Of note, 48% of fields surveyed were enrolled in H2Ohio, confirming that a significant percentage of farmers have already embraced the program, which offers a "Top Ten" list of conservation practices for farmers

to adopt. H2Ohio, and the results of this assessment, indicate farmers will participate in voluntary programs.

Acres Farmed and Ownership Status

Even though the assessment is focused on individual farm field practices, overall farm size is important when trying to understand if scale matters in conservation. Farm size is important in understanding the economies of scale when implementing certain conservation practices. For example, converting to strip tillage in a program can be very costly in smaller operations. OACI tracked the distribution of farm size to reflect adoption as it relates to operational size and to not oversample either small or large farms.

Field ownership status is a key factor in the in-field and edge-of-field decisions a farmer makes throughout the growing season. Farmers are often reluctant to make conservation decisions that require large investments or physical changes to the field without knowing they will be farming the field for a long period of time, and sometimes do not have that authority to make those changes on leased ground. The breakdown between fields owned versus leased was about even, at 48% owned and 52% leased (Figure 3).

Overall, 95% of the fields surveyed were managed by the farmer for 3 years or longer with only 5% being farmed less than 3 years (Figure 4). An encouraging indicator for increased investment in and adoption of conservation practices is the survey result showing that farmers know their land and are committed to their land – whether the land is leased or owned. With the vast majority farming the field for more than 3 years, this indicates that farmers do have a vested interest in their fields and more effort can be made to involve the lessee *and* the landowner in conservation decisions. Anecdotally, many lease agreements are verbally agreed upon which leaves uncertainty around length of lease and the ability to structure the agreement with water and nutrient conservation in mind.

Tillage Type

Tilling a farm field can be a major contributor to soil and nutrient loss. In this study, approximately 50% of the fields had reduced tillage practices including: 33% vertical tillage (shallow tillage of the soil that incorporates residue into the topsoil), 12% no-till (farming with little-to-no soil disturbance) and 5% strip tillage (only disturbs the portion of the soil that contains the seed row) (Figure 5).

Nutrient Management

86% of the fields assessed used commercial fertilizer as their nutrient source with only 12% using manure (Figure 6). This information is crucial to understanding the long-term trends in nutrient sources,

and to discussing the influences agriculture has on water quality. Manure is often the main talking point when discussing nutrients moving off of farm fields, but survey results indicate manure application is used significantly less than commercial fertilizer to supply crops.

Before applying their fertilizer for a new crop year, farmers must know the current level of nutrients in the soil. Soil testing helps farmers determine the level of nutrients in their soil and make decisions about what nutrients need to be applied to achieve an optimal crop. Survey results show that 83% of the fields

are being soil tested at least every three years (Figure 7). The vast majority of soil samples (87%) were being done using precision testing, via grid or zone methods (Figure 8). Only 4% of fields surveyed were being sampled with more than four years elapsing between tests (Figure 7).
For fertilizer recommendations, farmers utilized fertilizer retailers for 66% of fields surveyed and licensed crop consultants on 24% of fields surveyed. Farmers used their own knowledge regarding fertilizer on 9% of fields surveyed (Figure 9). This information indicates a strong partnership with professional resources. A retailer or consultant cannot make an accurate fertilizer recommendation without a recent soil test, which could be a contributing factor for the high soil test adoption.

Nutrient Applications

Approximately 54% of fields surveyed were covered by an approved voluntary nutrient management plan (VNMP) with 44% not covered (Figure 10). These plans were completed either by the farmers' local Soil and Water Conservation District (SWCD) or USDA-NRCS. VNMPs are important tools for taking soil test information and making a multi-year plan on how much nutrients will be applied to the field. The H2Ohio program will most likely increase this number in future assessments as the program requires a VNMP for enrollment.

Assessment respondents also indicated using the Tri-State Fertilizer Recommendations on 98% of the fields surveyed for determining the amount of commercial phosphorus (P) fertilizer to apply. Tri-State Fertilizer Recommendations are a set of guidelines for nutrient management based on field research in Ohio, Indiana and Michigan including over 300 on-farm trials across 41 Ohio counties. The Tri-State Recommendations provide sound guidelines for nutrient management and need updated to keep pace with contemporary practices in Ohio's field crops. Tri-State Recommendations also provide an objective framework for farmers to manage nutrients as judiciously and profitably as possible.

Approximately 89% of phosphorus (P) applied is for a 1-2-year crop need (Figure 11). This data shows farmers are applying only enough phosphorous for 1-2 years and reevaluating their fertilizer application frequently. The assessment indicated 34% of phosphorus applied was surface applied, which can lead to run-off if not incorporated into the soil within a short amount of time (Figure 12).
To determine the amount of nitrogen (N) to apply, farmers used adaptive management strategy on 20% of fields surveyed, Maximum Return to Nitrogen (MRTN) Model (The Ohio State University recommended N tool) on 57% of fields surveyed and weather/soil modeling service on 42% of fields surveyed.

Farmers used N stabilizers on 61% of fields surveyed versus 36% of surveyed fields where N stabilizers were not used. N stabilizers or inhibitors help keep nitrogen in forms that are less likely to leave the field. N stabilizers are widely available to farmers for use with N fertilizers; however, they are not readily available for phosphorus and potassium (K) inorganic fertilizers.

On the fields assessed, injection was the most popular method of nitrogen placement. Methods using a nitrogen starter during planting were also utilized to place the nutrient near the seed, making it accessible to a young root system (Figure 13). Injection placement helps keep nitrogen close to the plant root and makes it less likely to leave the field.

The vast majority of fields surveyed (70%) side-dressed most of their nitrogen in-season which helps with efficient uptake of the nitrogen into the growing corn plant (Figure 14). Side-dressing refers to applying nitrogen into the soil near the corn plant while it is growing

Other Nutrient Management Strategies

Variable Rate Technology (VRT) Application

Variable Rate application is a specific technology that is likely to be used on fields with variability in soil test levels of nutrients. Some fields do not indicate a need for this practice.

VRT allows for nutrient applicators to use grid or zone soil test results to apply just the right amount of nutrients the plant needs in each grid or zone. 40% of fields surveyed had been using variable-rate P application versus 60% using fixed-rate application. Of the fields surveyed, 13% of fields surveyed had been using variable-rate N application versus 87% using fixed-rate application.

Availability of equipment for VRT is another consideration. Of the fields surveyed, 31% of fields have VRT capabilities that exist on farm versus 69% that are through a supplier.

Manure Application (The following represent the 12% of fields surveyed that use manure)

USDA-NRCS 590 standards take into consideration appropriate setbacks and sensitive areas that should not receive manure applications. Of the fields surveyed using manure, 91% were fertilized using appropriate setback distances

Subsurface application means the manure is injected into the soil and stays where it is less likely to leave the field. 20% of fields were using subsurface manure application. Of the fields that received manure, 77% of fields surveyed incorporated the manure mechanically after surface application, which helps keep the manure in place. And 26% of fields surveyed had subsurface manure applied into vegetative cover or an actively growing crop.

Water Management Structures

42% of fields surveyed had a water management structure installed and 9% used multiple water management structures (Figure 15). Water management structures and drainage improvement help to hold water back and minimize soil erosion. In the Lower Maumee watershed, 90% of the fields surveyed had no visible signs of soil erosion.

Conclusion

This survey was completed in the first quarter of 2021, after enrollment began in the H2Ohio program but prior to the implementation of H2Ohio-funded practices. The assessment results establish a baseline of adoption for various farming practices in the Lower Maumee watershed. This information allows for a more targeted approach to increase best management practice adoption. OACI encourages Ohio farmers to get involved in the OACI Farmer Certification program, H2Ohio and other conservation program to learn about new practices, share information and become better stewards of the land. OACI plans to resample this area in the next three years to evaluate changing ado