# Understanding Watershed Impact by Measuring Soil Organic Matter

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## ABSTRACT

Limited data exists that provides a baseline of what percent of organic matter (OM) makes up Ohio's soils. This project was initiated with a grant from the Muskingum Watershed Conservation District to identify one county's OM percentage in row crop soils. Benefits of soil OM include improvement of soil physical condition, water infiltration and aeration, improvement of tilth and soil structure, greater water holding capacity, reductions in soil erosion, pH buffering, and energy supplies for microorganisms (IPNI Soil Fertility Manual 2006). Previous research suggests that a silt loam with one percent OM held 1.9 inches of water per one foot of soil and a soil with three percent OM held 2.9 inches of water per one foot of soil (Hudson 1994). Therefore, if more OM is present in the soil, more water would be held in the soil creating a slower rise of water levels within tributaries of the watershed district. The Muskingum County Extension office provides soil analysis resources to the general public and this grant funded OM analysis that is absent from the standard package. In 129 samples analyzed in this study, 1-2% OM was present in 29% of samples and 2-3% OM was present in 61% of samples. These results provide localized data and context to support the new statewide Fertilizer Applicator Certification Training (FACT) curriculum that is taught annually at the county level by OSU Extension in response to legislation signed into Ohio law in 2014.

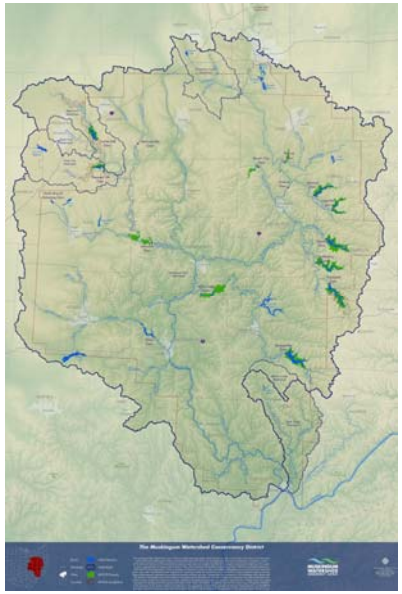

*Figure 1. Muskingum Watershed Conservancy District (used with permission).*

## INTRODUCTION

The role of nutrient management in agriculture is facing increased scrutiny in Ohio with concerns about recent harmful algal blooms in Lake Erie and the Ohio River. Muskingum County sits wholly in the Muskingum River Watershed (Figure 1), along the Muskingum River, which joins the Ohio River in Marietta, Ohio. The goal of this project is to provide a source of information to help county clientele understand the nature of soils in the county and to highlight the importance of preserving OM as a management goal for row crop producers.

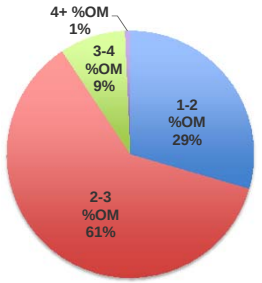


**Figure 2. Distribution of % organic matter values collected in 129 soil samples in Muskingum County in 2014-2015.**

## METHODS

Soil samples were collected by individual producers and brought to the county Extension office. Copies of all soil reports are provided to the Extension office as part of this service by the analyzing laboratory. Results are summarized from these reports.

Educational teaching opportunities are available during the statewide FACT program in the county. Soil nutrient management is highlighted in these programs.

**Table 1. Agronomic values reported in soil test reports including % organic matter in 2014-2015.**

| | %OM | pH | P (M3) | K | CEC |
|---|---|---|---|---|---|
| Average | 2.3 | 6.2 | 33 | 130 | 11.4 |
| Minimum | 1.4 | 4.8 | 2 | 37 | 6.5 |
| Maximum | 4.2 | 7.6 | 182 | 336 | 20.2 |
| Median | 2.2 | 6.2 | 20 | 114 | 11.0 |

## RESULTS

**Organic Matter**

129 soil samples were included in the data analysis. In addition to % OM, phosphorus, pH, and potassium are included to provide additional context to the information (Table 1). Producers declared on the sample paperwork what the intended next three years of cropping were expected to be and this information was used to break down the samples by rotation (Table 2).

- **54% of samples in are in a *no-till* corn soybean rotation.**
- **Corn soybean rotations represent 77% of all samples received.**
- **61% of the samples in this data set reported %OM between 2-3 % (Figure 2).**

**Phosphorous (P)**

- **Reported P levels in this study average 33 ppm (Mehlich 3) with a standard deviation of 38.1 indicating a high degree of variability in the samples.**
- **Values were reported as low as 2 ppm and as high as 182 ppm.**
- **Continuous corn rotations show the highest P levels but further investigation is required to determine actual trends.**

**Table 2. Agronomic values and rotations of 129 soil samples collected in 2014-2015.**

| Rotation | *n* | %OM (Avg) | pH (Avg) | P-M3 (Avg) |
|---|---|---|---|---|
| Continuous Beans | 7 | 1.9 | 5.7 | 35.1 |
| Continuous Corn | 7 | 1.7 | 5.6 | 80.6 |
| Corn/Beans | 34 | 2.2 | 6.3 | 21.3 |
| Corn/Beans (No Till) | 65 | 2.3 | 6.3 | 31.6 |
| Corn/Beans/ Wheat | 2 | 2.4 | 5.8 | 19.0 |
| Continuous Corn (No-till) | 5 | 2.4 | 6.0 | 98.4 |
| Other | 9 | 2.6 | 6.3 | 18.2 |
| Total | 129 | 2.3 | 6.2 | 33.2 |

Limitations

The results are derived from records received from the soil analysis laboratory. There are no controls to ensure the sampling method was uniform at all sites but best practice recommendations are provided by the Extension Office to the producer. Additionally, no controls are present to manage the geographic distribution of sample sites across the county or to specify soil type.

## IMPACT

Senate Bill 150 was passed in the state of Ohio in 2014 and set guidelines for FACT for producers including the responsibility of instruction through OSU Extension. This provides a direct contact opportunity to share this information. In the first year of the program, 65 producers were present and in the second year of the program 43 producers attended training. Additional producers are expected in 2017. The teaching cycle for FACT is three years.

- **Initially, FACT provides direct contact to an estimated 158 applicators in Muskingum County**.
- **Muskingum County contributes 35,700 acres of row cropland to the watershed.**

During FACT training, four best management practices are highlighted for phosphorus management including minimizing erosion, slowing the movement of water, knowing each field's risk, and striving to build soil quality. Preserving organic matter supports each of these four areas.

## CONCLUSIONS

There is an opportunity to focus on increasing soil organic matter in Muskingum County and this may be used as one tool to help address regional surface water quality issues. Assuming it takes one year to raise organic matter percent 0.1-0.2%, it would take up to 10 years to increase an average value from 2.3% OM to 3.3% organic matter. This further supports the need for producers to be conscious of soil management to preserve the organic matter that is currently in place. There are increasing opportunities for Extension professionals to focus on topics that support nutrient management and water quality in Ohio.

## BIBLIOGRAPHY

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## ACKNOWLEDGEMENTS

- *Funding for this project was provided by the Muskingum Watershed Conservancy District, New Philadelphia, OH*
- *Soil sample analysis was provided by the Agricultural Analytical Services Laboratory, University Park, PA*
- *The authors recognize Daniel Lima (OSU Extension) and Jim Hoorman (OSU Extension) for their efforts in coordinating poster submission.*

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