Soil Testing and Nutrient Application Practices of Ohio Agronomy Retailers

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Abstract

A survey of agricultural retailers was undertaken to provide a benchmark of current practice adoption of soil sampling, type of spatial sampling, placement and timing of nutrient application currently being used in Ohio's two major watersheds. The responding retailers provided services on 3.8 million acres representing 39% of Ohio's row crop and hay production acres with 1,920,450 in Lake Erie Watershed while 1,910,050 acres were in the Ohio River Watershed. Eighty two percent of the soil sampled was done according to methods that meet or exceed university recommendations. The Lake Erie Acreage Weighted Average (AWA) reported 74 % and the Ohio River AWA 90% of the acreage being soil sampled according to methods that meet or exceed recommendations. Farmers in the Lake Erie basin are more likely to surface broadcast phosphorus with no tillage done (36%) than those in the Ohio River basin (23%). Incorporation with a planter as starter fertilizer accounts for 30-33% of the applied phosphorus regardless of geography. For all of Ohio AWA most fertilizer is applied in the Fall (September –November) and Spring (March-May) accounting for 77% of phosphorus application. The two watersheds are similar in the Fall application but the Winter period application is higher, 21% in the Ohio River Watershed than 8% in Lake Erie Watershed. Spring application is lower in the Ohio River Watershed at 27% compared to 41% in the Lake Erie watershed.

Introduction

The level of adoption of agronomic Best Management Practices such as soil testing, nutrient incorporation and timing of application have come under scrutiny with increased incidence of cyanobacteria that can result in Harmful Algae Blooms (HAB) outbreaks in Ohio lakes (Bridgeman, 2012). HAB can produce toxins which include neurotoxins, heptatoxins, endocrine toxins or tumor promoters that can be harmful to people, fish and animals resulting in health advisories (Ohio Sea Grant, 2010). Lake Erie, Grand Lake St. Mary's and other smaller inland lakes have had advisories posted, limiting recreation use and resulted in increased treatment cost to municipalities where surface water is used as a raw water source in recent years (Ohio EPA, 2013). One of the triggers for cyanobacteria proliferation in fresh water is associated with phosphorus enriched waters.

The Lake Erie Watershed has the highest level and longest history of continuous monitoring in the state thus serves as a situational example. The 2011 water year resulted in HAB blooms that met or exceeded historical precedence in this major water body for the state (International Joint Commission, 2013). Recent trends in water sampling in Lake Erie Watershed have shown an increase in the Dissolved Reactive Phosphorus (DRP) percentage in water samples while Total P has been fairly stable (Heidelberg University, 2010). DRP has the consequence of a higher bioavailability of nearly 100% compared to approximately 26% bioavailability for Total P bound to sediment. Non-point sources have been suggested as the major contributor to increased DRP loading (Ohio Phosphorus Task Force, 2010). Agriculture is the largest land use in the Lake Erie basin and has come under scrutiny for management practices leading to increased level of phosphorus. (Ohio Lake Erie Task Force Final Report, 2013).

Historically, improvement in Lake Erie water quality from the 1970's through 1990's resulted from management of point sources of phosphorus, including sewer and industrial sources, through changes in treatment and reducing source water concentration entering treatment by reduced phosphorus containing detergents. Agriculture contributed to reduction of non-point sources by adoption of soil conserving tillage practices that reduced total P loading. (Jeanerette, 1989). During the period 1998 to 2005 total phosphorus loading from non-point sources into Lake Erie were estimated to account for 60.8 percent of the total load (Ohio EPA, 2010). A review of Ohio soil test P values as measured by soil testing laboratories from 2005 to 2010 indicated that 42% of the samples were below the critical soil test level and that soil test levels for P had declined 1 ppm (Fixen et al, 2010). Agricultural land use is high in the basin with 59% of Ohio's Lake Erie area under cultivated agricultural land. In the western basin area of the watershed, the agricultural land use percentage approaches 72%. Thus water quality improvements via reductions in non-point source loading of phosphorus have being targeted in current discussions with agriculture being a focus land use due to the use area percentage and utilization of phosphorus fertilizer to maintain productivity.

A survey of agricultural retailers was undertaken to provide a benchmark of current practice adoption being used in Ohio's two major watersheds. The target population for the survey was Ohio Agriculture Retailers supplying fertilizer and chemical inputs to farmers. These businesses have a significant influence over fertilizer supply availability and agronomic recommendations. Objectives of the study included determining frequency of soil testing over spatial method and

understanding phosphorus application timing, method and incorporation as reported by agricultural retailers of their farm customers.

A direct mail survey related soil testing practices and nutrient application was sent to 250 members of the Ohio Agribusiness Association (OABA) mailing list in March, 2013. OABA estimated that 95% of agricultural retailers who provide these services are members. The member mailing list included agricultural retailers in the state of Ohio who supply fertilizer for crop production and provide services such as soil testing, nutrient recommendations and application either through rental equipment or custom fertilizer application services. The survey was approved by The Ohio State University Institutional Review Board, Protocol Number 2013E0116.

A total of 100 surveys were returned for a response rate of 40%. Of the returned surveys, 55% offered soil testing services to their clientele. Of the 55 businesses responding, 52 supplied fertilizers as part of their business activity for customers. The average retailer size was 76,235 acres.

The survey reported total acres serviced, what percentage of their service area was in each of the Ohio's two major watersheds, Lake Erie and the Ohio River and percentage of adoption of various practices totaling to 100 percent. This allowed summarization of practices as simple averages and Acreage Weighted Averages (AWA) by Watershed or combination.

Results and Discussion

The responding retailers provided services on 3.8 million acres of crop production. The number of acres serviced in Lake Erie Watershed was 1,920,450 while 1,910,050 acres were in the Ohio River Watershed. The total acreage of corn, soybean, wheat and hay production in the state for 2012 was 9.64 million acres (NASS, 2012). The responding businesses represented 39% of the state's crop producing acres.

An objective of the survey was to determine, "Are Ohio farmers utilizing soil test in nutrient recommendations"? University soil testing recommendations in Ohio suggest sampling in relatively uniform areas no more than 25 acres in size with a time between sampling of no more than 4 years (Vitosch, 1995). Figure 1 highlights survey responses to the question on soil sampling intensity and spatial representation method. Result show that 82% of the "All Ohio AWA" was soil sampled according to methods that meet or exceed university recommendations. This is comparable to previously reported results of 91% soil testing by recommended practices in Ohio (Hoorman, 2013). Results of a survey of Western Lake Erie Basin producers reported 14.7% of responding farmers never soil sampled (Wilson, 2012).

Differences in soil testing intensity and type over the two watersheds are noted. The Lake Erie AWA reported 74 % and the Ohio River AWA 90% of the acreage being soil sampled according to methods that meet or exceed recommendations. Differences between the watersheds were reported for sampling of areas over 25 acres with 17% in the Lake Erie Watershed and 6% in the Ohio. Utilization of grid and zone sampling is higher in the Ohio River Watershed with 68% of the acres sampled in this way compared to 31% in the Lake Erie Watershed. It is not surprising to see the regional differences in soil testing due to the soil formation differences in Lake Erie

Watershed area compared the Ohio River. The Western Lake Erie Watershed is predominant by Erie-Huron Lake Plain which is nearly level glacial plain with a few scattered ridges of sandy soils that represent past shorelines and moraines (NRCS, 2006). The major crop producing area of the Ohio River basin is Indiana Ohio Till Plain dominated by broad nearly level ground moraines that are broken in some areas by kames, outwash plains and stream valleys with relief of a few meters (NRCS, 2006).

Timing and placement of nutrient applications has been discussed as a potential cause of increased DRP loading with alternatives for timing and placement as a solution (Bruulsema, 2012). Several studies suggested that surface applications of nutrient lead to increased exposure of nutrient to surface runoff or preferential flow through tile, especially where rainfall occurs shortly after application (Allen, 2008; Daverede, 2004; Kaisera, 2009; Sharpley, 2001; Tabbara, 2003). Figure 2 summarizes results of placement in relation to incorporation of nutrient via tillage, strip till units or planters. Results suggest that farmers in the Lake Erie basin are more likely to surface broadcast phosphorus with no tillage done (36%) than those in the Ohio River basin (23%). Incorporation with a planter as starter fertilizer accounts for 30-33% of the applied phosphorus regardless of geography. Incorporation with strip tillage is also similar for all geographies but accounts for only 3-4% of the applied phosphorus.

Winter application of nutrients on frozen or snow covered ground can be high risk for loss depending on thaw conditions. Application timing in relation to calendar year timing is broken out in Figure 3. For all of Ohio AWA most fertilizer is applied in the Fall (September – November) and Spring (March-May) accounting for 77% of phosphorus application. The two

watersheds are similar in the Fall application but the Winter period application is higher, 21% in the Ohio River Watershed than 8% in Lake Erie Watershed. Spring application is lower in the Ohio River Watershed at 27% compared to 41% in the Lake Erie watershed.

Figure 4 shows very little difference with 74-79% between watersheds where retailers take soil test and make rate recommendations. Farmers provide the fertilizer recommendation in the remaining instances.

Variable rate application of fertilizer is a practice that should result in better targeting of nutrients in the field. The adaptation of variable rate application is 45% for the All Ohio AWA. Difference do appear in the in the Watersheds with 55% in the Ohio River AWA and 33% in the Lake Erie AWA.

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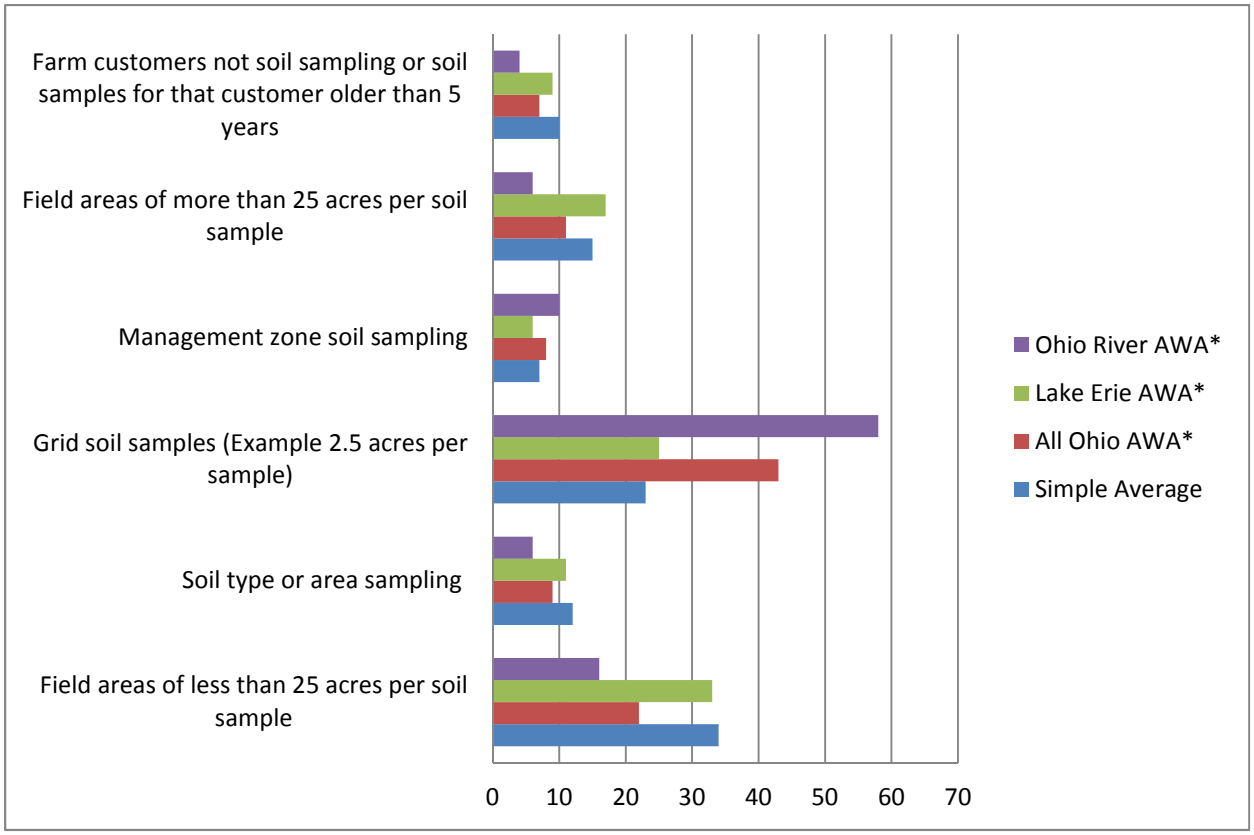
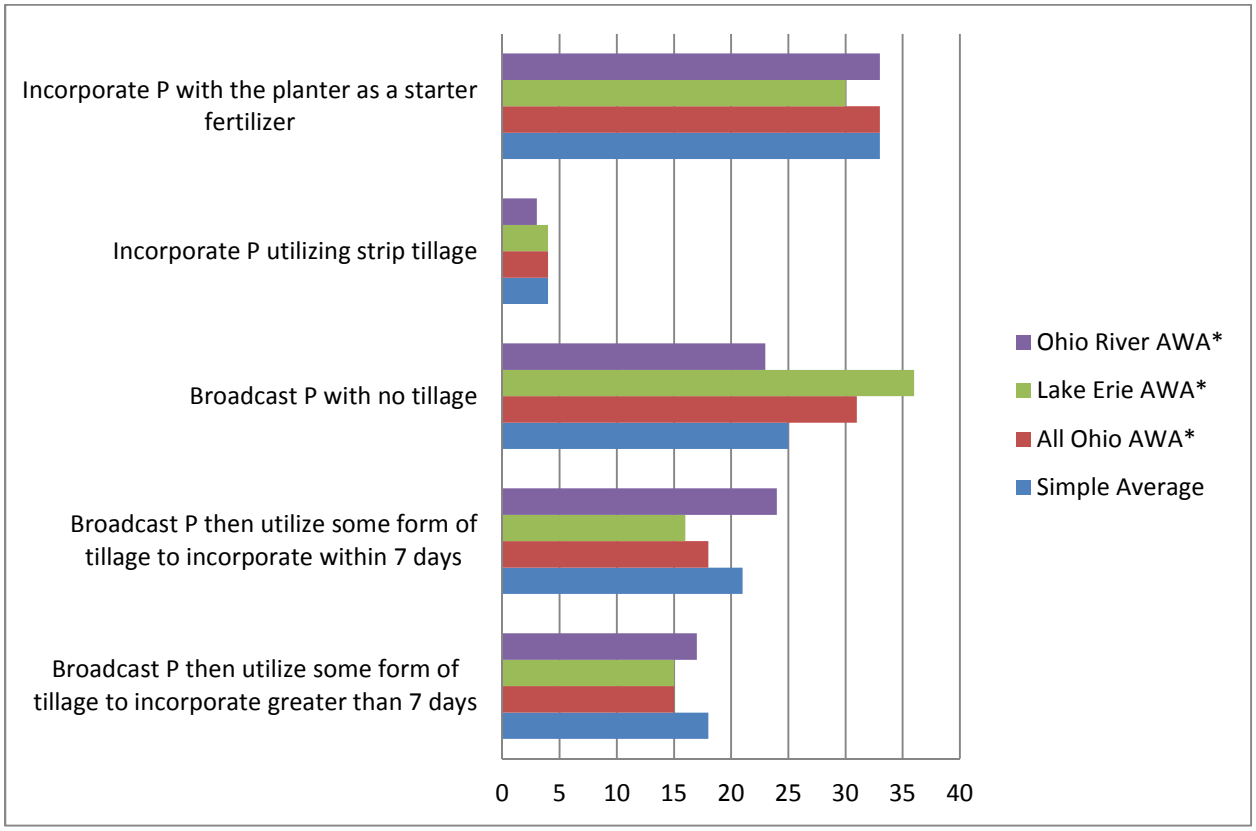
Figure 1. Soil Sample Methods by Region and Type (March, 2013).



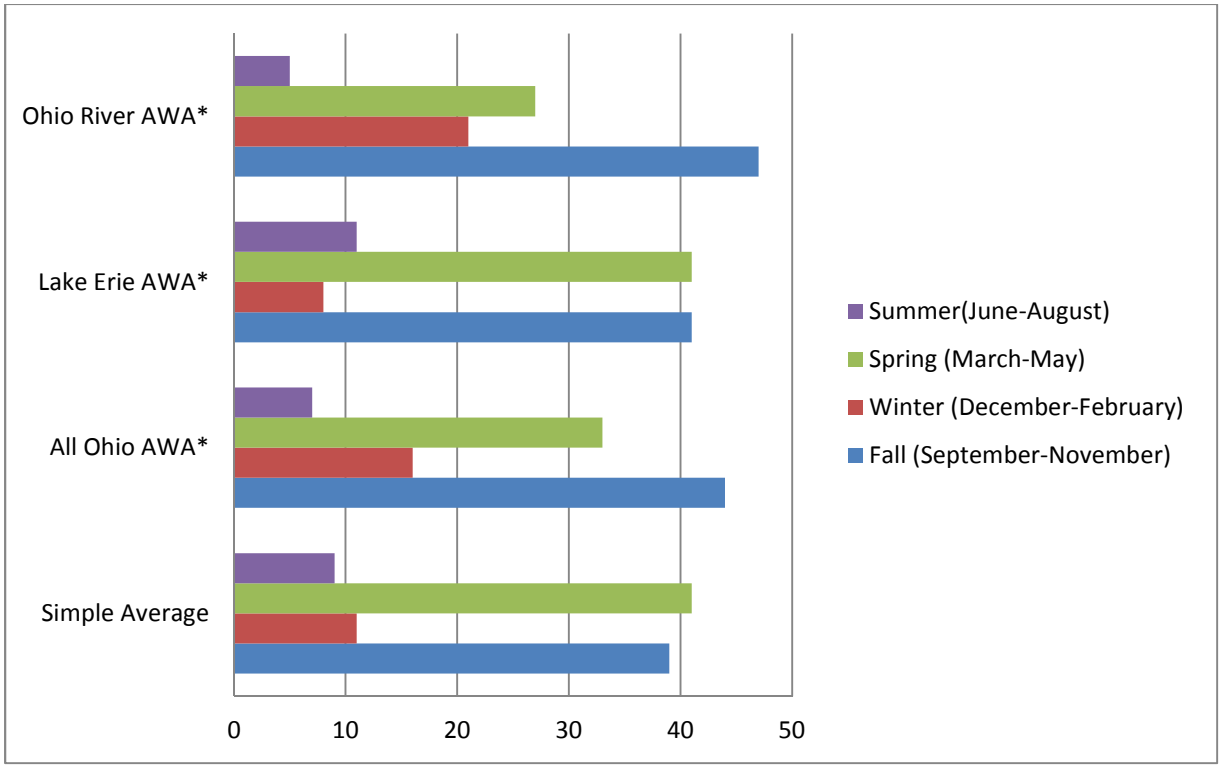
*Acreage Weighted Average (AWA)

Figure 2. Estimate of method of application, placement and tillage of phosphorus fertilizer (March, 2013).



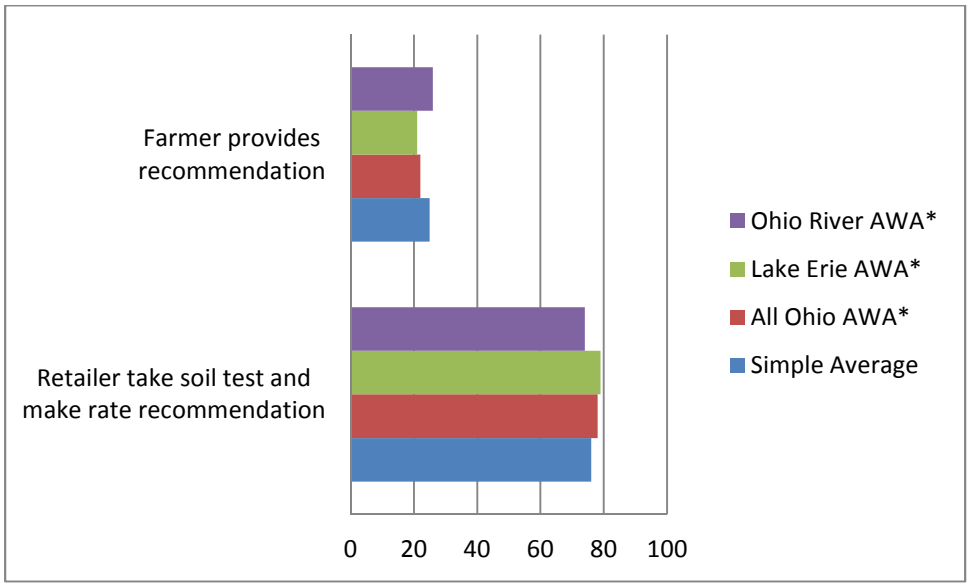
*Acreage Weighted Average (AWA)

Figure 3. Seasonal timing of phosphorus fertilizer application (March, 2013).



*Acreage Weighted Average (AWA)

Figure 4. Estimate of source of recommendations for acres Ohio Retail Fertilizer supply P and K product (March, 2013).



*Acreage Weighted Average (AWA)