Agricultural Environmental Issues: Past, Present, and Future

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Abstract

Agriculture is the world's main source of food and fiber to ensure the sustainability of humans and animals on this planet. Agriculture land is shrinking because of the constant increase in population and urbanization, which drives the excessive use of agrochemicals to meet the populations food demands. Excessive use of agrochemicals poses a serious threat to the environment in terms of subsurface/groundwater leaching, nutrient runoff to water bodies, greenhouse gas emissions, and volatilization. This study evaluates the impact of agricultural practice on environmental risks in Eastern Canada. Furthermore, this study will suggest more sustainable and environmental options for food production all while reviewing the agricultural management practices to quantify the environmental issues. Additionally, we will examine the potential of using precision agricultural technologies to mitigate these environmental threats. Detailed results will be presented at the conference.

Key Words: Greenhouse Gas Emissions, Subsurface Leaching, Sustainability, Nutrient Runoff, and Precision Agriculture

Recommendations

In order to achieve more sustainable and environmentally friendly options for food production, precision agriculture can be very helpful. Some recommendations would include:

Implementation of Variable Rate Applicators

Variable rate applicators (map/sensor based) can encounter spatial variations to apply agrochemicals on an as-needed basis (Fig. 1). Site-specific application of agrochemicals can lower the environmental issue (GHGs, nutrient runoff, volatilization, and sub-surface leaching). This implementation of variable rate technologies has a great potential of achieving sustainable food production.

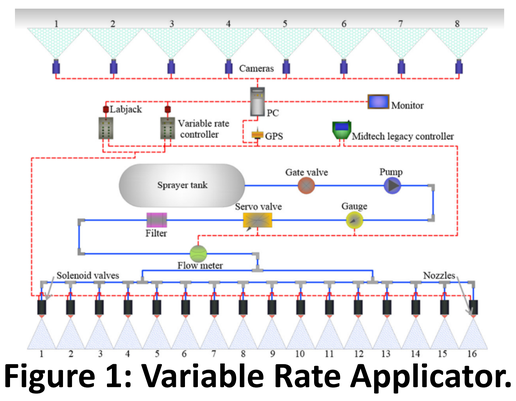

Figure 1: Variable Rate Applicator.

Complimentary Crops

This strategy would keep the soil covered with growing crops to aid in the prevention of inputs such as pesticides and fertilizers to become more sustainable [5].

Figure 2: Potato Crop in O'Leary, PE

Environmental Issues

Subsurface/Groundwater Leaching

The subsurface of fields is considered to be the area near the depth of the roots of the crop, where regular drainage occurs either naturally or by constructed channels to remove water from these low-lying wet areas. The concerns of this towards the environment consists of water contamination from salts, pathogens, pesticides, and nutrients that can all affect nearby water sources. In order to monitor these contamination levels site specific data collection was recommended by Alberta Agriculture and Forestry for their specific cases [1]. Site specific data collection is important due to the varying homogeneity of the soils.

Nutrient Runoff to Water Bodies

Nutrient runoff is the result of high levels of nutrients such as nitrogen and phosphate from fertilizers making their way towards rivers, streams, lakes, and estuaries. This runoff often results in the pollution of these bodies of water as well as eutrophication and algal blooms to begin as a product of the event [2]. The high nitrogen levels can result in the contamination of potable water sources, whereas, high phosphate levels aid in the development of algal blooming.

Figure 3: Algal Blooms in Lake Erie in 2014

Greenhouse Gas Emissions

Greenhouse gas emissions most commonly come from natural or synthetic fertilizers in the form of methane and nitrous oxide where some emissions of course are contributed from fuels used to power farm equipment. The fertilizers are however the larger contributors in this equation where in the year 2011 agriculture contributed to 13% of the worlds greenhouse gas emissions [3].

Volatilization

Volatilization favors conditions with high soil temperatures, windy with high soil pH (>7.5), coarse texture, and low organic matter. All of these conditions contribute to volatilization which is the loss of gaseous nitrogen due to the reaction of urea with the soil moisture resulting in the product of ammonia [4].

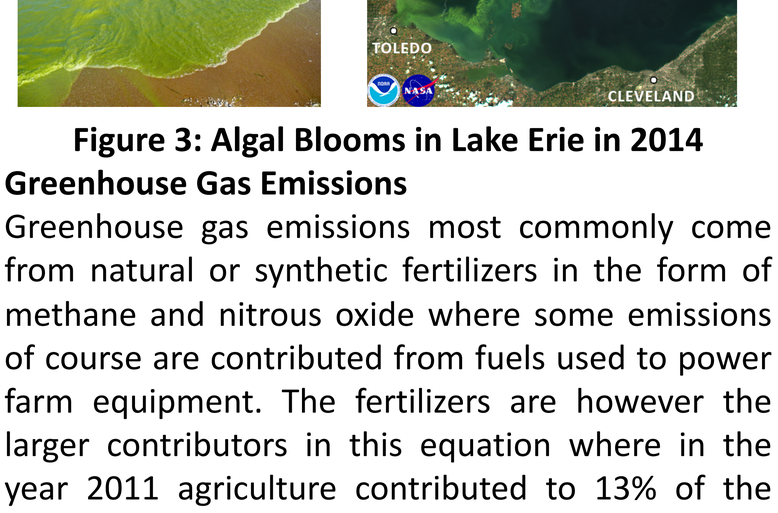

Figure 4: Environmental Issues - Agriculture.

Perspective of Issues

Past

When the time of the agricultural revolution was in full swing there was little to no concern for environmental issues.

Present

Technology has increased the productivity of agriculture exponentially. These technologies have had both positive and negative impacts. Some positive impacts are the increasing yield portions to provide for the rising population as well as the production of fibers that can now be harvested. However, agrochemicals have been resorted to in order to supply for our population which is causing the outbreak of new issues as previously discussed.

Future

The future is the point where changes will need to be made in order to mitigate any damage that has done already. This is where precision agriculture (PA) is expected to thrive. PA can be visualized by the following three step process.

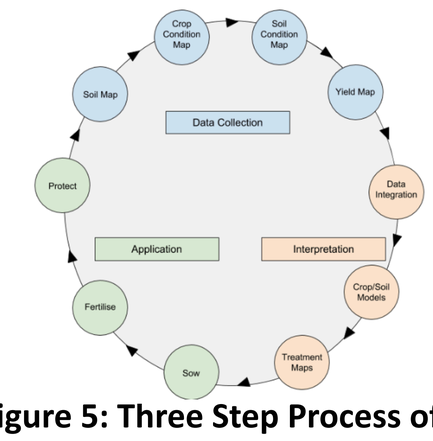

Figure 5: Three Step Process of PA.

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