# Measurement of GHG Footprint; Organic vs Synthetic Fertilizer Industry: Agriculture

## 1 BACKGROUND

The invention of petro-based Synthetic Nitrogen Fertilizer (Synthetic Fertilizer) is considered to be one of the most important inventions of the 20th century as it has allowed farmers to significantly increase crop yields for feeding an ever-increasing global population.

However, as with participants in all other key sectors, the stakeholders of agriculture are faced with the challenge of reducing environmental impact which is directly affecting our climate, while continuing to meet an ever-growing demand for their produce.

Globally, agriculture is estimated to be the second-largest source of climate change related emissions and the production and application of synthetic fertilizers contributes significantly to Greenhouse Gas (GHG) emissions which in turn takes a heavy toll on our environment.

How does Synthetic Fertilizer contribute to climate change?

- Manufacturing Synthetic Fertilizer requires energy-intensive processes that use significant amounts of fossil fuels for conversion of raw materials into fertilizer.
- Anhydrous ammonia, an effective fertilizer, is the second-most produced chemical and its production alone contributes to roughly 2% of worldwide $CO_2$ emissions.
- The application to soil of Synthetic Fertilizers also produces GHGs because plants absorb only half of the nitrogen and the rest eventually contaminates waterways in the form of “run-off”. One of the by-products thus produced is Nitrous Oxide which is a toxic GHG and is 300 times more deadly than CO2, and greatly damages the ozone layer as it traps the heat in the atmosphere.
- There are 2500 Gigatons of carbon captured in the earth’s soil which is three times the amount of carbon in the atmosphere. According to the Rodale Institute, we could sequester 100% of current CO2 emissions by switching to regenerative farming practices.
- In addition, Synthetic Fertilizer has been linked to the deterioration of soil health by depleting organic matter and biodiversity.
- Finally, fertilizer is voluminous and required in large quantities across the globe and transporting fertilizer also contributes to an increasing GHG footprint.

The agriculture industry is under increasing pressure to mitigate its impact on climate change by reducing its use of Synthetic Fertilizers, however, they are challenged with the lack of tools to help them measure GHG reduction when available substitutes such as Organic Fertilizers and alternate processes are used.

The benefits of implementing a technology that can compare the GHG footprint of Organic Fertilizers Vs Synthetic Fertilizers include, but are not limited to:

- Economic
    - Farmers can charge a premium for their crops using organic fertilizers
    - Farmers can offset their emissions and earn carbon credits which can be monetized

- Environmental analysis
    - Reduction of nitrous oxide escaping into the atmosphere
    - Decrease in soil pollution and organic matter deterioration
    - Managing run-off into the waterways which results in water contamination

- GHG monitoring helps stakeholders understand their exposure to GHG-related risks
    - Identifying emissions reduction opportunities
    - Creating baseline data and reduction targets for tracking performance
    - Communicating with stakeholders including regulatory, customers and general public

## 2 Current Solutions

There are a few online carbon calculators that were developed to measure carbon emissions related to agriculture, however, there are no known technologies or tools that can accurately calculate the GHG footprint related to the use of different kinds of Synthetic and non-Synthetic fertilizers.

The USDA has developed a tool called ET-FARM™ that estimates carbon stored in soil but that's only one part of the measurement equation.

As well, there are known technologies that measure the amount of carbon in the soil using sensors, however, they do not specifically measure or calculate the GHG footprint of the use of fertilizers.

The tools that are currently available are restricted in what they are capable of measuring along with other limitations including complexity of use and accessibility to all in the farming trade.

## 3 Pain Points

Farmers are hesitant to adopt new tools and technologies if they are very expensive with a low ROI, require extensive training or when they lack proper after sales support from the supplier or manufacturer. Therefore, the technology we are seeking must be easily accessible and affordable with the required infrastructure for training and after sales support in place.

The current tools are either very complex to use, accessible for a limited number of stakeholders, or they do not have the required capability to measure and compare the GHG footprint of using Organic Vs Synthetic Fertilizers.

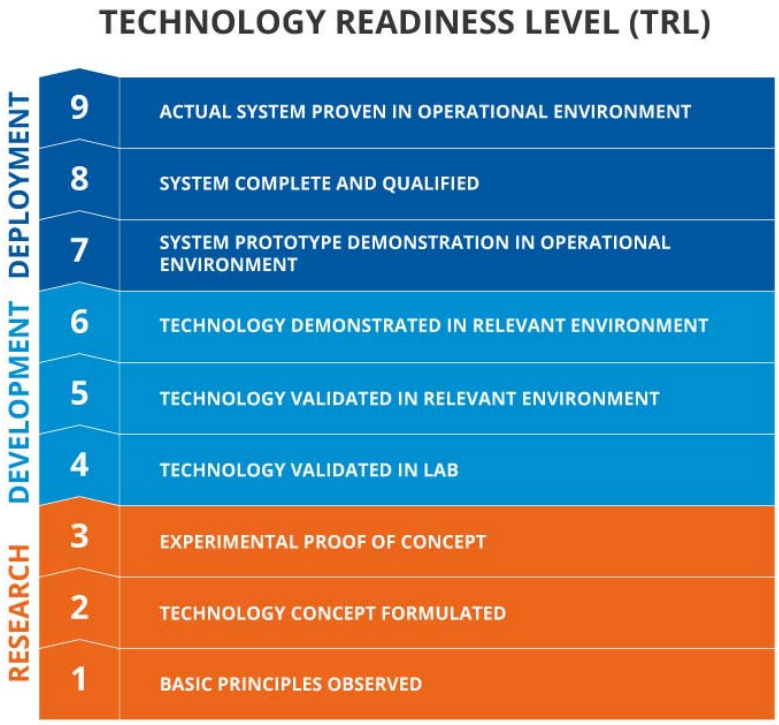
Farms are under economic pressure as they are threatened with labor shortages, and rising input cost and therefore skeptical of adopting new technologies as they are uncertain of the ROI. Therefore, any new technologies introduced must be economical or demonstrate ROI.

## 4 Desired Outcome

We are seeking new age transformational methods and technologies to monitor and measure the GHG impact of various types of Synthetic and Organic Fertilizer applications. This will enable the end user to accurately assess the reduction in GHGs when new and better fertilizer technologies and compositions are used.

In addition, such Solutions should address the typical pain points stated above and be seen a facilitator for farm operators to reduce their GHG footprint and help them progress to net zero in conjunction with other initiatives.

We are seeking solutions that are at a minimum Technology Readiness Level (TRL) of 6 as per the grid provided below:




Specific requirements for this Challenge include:

- Technology must be validated on farms, greenhouses and/or vertical farms
- Considerations need to be made for indoor and outdoor growing
- Cloud-based technology which can be accessed via internet or mobile app. is preferred.
- Ability to report in both Imperial and Metric units
- Any intellectual property & technology must be in public domain, owned by the submitter or the submitter should be sufficiently licensed to use the same

The Solution offered must be able to measure at minimum the below GHG's and their impact:

- Carbon dioxide ($CO_2$)
- Nitrous oxide ($N_2O$)
- Methane ($CH_4$)

## 5 Platform Story

Concerned about climate change and the devastating environmental and subsequently economic impact it is having on Canada, a group of entrepreneurial Canadians decided to pool in their qualifications, experiences and resources to launch get2net0.

Get2net0 recognizes the incredible amount of effort required for Canada and Canadians to achieve their Net-Zero aspirations and recognizes the opportunity for Canada to emerge as a global leader and role model in showing the way to other nations. In turn get2net0 will expand its outreach globally.

To support this effort get2net0 is launching a simplistic yet effective portal which to begin with allows enterprises or “Challenge Sponsors” to throw challenges on any topic related to achieving reduced or capturing greenhouse gas emissions, including but not limited to, early-stage planning, developing roadmaps, technology solutions, logistics solutions, process or chemistry. Challenges can also be on the topic of adaptation to and prevention of catastrophic events which have now become common place. Once a challenge is posted, individuals and teams from around the globe compete to provide the best solutions. For the solution providers whether they be students working in teams, think-tank participants, start-ups or off-the-shelf solution providers, these Challenges will provide opportunities to showcase their capabilities and in return be rewarded for their ingenuity.

In celebration of the launch of this one-of-a-kind platform, get2net0 is Sponsoring 3 diverse Challenges in covering the sectors of Energy, Agriculture and Technology, all with the purpose of finding Solutions that will help mitigate the Greenhouse Gas (GHG) footprint in those respective sectors.

## 6 Reward and Recognition offered

Monetary: Reward for the top Solution submission will be C$5,000. The rewarded Solution will be considered for further discussion.

Recognition: With the consent of the Solution Submitters, the winning Solution will be featured in online forums and the success shared with the Get2Net0 network. In addition, as mutually agreed on, introduction to professional networks, business development assistance and access to public and private funding could be provided.

## 7 Challenge Rules & Regulations including Intellectual Property

In providing your Solution you agree to the Challenge Participation Rules

## 8 Guide to Providing a complete Solution and the scoring Rubrics