

World Soil Day 2021

Fertilizer Canada and the Soil Conservation Council of Canada (SCCC) have teamed up in an effort to promote the awareness and visibility of World Soil Day! With the increased demand for sustainable environmental practices across the agricultural sector, World Soil Day marks an important day for the industry. According to Plant Nutrition Canada's (PNC) Chief Scientist, Dr. Tom Bruulsema, "a healthy soil is one that is productive"! It is clear that the public and private sectors must continue working together to take action and protect the soils that provide for Canadians each growing season!

Since its adoption in 2014, World Soil Day has been endorsed by the Food and Agriculture Organization (FAO) every 5th of December. This is a means to focus attention on the importance of healthy soil and advocate for the sustainable management of soil resources. This year's campaign aims to raise awareness on the importance of maintaining healthy ecosystems and human well-being by addressing the growing challenges in soil management, fighting soil salinization, increasing soil awareness, and encouraging societies to improve soil health!

When it comes to soil health and the fertilizer industry, Dr. Tom Bruulsema, a highly respected professional in the agricultural sector, has a lot to say. We spoke with Tom to get his perspective on why soil health and the uptake of 4R Nutrient Stewardship (Right Source @ the Right Rate, Right Time, and Right Place®) should be matters of national importance. We also wanted to explore why the general Canadian public should be advocating for soil health and conservation alongside the agricultural sector.

In this Q&A, we look at what soil health means to Tom. We also dive into some questions about how soil health and conservation relate to sustainable and regenerative agriculture, what actions can be taken to address the barriers currently observed in soil health practices, the value of the fertilizer industry and 4R Nutrient Stewardship, and lastly, where he wants to see soil health and the 4Rs in the future.



Dr. Tom Bruulsema, Chief Scientist, Plant Nutrition Canada (PNC)

What does soil health mean to you? How does this view relate to sustainable and regenerative agriculture?

A healthy soil is one that is productive! To be productive, it needs to support healthy plant growth. Using the term "health" implies that soil has not only physical and chemical properties but biological as well

because the soil is full of communities of organisms ranging in scale from microbes like bacteria and fungi to mites, nematodes and earthworms.

Soil health is important to sustainable and regenerative agriculture because it synergizes well with crop production. Life in the soil depends on plants as primary producers, and the development of soil health is enhanced by the growth of plants.

Producers are expressing an increased interest in soil health practices (frequent soil health testing, cover cropping, intercropping, application of organic amendments [manure, compost, biosolids], longer and more diverse rotations, zero till, etc.).

Yet, across Canada, many of these practices are not widely adopted. What do you view as the primary barrier(s) preventing producers from adopting soil health and conservation practices?

Each farm differs in opportunities to work on improving soil health. For those in short growing seasons, cover crops may have little opportunity to grow, absorb nutrients, and to contribute carbon to the soil. Some farms are far from any manure supplies, compost or biosolids, and such organic materials are bulky and costly to transport.

Soil health testing is also a fairly complex practice. When we test for fertility, we are looking for very specific nutrients. If we discover shortages, it's much easier to know what to do in an actionable sense. Though soil health testing provides a lot of data, not all of it is actionable, as there are deficiencies in soil health measurements that, in turn, make it difficult to know what next steps are required. This can include deficiencies in organic matter, penetration resistance in the soil, and bulk density.

Management of cropping systems that include conservation tillage, cover crops and intercropping is more complex, and it is more challenging to respond to variations in weather and market signals in such systems. This, in turn, leads to a plethora of decisions that farmers must make under a lot of variabilities.

What actions could be taken to address these barriers? This could be on behalf of the government, industry professionals, organizations (SCCC, Fertilizer Canada, NGOs), researchers, etc.

There is a diversity of challenges and actions that are representative of these barriers. One of the items that can help the growers the most are digital decision-making tools that tap into past and current weather data and forecast probabilities. If we want to time the nutrients and apply the right amount for the respective crops, we have to be in touch with the weather and with the evolving yield potential for each of the crops. This can be helpful in making decisions on when to seed and when to terminate for optimum performance of the crop rotation. Investing in these types of opportunities to develop digital decision-making tools can be instrumental for growers.

There are also opportunities to develop technologies that make organic sources of nutrients from recycled sources more accessible and transportable. These organic sources can be made into forms that are easily blended with fertilizers, and that can be more readily available for use under 4R Nutrient Stewardship.

You published a paper measuring soil microbial nitrogen, carbon, and carbon isotope ratio. Has your view on the role of soil microbes in soil health changed since then (1996), and if so, why?

We discovered that the turnover rate of carbon in what we call the "microbial biomass" is really quite slow, perhaps 20 percent per year. That's a lot slower than the growth-death cycle of bacteria on a petri dish in the lab. So, a lot of what is measured as microbial biomass in the soil is not all that active and is possibly often in some kind of resting phase. Our hypotheses were that variations in the amount of nitrogen contained in the microbial biomass might result in either competition with or contribution to the crop's needs. What we found was little variation through the growing season.

Since that time, there have been remarkable advances in the science of molecular biology allowing for the study of specific microbial genes encoding for specific enzymes catalyzing important transformations of nitrogen in the soil. But the complexity of microbial community dynamics makes it hard to prescribe practices that might, for example, reduce nitrification

rates or denitrification or emissions of nitrous oxides. But these are real possibilities for the future.

Throughout your time as a professional in the agricultural sector, have you been able to observe the value of the fertilizer industry and the practices and technology it has adopted to positively impact soil health in Canada?

The fertilizer industry's main impact has been to build and maintain the fertility of agricultural soils. Had it not been for fertilizer inputs to replace and replenish the nutrients removed by crop harvest, Canada's soils would not be supporting plant growth as well as they are now. At times, fertilizer has actually been seen to build-up the soil fertility in fertility-poor soils. Thanks to fertilizer, crops have been able to grow actively, and when they grow actively, they are able to contribute more carbon to the soil. Farmers have also adapted to the demands of conservation cropping systems, using planters and application equipment that places nutrients into the soil where they are available to plants.

Do you see 4R Nutrient Stewardship (Right Source @ the Right Rate, Right Time, and Right Place®) as a viable contribution to environmental sustainability in Canada? Why?

Yes! It's exactly that, a viable contribution. It's focused on all four components of nutrient application: source, rate, time and place. All four are equally important, not only for ensuring the maximum use by the crop but also for minimizing losses that might harm the environment. But it is only a contribution. Environmental sustainability also depends on a holistic system of good practices for managing crops, weeds, insects and diseases as well. We can increase nutrient use efficiency to a certain degree using 4R Nutrient Stewardship, but if we are not managing crops to their maximum yield potentials, we will fall short on nutrient use efficiencies as well.

Of course, you are already aware of the evidence-based research that has proven the benefits available from the adoption of the 4Rs as an integrated on-farm management practice.

If you were to look 10 years into the future, where would you like to see Canada with respect to 4R Nutrient Stewardship? For instance, do you expect to see it officially recognized by the Canadian government? Do you hope to see more universities teaching this in agricultural and environmental studies? Do you think more acres of land will be covered under 4R Nutrient Stewardship?

First and foremost, sustainability is a collaborative effort. That is something we have learned over the years with 4R Nutrient Stewardship. Especially in the Lake Erie Watershed program, there was vast collaboration needed between government agencies and environmental NGOs. This type of collaboration is needed to gain national recognition. It [recognition] builds slowly. It is not a unilateral decision solely made by the government. Though it would be great to see the federal government be more supportive of 4R Nutrient Stewardship, we as an industry need to do our part to document the work we do, provide the essential data to demonstrate where the 4R practices are being applied so that we can showcase the benefits of reduced nutrient losses, environmental impacts, and greenhouse gas (GHG) emissions.

In terms of education, 4R Nutrient Stewardship recognition will certainly continue growing as more of the industry becomes active in implementing its principles. It's already being taught in university agricultural and environmental studies.

Fertilizer Canada is reporting several more millions of acres of farmland covered under 4R Nutrient Stewardship. In addition, the 4R principles are evolving to address a broader range of sustainability issues, with more emphasis on GHG emissions, nourishing crops in order to nourish people, carbon footprints, better human nutrition, and the circular economy.

Should matters of soil health and conservation concern Canadians outside of the agricultural sector? If so, why?

Canada's relatively abundant and healthy soils support the nutrition and health of Canadians, as well as the export of agricultural products. As such, it is in the public's best interest to ensure that soil health and conservation are national priorities for the generations to come. Conserving soil health is also in the best interest of farmers, and thus, they are likely to continue doing so, provided they have continued access to the nutrients needed to replenish those removed by crop harvest.

Climate change has brought new light to the importance of ensuring our soils remain in good health for future generations. Healthy soils are more resilient and can resist the devastating effects of increasing global temperatures such as moisture, changes in growing season length, soil erosion, nutrient run-off, and variability in pests and insects.

Healthy soils benefit farmers by increasing their bottom lines. But they also benefit Canadians as healthy soils remove significant quantities of GHGs, improving air and water quality, providing wildlife habitat, and increase biodiversity. Canadian government officials, private sector specialists, and

growers need to continue working harmoniously to mitigate the effects of climate change while capturing the benefits healthy soil can provide.



To celebrate World Soil Day, **Fertilizer Canada** and the **SCCC** have created an Industry Quiz for you to test your knowledge and awareness about soil health, the fertilizer industry, and 4R Nutrient Stewardship! Visit

<https://www.surveymonkey.com/r/638M6MH> to take the quiz!

Fertilizer Canada is the industry association representing manufacturers, wholesale and retail distributors of nitrogen, phosphate, potash and sulphur fertilizers. They take pride in advocating for sustainability, stewardship, safety and security through our industry-leading standards and Codes of Practice. As the foundation of Canada's agri-food sector, Fertilizer Canada applies innovative solutions that positively impact the environment, the economy, and the social fabrics of Canadian life.

The Soil Conservation Council of Canada (SCCC) has a rich history as the face and voice of soil conservation in Canada. The SCCC is the only national organization to concentrate on the issues of soil health and soil conservation within a broadly based landscape context. It works to build a greater understanding of the importance of soil as an essential resource to society by facilitating the exchange of information with all stakeholders. Healthy soils are the foundation of sustainable food production, enhanced biodiversity and cleaner air and water for present and future generations.



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