OCI

TOWARDS A SUSTAINABLE FOOD SYSTEM

November 2022

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Agriculture both contributes to global warming, with ~30% of GHG emissions coming from agriculture, and bears the impacts of climate change, which threatens food security, especially for the most vulnerable populations.

While we need to mitigate the impacts of climate change coming from agriculture, we also need to ensure food security for the growing population, which is already a challenge. The world will need to produce about 70% more food by 2050 to feed an estimated 9 billion people. The problem is intensified by agriculture's extreme vulnerability to climate change. Negative impacts are already being felt, in the form of increasing temperatures, weather irregularity, shifting agroecosystem borders, invasive pests and crops, and more frequent extreme weather events. On farms, these climate impacts are reducing crop yields, the nutritional quality of major grains, and lowering livestock productivity.

There are many proposals around the world from governments, leading food and agriculture think-tanks, NGOs and consumer goods companies about how to address these challenges. The options presented, from regenerative agriculture and organic farming, to more sustainable use of conventional inputs, often seem in contradiction to each other. In reality, our food system is as diverse as the geographies it operates in and the people working within it. Therefore, the one-size-fits-all approach needs to be replaced with science-based measures that are adapted to local contexts.

OCI fully supports the ambition to transform our food system to a sustainable and just one. This transition will ensure food security while addressing key impacts of the food systems today, including reducing soil degradation, nutrient losses, greenhouse gas emissions, loss of biodiversity and (in)direct land use changes. In this regard, promoting efficient use of mineral fertilizers via the application of sustainable intensification practices represents an effective and valid solution to achieve these objectives, ensuring higher crop yields from the same land area, with a reduced impact on the climate and environment.

OCI is actively working on solutions to address environmental impacts and improve yield across the value chain. Our strategy is three-fold:

1 Reduce the embedded carbon footprint of nitrogen fertilizers through alternative feedstocks (e.g., green, bio-based and recycled hydrogen), and carbon capture and storage.

2 Develop products that will enhance nutrient use efficiency, thereby reducing losses and increasing yield.

3 Collaborate across the value chain to promote sustainable intensification.

1 Fertilizers are key part of the solution to a sustainable food system and food security

Mineral fertilizers play a crucial role by supplying plants with the nutrients they need to grow. With no application of fertilizers, the soil would be depleted and it would be particularly difficult to grow crops. Nevertheless, the composition of mineral fertilizers and the importance of the role they play is often misunderstood.

Mineral fertilizers are mostly composed by nitrogen, potassium and phosphate: all these sources can be found in nature and, together with fertilizers of biological origin, they play an essential role in providing crops with the nutrients necessary to grow yields.

A balanced level of fertilization through effective management of nutrients is critical to avoid under or over-supply and it contributes to food security, considering that today about 50% of the world's population has access to food thanks to the use of mineral nitrogen fertilizers[1]. In addition, through enabling maximal yield on existing farmlands, mineral fertilizers help prevent deforestation and land use change to meet the food supply demands of our growing population. Fertilizers also increase the carbon sequestration potential of agricultural soils by contributing to their building up of soil organic matter (SOM). SOM facilitates higher nutrient uptake by plants, and increased plant growth absorbs more CO_2 from the atmosphere [2].

Overall, we believe that sustainable use of fertilizers is a key factor in a sustainable food system, contributing to achievement of the Sustainable Development Goals (SDGs):

SDG 2 "Zero Hunger"

SGD 3 "Good Health and Well Being"

SDG 6 "Clean Water and sanitation"

SDG 12 "Responsible Production and Consumption"

SDG 14 "Life below Water"

SDG 15 "Life on Land"

1 https://ourworldindata.org/how-many-people-does-synthetic-fertilizer-feed

2 Hijbeek R, van Loon MP, van Ittersum MK. 2019. Fertiliser use and soil carbon sequestration: opportunities and trade-offs. CCAFS Working Paper No. 264. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).

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2 Sustainable intensification measures

Inappropriate fertilization practices can lead to the loss of nutrients to the environment. If those nutrients are not replaced, soil health will decline and eventually lead to soil degradation. In order to prevent the expansion of agricultural production onto uncultivated land, and thus avoid further loss of biodiversity[1] and the release of sequestered carbon[2], it is crucial to supply existing agricultural land with sufficient nutrients. The importance of healthy soils for agricultural production is particularly crucial in the current geopolitical situation, where we are confronted with a serious food security threat, also resulting from an abrupt reduction in fertilizer production, with consequences across the whole agri-food supply chain. By applying sustainable intensification practices, farmers will be able to maximise the use and efficiency of existing farmland while minimising the environmental impact on the same land area. **Sustainable intensification can therefore represent an effective and valid approach to the sustainability of the agri-food supply chain, while contributing to food security** including measures such as:

- The use of harmonised standards and indicators such as the Nitrogen Use Efficiency (NUE) Indicator, for example. This was developed by the EU Nitrogen Expert Panel , which is able to provide information about resource use efficiency.
- The use of precision farming tools and techniques that can help farmers to effectively assess crop nutrient requirements.
- An increase in the replacement of conventional mineral fertilisers with Enhanced Efficiency Fertilisers (EEF's) which improve fertiliser use efficiency, mitigate climate change and reduce nitrogen losses to the environment significantly.
- The adoption of "4R" principles: using the right fertiliser source at the right rate, at the right time and in the right place.
- The use of targeted fertigation techniques.
- The use of low carbon and renewable ammonia in fertiliser production, helping to reduce overall Scope 1 GHG emissions.

3 Reducing GHG emissions in the nitrogen fertilizer value chain

The production of fertilizers is a significant contributor to global GHG emissions. Ammonia is the basis of nitrogen fertilizers and its production accounts for about 2% of total final energy consumption, virtually all of which comes from fossil fuels today, resulting in a carbon dioxide (CO_2) footprint equivalent to the total emissions of South Africa's energy system (about 1.5% of global emissions)[3]. In 2021, the IEA published the ammonia technology roadmap, which outlines technological pathways to significantly reduce GHG emissions from ammonia production including electrolysis, pyrolysis, using biomass and carbon capture and storage. However, these pathways require significant capital investment and still result in higher cost of production compared to the status-quo.

Nitrogen fertilizer use is associated with GHG emissions equivalent to an estimated 720 million tonnes of carbon dioxide a year. In 2022, International Fertilizer Association and Systemiq published the Reducing Emissions from Fertilizer Use report[4] which highlights actions to scale up in order to cut scope 3 emissions – mostly the indirect emissions that occur when fertilizers are applied in the field. The measures proposed are strongly aligned with sustainable intensification measures.

1 Newbold T. 2018 Future effects of climate and land-use change on terrestrial vertebrate community diversity under different scenarios. Proc. R. Soc. B285:20180792.http://dx.doi.org/10.1098/rspb.2018.0792
2 Erşahin, S. et al. (2017). Terrestrial Ecosystem Carbon Dynamics as Influenced by Land Use and Climate. In: Erşahin, S., Kapur, S., Akça, E., Namlı, A., Erdoğan, H. (eds) Carbon Management, Technologies, and Trends in Mediterranean Ecosystems. The Anthropocene: Politik—Economics—Society—Science, vol 15. Springer, Cham. https://doi.org/10.1007/978-3-319-45035-3_3
3 IEA (2021). Ammonia Technology Roadmap. https://www.iea.org/reports/ammonia-technology-roadmap
4 IFA and Systemiq (2022). Reducing Emissions From Fertilizer Use Report https://www.fertilizer.org/Public/Sustainability/Fertilizer_Use/Reducing_Emissions_from_Fertilizer_Use_Report/Public/Sustainability/Report_Reducing_Emissions_from_Fertilizer_Use.aspx

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4 Enabling climate adaptation

In addition to the climate change mitigation impact of fertilizers with inhibitors, they also have a positive impact in helping farmers who are coping with more adverse weather conditions such as drought and flooding. For example, when irrigation is not available, plant nitrogen uptake from mineral fertilizer is dependent on natural precipitation. Nitrogen fertilizers treated with nitrification inhibitors can help farmers to adapt to the growing uncertainty of precipitation distribution as they can be applied earlier in the season. The inhibitors help to prevent nutrient leaching and therefore allow more nutrients to be available to plants during growing season, even in dry years. In contrast, the common practice of top dressing in dry years leaves fertilizers insolubilized and unutilized.

5 Achieving impacts at scale

The barriers to scale the solutions outlined are immense. It takes collaboration across the value chain from governments, private sector companies and civil society to the farmers to achieve.

Role of companies
The Reducing Emissions from Fertilizer Use report captured well the actions that individual companies need to take, and the collaborative actions needed across the value chain. (see figure 1)

Role of governments
Public policy has an important influence on farmers' business decisions. Some established policies, having achieved their initial objectives, now create perverse incentives for inefficient fertilizer use and should be reformed. In other areas, new regulations, payments or emissions pricing schemes may be needed. The appropriate levers will vary by geography and farm type, and those making reforms should carefully consider the impacts on farmers.

Role of civil society
Civil society can play an important role in tackling disinformation at all levels, acknowledging the positive role played by fertilizers, through the promotion of a balanced level of fertilization that combines organic sources with mineral supplements.

Role of the farmers
The farmers are the ultimate steward of the environment and ecosystems they operate in. They ensure that safe and nutritious food reaches our tables; they produce biomass; they keep the soil healthy; they contribute to protecting and restoring biodiversity; they minimise waste[1]. They can also support climate change mitigation efforts by implementing climate-friendly agricultural practices.

We support the position of the World Farmers' Organization promoting a "farmers' route" to a sustainable food systems transformation, which embraces three principles[2]:

1 **Inclusiveness:** The "one size fits all" approach can't work in a complex, interrelated system involving multiple actors.

2 **Transparency:** Promoting fairer, more transparent and trust-based relationships between food production and consumption and among value-chain actors is crucial in order to "Leave No One Behind".

3 **Farmer-Driven Approach**: Farmers are the backbone of our society and economy. Without farmers, there can be no food systems. Hence, farmers need to be at the table in shaping resilient food systems for the future.

Figure 1: Actions for fertilizer companies to address emissions alone and in coalition

	Fertilizer manufacturer	Fertilizer traders and blenders	Fertilizer sellers
Individual companies	Improve understanding of the distribution chain		
			Educate and incentivise advisers, input suppliers and machinery providers for sustainable nutrient choices
			Advise farmers on good practices
	Supply enhanced fertilizer products		
	Supply tailored nutrient blends		
	In-house RND		
Fertilizer sector together	Nutrient stewardship collective outreach programmes		
	Pre-competitive innovation initiatives (e.g., challenge prizes)		
	Work with standard setters to develop high quality farm certification criteria and robust evidence bases for carbon credit issuance for nutrient management		
In coalition with food chain and policy makers	Form partnerships with research institutions to influence priority areas for research		
	Commercial partnerships with and advice for food companies to reward farmers for making changes to practices Commercial incentives for farmers to adopt best fertilizer and wider farm management practices		
	Advocate policy reforms that better support emissions reductions Advise policymakers on priorities and what is possible		

1 Food and Agriculture Organization (2020), Tracking progress on food and agriculture-related SDG indicators report
2 World Farmers' Organization (2020), Policy Paper on Sustainable Food Systems, The Farmers' Route to Sustainable Food Systems

About OCI N.V.

OCI N.V. (Euronext: OCI) is a leading global producer and distributor of hydrogen products providing low carbon fertilizers, fuels, and feedstock to agricultural, transportation, and industrial customers around the world. OCI's production capacity spans four continents and comprises approximately 16.3 million metric tons per year of hydrogen products including nitrogen fertilizers, methanol, biofuels, diesel exhaust fluid, melamine, and other products. OCI has more than 3,850 employees, is headquartered in the Netherlands and listed on Euronext in Amsterdam.

Learn more about OCI at www.oci.nl. You can also follow OCI on Twitter and LinkedIn.

About Fertiglobe

Fertiglobe is the world's largest seaborne exporter of urea and ammonia combined, and an early mover in clean ammonia. Fertiglobe's production capacity comprises of 6.7 million tons of urea and merchant ammonia, produced at four subsidiaries in the UAE, Egypt and Algeria, making it the largest producer of nitrogen fertilizers in the Middle East and North Africa (MENA), and benefits from direct access to six key ports and distribution hubs on the Mediterranean Sea, Red Sea, and the Arab Gulf. Headquartered in Abu Dhabi and incorporated in Abu Dhabi Global Market (ADGM), Fertiglobe employs more than 2,600 employees and was formed as a strategic partnership between OCI N.V. ("OCI") and the Abu Dhabi National Oil Company ("ADNOC"). Fertiglobe is listed on the Abu Dhabi Securities Exchange ("ADX") under the symbol "FERTIGLB" and ISIN "AEF000901015.

To find out more, visit: www.fertiglobe.com

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