



Knowledge grows

Our position on Soil Health



The importance of soils

Soils are the foundation of agriculture and our food system. Soil health and vitality are pre-requisites for robust crop production and a sustainable future for farming.

Comprised of minerals, organic matter, air, water and living organisms, soils provide a rooting medium and nutrient source for plants. Soils contain a wealth of biodiversity and play a key role in regulating, storing and filtering water. Additionally, because of their ability to store carbon, soils play an important role in climate change mitigation.

Soil **quality** or soil **fertility** typically refers to the ecosystem services soils provide, such as adequate crop yields. Soil health, in a broader sense, emphasizes the role of soil as a living ecosystem that sustain the wellbeing of animals, people and planet. It is this broad definition of soil health that Yara bases its work to improve and maintain soil health and vitality.

Soils are being degraded

An estimated one third of agricultural soils are degraded¹ which leads to agricultural productivity losses, reduced water holding capacity and a decreased ability for the soil to capture

carbon. The degradation of soils is a risk for food production globally and subsequently, a threat to food security.

Soil degradation occurs due to a variety of both natural and human-induced processes. The most significant threats to soil function at global scale include soil erosion, loss of soil organic carbon, soil nutrient mining and nutrient imbalance, acidification, salinization and sodification.^{1,2} With the pace of soil erosion drastically exceeding the pace of soil formation,³ we see an urgent need for soil preservation and the restoration of degraded soils. When combined with other threats to soil health (climate change, imbalanced nutrient and carbon flows combined with growing demand for food), it is imperative that we act to prevent a severe impact on food supply.

Sustainable cropland management, sometimes referred to as conservation agriculture, regenerative agriculture or good agricultural practice, aims at improving soil health and the proper functioning of the wider agro-ecosystem.

Practices can include a variety of methods, such as crop rotations, use of cover crops, reduced tillage, optimized nutrient applications incorporating organic fertilizers and balanced use of mineral fertilizers, liming and prevention of soil compaction. Applying these practices over time will likely maintain and improve soil health, depending on location- and condition-specific contexts. The United Nations Global Compact's Principles for Sustainable Soil Management⁴ provides a helpful framework for good soil management, stewardship and policymaking.



Examples of what a healthy (left) and degraded (right) soil can look like. Both soil samples are from Bulgarian clay loam soils. Photos: Harold Mathijs van Es



The vital role of balanced crop nutrition

Best practice crop nutrition management, ensuring balanced fertilization suited for local conditions, is at the core of all good agricultural practices.

When crops are harvested, nutrients are removed from the soil. If these nutrients are not replaced, soil health will decline and eventually lead to soil degradation. Applying adequate amounts of organic biomass and required nutrients, in the form of organic or mineral fertilizers, maintains or increases crop growth, which in turn provides for larger quantities of crop residues to be returned to the soil. It contributes to the nutrition of soil organisms and the improvement of soil organic matter content and soil carbon sequestration.

When assessing soil carbon contents, it is important to consider that soil organic carbon levels and soil health are not necessarily correlated. A high level of soil organic carbon on its own is not a reliable indicator of soil health.

Fact box: Regenerative agriculture

Regenerative agriculture refers to farming practices that revitalize soil, optimize the application of organic and mineral fertilizers, reduce the use of pesticides and positively impact the environmental footprint of agriculture. The approach focuses on increasing agrobiodiversity and reducing agriculture's negative externalities while maintaining cropland productivity and supporting farmer livelihoods.

In addition to the major nutrients – nitrogen, phosphorus and potash – crops ultimately need a total of 13 different nutrients to obtain optimal yield and quality. Without a balanced approach to manage all plant nutrients, soils will become degraded. This is illustrated by the “Law of the Minimum” (Liebig, 1843) which states that “crop yields are proportional to the amount of the most limiting nutrient”.

Soil acidification is a major concern of soil health. The application of nutrients come with a specific requirement of lime and this needs to be managed to avoid soil acidification. In case this is not managed properly, soil health can suffer, and soil can become too acid for crop and soil life. As the importance of liming is widely known, it is addressed in common advisory systems.

Nutrient applications to farmland that exceed the nutrient demand of the agricultural crops can harm water quality and marine ecosystems and may lead to increased greenhouse gas emissions. Soil health is less sensitive to nutrient oversupply and many soils benefit from a nutrient accumulation up to a certain level.



Fact box: Long-term trials provide valuable knowledge

Long-term crop growing trials are a unique tool to gather knowledge on the impact of fertilizer use in agriculture. In a long-term trial, fields are divided into smaller plots and receive the same fertilizer rate over an extended period of years enabling the measurement of fertilizers effects on crop yield and soil health over time. Yara has its own long-term trial at Hanninghof, Germany which was established in 1958.

The results from long-term fertilizer trials provide solid evidence that balanced crop nutrition is important to maintain soil organic matter. When fertilizers are applied to degraded soils, and supported by a balanced crop nutrition program, the soil organic matter will increase. Analysis of more than a hundred long-term fertilizer trials shows that fertilized land has a higher soil organic matter content than unfertilized land. Land managed by supplying organic sources of nutrients, in addition to mineral sources, have the highest content of soil organic matter. Balanced crop nutrition together with good agricultural practices are determining factors in the regeneration of agricultural soils.



The challenge of defining, measuring and monitoring soil health

Soils are living ecosystems characterized by varying natural states. They are in constant change and some level of degradation occurs naturally, without human intervention. Due to the variability and constant evolution of soils, an all-encompassing and scientifically standardized framework to define a “healthy soil”, does not yet exist. There are various ongoing initiatives aiming to establish standardization methods to evaluate and monitor soil health, such as Yara’s Soil Health Report that is being developed in Pocklington, United Kingdom.

The importance of an enabling policy environment

Due to the complex cross-sectorial, and often site-specific, nature of soil and land management, national, regional and global level policies and regulations tend to be fragmented. The exception is the United Nations Convention to Combat Desertification (UNCCD) 2018 – 2030 Strategic Framework, which sets global commitments to achieve Land Degradation Neutrality (LDN). This provision is currently the sole legally binding international agreement that links environment and development with the promotion of healthy soils.

Achieving the goals set forth in the LDN requires a policy environment in which various regulatory bodies coordinate policy on cross-cutting soil issues (agriculture, water, waste, pollution, food security and safety) in close association with farmers, scientists and the private sector. In addition, farmers require better access to knowledge, tools and financial incentives to stimulate an effective delivery of enhanced soil ecosystem services.

Yara’s position

Soils matter

Yara takes a long-term view on soil health. By providing farmers with tools and services enabling a precise and balanced nutrient management in combination with suitable fertilizer products, we help them preserve and improve the fertility and health of their soils, a benefit that carries forward to future generations. Over a century of crop nutrition research, mineral fertilizer manufacturing and distribution, have shown us that an integrated approach to soil health management is needed to ensure the long-term productivity of agriculture.

We provide science-based advice on specific, localized nutrient requirements for a large range of crops, as well as decision support systems for farmers. Imbalanced crop nutrition is one of the major drivers of soil degradation. Optimal farming practices should address liming requirement and incorporate the use of organic materials available at farm, in combination with complementing mineral fertilizer guided by precision farming technology.

Yara supports the UN Global Compact’s Principles for Sustainable Soil Management⁴ through a commitment to global soil health that is underpinned by stakeholder partnerships, the promotion of improved soil management and the inclusion of soil health in strategic and operational planning, as suggested by UN Global Compact.

Our current engagement in soil health includes the following activities:

- **General crop nutrition:** Yara provides fertilizers containing all required macro- and micronutrients, tailored for different crops and conditions. Our team of approximately 800 agronomists are trained in crop nutrition and crop management practices which provide optimal fertilizer solutions for farmers.

Every year, our field-staff across the world meets and shares crop nutrition knowledge with over a million farmers in farmer meetings, crop clinics, field days and lecture events. Additionally, we are active in regional collaboration projects, like the Good Harvest Program in Brazil, that aims to shape the future of agriculture.

- **Research and development:** Our research teams have worked on soil health for more than 60 years with a strong focus on long-term trials. We constantly explore new agricultural solutions and engage with other research organizations to advance soil health and vitality.
- **Soil health analytics:** Yara’s Analytical Services provide soil analysis for farmers around the world. Our comprehensive soil analysis covers chemical, physical and biological indicators of soil health which provides information to the farmer that can serve as a starting point for the adjustment of soil or crop management practices. Yara Megalab™ is a secure, internet based biometric data and interpretation service for agricultural analyses that operates in cooperation with a network of partner laboratories around the world.
- **Digital farming:** Our digital offering includes precision farming tools that support farmers with improved management practices that result in balanced crop nutrition. This offering ranges from satellite-enabled precision fertilization tools to nutrient management applications that assist advisors in providing field-tailored crop nutrition programs based on soil or tissue analyses. Yara’s digital crop nutrition tools are fine-tuned by agronomy experts and optimized for both crop and geography variances.

Our position on Soil Health

Crop nutrition for the future

Yara's existing best practice of balanced crop nutrition is a key component of future-fit farm management practices, ideally positioning the company to increase both its depth and reach in terms of promoting soil health. The future model of farmer income and profitability will determine the improvement at farms. As a farm input and service provider, we prioritize initiatives that will benefit the farmer in the short, medium and long term.

In support of this, Yara engages in the following:

- **Research and Development:** Improving our capability of measuring soil health and making efforts to further determine the farm level value derived from soil organic matter increase and broader soil health indicators.

- **Commercial offering:** Developing tools and solutions to enable the transfer of knowledge to farmers, leveraging our current expertise on balanced crop nutrition and preparing future-fit solutions with a holistic view to soil health.
- **Circular economy:** Engaging in the recovery and reuse of nutrients based on organic sources and exploring integrated solutions for precise crop and soil nutrition.
- **Collaboration:** Promoting and engaging in partnerships and collaborations, e.g. to develop improved farmer income models, and on various other soil health initiatives that support our industry in becoming greener, smarter and more resource efficient.



Yara's soil related platform commitments

One Planet Business for Biodiversity (OP2B) is a business-led coalition that gathers forward-thinking companies to work individually and collectively to protect and restore biodiversity in agricultural systems. The coalition focuses on scaling up regenerative practices to protect soil health, diversifying product portfolios and restoring high value ecosystems.

International Organic & Nitrogen Fertilizer Long Term Trial Alliance (IOSDV) is a union consisting of private and public research organizations that have established long-term trials and work together on a better understanding of sustainable soil and crop management practices in different climatic zones. Yara has been part of this Alliance for nearly 40 years.

Farming for Generations is global alliance to support dairy farmers to adopt regenerative agricultural practices that preserve and renew our planet's resources, respect animal welfare and ensure the long-term economic viability of farms for the next generation.

CocoaSoils is a five-year research program that deploys an Integrated Soil Fertility Management (ISFM) approach for cocoa intensification that consists of improved planting materials, canopy cover management and pest/disease control combined with targeted fertilizer application to enhance sustainability and avoid deforestation. Yara is a founding member of this program.

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Sources

¹ Food and Agriculture Organization of the United Nations (2015): *Status of the World's Soil Resources, Technical Summary* Available at <http://www.fao.org/3/a-i5126e.pdf>

² Montanarella, L. et al. (2016): *World's soils are under threat*. Available at <https://soil.copernicus.org/articles/2/79/2016/>

³ IPCC (2019): *Special Report on Climate Change and Land, Summary for Policymakers*. Available at <https://www.ipcc.ch/srccl/chapter/summary-for-policymakers/>

⁴ UN Global Compact (2016): *Principles for Sustainable Soil Management* [Online]. Available at: <https://www.unglobalcompact.org/library/4101>

About Yara

Yara grows knowledge to responsibly feed the world and protect the planet. Supporting our vision of a world without hunger, we pursue a strategy of sustainable value growth, promoting climate-friendly and high-yielding crop nutrition solutions for the world's farming community and food industry.

Yara's ambition is to be the Crop Nutrition Company for the Future. We are committed to creating value for our customers, shareholders and society at large, as we work to develop a more sustainable food value chain. To achieve our ambition, we have taken the lead in developing digital farming tools for precision farming, and work closely with partners throughout the food value chain to improve the efficiency and sustainability of agriculture and food production.

Founded in 1905 to solve the emerging famine in Europe, Yara has established a unique position as the industry's only global crop nutrition company. With our integrated business model and a worldwide presence of around 16,000 employees and operations in over 60 countries, we offer a proven track record of responsible and reliable returns. In 2019, Yara reported revenues of USD 12.9 billion.

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