

Global Symposium on Soils for Nutrition

Organizers: FAO (Food and Agriculture Organization of the United Nations); GSP (Global Soil Partnership)

July 26 - 29, 2022
Virtual, Rome, Italy

1. Background

Humans, like microorganisms, plants, and animals, need sufficient food to survive. But food has to be safe and nutritious not only to provide energy and basic nutrients, but also to prevent disease and the intake of harmful toxic substances. About 95% of our food nutrients comes from soils which have a natural capacity to support crops and forage grasses by providing them with nutrients through the soil solution. However, when crops and forage grasses are harvested, nutrients are removed from the soil. These nutrients can be replaced by the addition of inorganic or organic fertilizers, thanks to which part of the productive potential of the soils is achieved. Proper use of fertilizers may promote biomass production and contribute to increased soil organic matter and soil health. However, underuse, misuse, and overuse of fertilizers increase global climate change, degradation of soil and water resources and potential harm to human, animal, and soil health. For example, the sum of global nitrogen losses (excluding ocean emissions) represents a loss of agricultural fertilizer resources worth approximately \$200 billion USD annually¹. Moreover, the costs for human health and the impact on aquatic and terrestrial ecosystems amount to \$400–4000 billion USD annually due to nitrogen overuse and misuse.

Nutrient imbalance was identified as one of the main ten soil threats that affects soil health globally². To date, it is very clear that nutrient imbalance brings with it devastating environmental, social, and economic effects. Even though 195 million tonnes of fertilizers were applied in 2020, and the annual application rate increases 2% every year³, hunger still affected 768 million people and increased 16 % compared to 2019⁴. Is it possible to unlock the productive potential of soils in a natural and sustainable way to obtain sufficient, nutritious, and safe food? Or do we rely exclusively on external inputs to replace mined soil nutrients? There is sound evidence that food production to meet the demands of the world's population can be achieved hand in hand with sustainability without compromising one or another. Traditional knowledge and emerging strategies can help to solve the nutrient imbalance our soils face.

This is a question that humans need to answer not only to achieve food security and nutrition but also other sustainable development goals.

As part of its efforts to achieve the 2030 Agenda for Sustainable Development, Land Degradation Neutrality, and the Post-2020 Global Biodiversity Framework, the FAO's Global Soil Partnership (GSP) promotes sustainable soil management as a mean to achieve food security and nutrition while protecting the

¹ Sutton, M. 2020. Just enough nitrogen. Elsevier.

² FAO 2015. The Status of the World's Soil Resources report. Rome

³ FAO 2019. World fertilizer trends and outlook to 2022. Rome.

⁴ FAO 2021. The State of Food and Agriculture 2021. Rome

environment. The FAO's GSP has published the Voluntary Guidelines for Sustainable Soil Management (VGSSM)⁵. Their role is to guide strategic and context-specific decision making on soils at all relevant levels to address major global threats, such as the imbalance of nutrients and nutrient cycles, and the pollution of soils. The International Code of Conduct for the Sustainable Use and Management of Fertilizers (The Fertilizer Code) is an important tool for implementing the VGSSM specifically regarding nutrient imbalances and soil pollution. This instrument addresses the three main issues related to fertilizer use and management across world: underuse, misuse and overuse, as well as the consequences, and recommendations to different stakeholders directly or indirectly involved with fertilizers. In response to these complex challenges, it's decided at the GSP's Ninth Plenary Assembly in September 2021 to organize the Global Symposium on Soils for Nutrition (SYMPOSIUM) in 2022, which serves an important platform to review the state of the art of soil fertility in the context of food security, human nutrition, environmental health and climate change.

Role of soil fertility on food security and nutrition

Although food security is a global goal that requires consideration of multiple factors, healthy and well-nourished soils are central to achieving it. A balanced supply of soil nutrients is essential to support crop and forage grass yields and the nutritional value of the agri-food system. An integrated approach of the soil-plant nutrient cycling is crucial to improve our knowledge about the system's functionality and interactions, and thereby enable better decisions on soil nutrient management while protecting the environment in a climate change scenario.

Although the production of primary crops has doubled in the last 20 years, it remains unclear how long soils can sustain such production. For this reason, it is important to understand soil nutrient availability in different areas, so as to know how and where to improve soil fertility. Are the world's soils capable of continuing to produce sufficient food with their intrinsic characteristics?

There are various topics linked to sufficient, safe and nutritious food. One of the main dimensions of food security is sufficient food production, which can be supported by improving integral soil fertility. This is the ability of a soil to support plant growth by providing not only the essential nutrients, but also the adequate chemical, physical, and biological conditions as a habitat for plant growth and the maintenance of ecosystem services. Soil nutrient imbalance was identified as one of the major soil threats in the Status of the World's Soil Resources report (FAO, 2015)⁶. The lack of basic nutrients, including macro and micronutrients, leads to the underdevelopment of plants and decrease in yields and crop nutritional value.

Food quality, which includes the safety and nutritional value of food products, is another key dimension of food security. Healthy soils provide macro- and micronutrients that influence plant nutrition when soils are sustainably managed. In addition, plants supplied with balanced and sufficient nutrients grow healthier and are more resilient to pest and diseases. In contrast, soil macro- and micronutrient deficiencies limit plant health, crop productivity and the nutritional quality of food, which together ultimately affect nutrition and human health⁷. The chronic lack of micronutrients –derived from nutrient-deficient soils and crops– can

⁵ FAO 2017. Voluntary Guidelines for Sustainable Soil Management Food and Agriculture Organization of the United Nations. Rome, Italy.

⁶ FAO, 2015. Status of the World's Soil Resources. Food and Agriculture Organization of the United Nations. Rome, Italy

⁷ Sanchez, P.A., Swaminathan, M.S., 2005. Hunger in Africa: the link between unhealthy people and unhealthy soils. Lancet 265, 442–444.

cause severe but often invisible health problems, especially among women and children⁸, known as ‘hidden hunger’. Worldwide over 2 billion people suffer from iron (Fe), zinc (Zn) and/or other (multiple) micronutrient deficiencies⁹. The problem is most severe in low- and middle-income countries, especially in Africa where the estimated risk for micronutrient deficiencies is high¹⁰.

Although hidden hunger is a multifactorial challenge, adequate soil nutrient content plays a determinant role to combat this problem. The nutrition-sensitive agriculture approach addresses soil and crop nutrition in an efficient, inclusive, and sustainable manner since it is centered in the implementation of diversified farming systems aiming at the production of high-quality nutritional food to overcome malnutrition and micronutrient deficiencies.

Environmental impact of unsustainable soil fertility management

To achieve food security and sustainable development goals, natural resources, including soil, water, and biodiversity, should be managed sustainably and in an efficient, so as to avoid and minimize negative impacts on the environment. In this sense, the overuse and misuse of fertilizers lead to nutrients excess (especially nitrogen and phosphorus) from agricultural fields and cause a number of environmental problems including: i) deterioration of water quality and eutrophication of aquatic ecosystems; ii) exacerbation of climate change due to increased release of greenhouse gases such as nitrous oxide and methane from soils to the atmosphere; iii) leaching of mobile forms of nitrogen to water used for human consumption, with potential human health impacts; iv) soil pollution and; v) crop failure¹¹.

Apart from the inappropriate use of fertilizers, their quality deficiencies can represent a source of severe and persistent environmental pollution and cause significant human health problems. Concerns associated with the lack of evaluation and regulation of the quality and composition of the fertilizers applied to soils, such as heavy metals content linked to the mining and the production process, the sources of raw material, and the presence of harmful microbes, can cause serious contamination problems and damage to human and animal health. In the case of recycled nutrient sources and products intended for use in plant production, the nutritive content, and quality, as well as safety in terms of the content of dangerous or toxic materials should also be considered. Maintaining soil fertility should reduce externalities such as environmental pollution caused during nutrient extraction and processing. Examples of these externalities include exposure to asbestos fibres which can also be inhaled by people in areas surrounding mining sites, and organic contaminants produced as by-products frequently from mining¹².

In addition, mineral reserves depletion derived from mining for fertilizer production highlights the urgency of using soil nutrients in an efficient, safe, and sustainable manner.

Social, legal and economic implications of soil fertility management

Inequality in productive capacities of food is related to soil and land management policies or the lack of them. Frequently the lack of resources and/or incentives is one of several obstacles that prevent the

⁸ Black, R.E., Victora, C.G., Walker, S.P., Bhutta, Z.A., Christian, P., de Onis, M., Ezzati, M., Grantham-McGregor, S., Katz, J., Martorell, R., Uauy, R., 2013. Maternal and child undernutrition and overweight in low-income and middle-income countries (and the Maternal and Child Nutrition Study Group). *Lancet* 382 (9890), 427–451.

⁹ WHO, 2016. Vitamin and Mineral Nutrition Information System. World Health Organization(www.who.int).

¹⁰ Ruel-Bergeron JC, Stevens GA, Sugimoto JD, Roos FF, Ezzati M, Black RE, et al. (2015) Global Update and Trends of Hidden Hunger, 1995-2011: The Hidden Hunger Index. *PLoS ONE* 10(12): e0143497.doi:10.1371/journal.pone.0143497

¹¹ FAO, 2019. The International Code of Conduct for the Sustainable Use and Management of Fertilizers. Rome.

¹² FAO and UNEP. 2021. *Global assessment of soil pollution: Report*. Rome.

establishment of good practices contributing to better nutrition of soil, crops, and people. Adequate soil governance and proper policies and strategies aimed at increasing the production, safety and nutritional value of food in a sustainable way require international and national collaboration between governments, local authorities, industries, and citizens. Coherent policies focused on encouraging sustainable soil management practices and judicious use and management of nutrients are essential to achieve food security worldwide, leaving no one behind¹³.

2. Scope, goals, and objectives

The Global Symposium on Soils for Nutrition aims to review the state of the art on the role of soil fertility in delivering sufficient, high quality, safe, and more nutritious food for better nourished plants, animals, and people. The Symposium is expected to identify critical knowledge gaps and provide the basis for discussion among policy makers, food producers, scientists, fertilizer industry, practitioners, and other stakeholders on the creation of solutions that can provide a more nutritious agri-food system for enhancing human health and wellbeing while protecting the environment.

Food starts with soils, and with less than 10 years until the 2030 - the deadline for achieving the UN Sustainable Development Goals (SDGs), there is a call for urgent attention to the factors and forces driving the performance in agri-food systems. The Symposium will elaborate how healthy soils could contribute to the achievement of the SDG2 - Zero hunger and will also contribute to the fulfillment of SDG 3-Good health and wellbeing, SDG 6-Clean water and sanitation, SDG -12 Responsible production and consumption, SDG 13-Climate action, and SDG- 15, Life on land. Finally, the GSP and this Symposium are successful examples of how partnership and enhanced collaboration (SDG 17) among all stakeholders to advance towards the achievement of the SDGs.

The specific **objectives** of the Symposium are:

- Examine the current scientific, technical, and traditional knowledge on the role of integral soil fertility management for nutrition, food production, human health, and climate change mitigation opportunities;
- Examine the knowledge on soil nutrient budgets, the application of external nutrients and the existing possibilities to match soil fertility to crop requirements;
- Present innovative, effective and replicable methodologies, technologies and practices that promote sustainable crop and forage production, with a view on upscaling these approaches to promote the sustainable management of soil fertility for crops and human nutrition;
- Explore different nutrient sources, their efficiency, and options for soil fertility management including analysis of their benefits and trade-offs related to fertilizers quality and potential environmental impact; and
- Identify policies that maintain and improve soil fertility and nutrition and encourage the adoption of effective practices that facilitate sustainable food production systems to meet food security.

The symposium is also expected to contribute to the understanding of the challenges and opportunities in soil fertility, crop, animal and human nutrition, and the environmental impact associated with soil fertilization for the different stakeholders including the government sector, industry, national agricultural research systems, universities, and waste and recycling industry.

¹³ Soil Governance, Global Soil Partnership. <https://www.fao.org/global-soil-partnership/areas-of-work/soil-governance/en/>

3. Expected outcomes

The Symposium envisions to achieve the following outcomes:

- Knowledge gaps identified on how soil fertility supports better production, better nutrition, a better environment, and a better life;
- knowledge, methodologies, and policies regarding the availability, assimilation and use efficiency of fertilizers reviewed and summarized;
- Improved understanding of how the adoption of sustainable soil management can produce nutritious food to fight malnutrition and contribute to human wellbeing;
- Obstacles that halt the implementation of improved sustainable soil fertility practices worldwide identified;
- Available information and knowledge gaps to undertake monitoring and mapping of soil nutrients are identified;
- The state of soil pollution due to overuse/misuse of fertilizers is identified;
- The gaps in the implementation of tools for guiding the sustainable use and management of fertilizers is identified.
- An outcome document “Soils for nutrition” will be the main outcome of this symposium presenting an agenda for action in this topic that will be implemented by the GSP Secretariat and its partners.

4. Symposium themes

The Symposium will be held virtually over four days on July 26 - 29, 2022, with an expected participation of representatives from countries around the world.

The Symposium will have a high-level opening session with speakers from co-organizing institutions, to present the importance of soil nutrition in the maintenance and enhancement of soil health, in achieving crops and human nutrition, food security, combating and adapting to climate change, and overall achieving the SDGs.

Keynote speakers will be invited for setting the scene for the Symposium with the participation of leading experts in relation to the following four main themes, aimed at providing state-of-the-art scientific evidence about the role of soils for a better nutrition. The launch of poster exhibition and side activities will conclude the program of the first day.

Theme 1. Status and trends of global soil nutrient budget

Crop and forage production improvement could be supported by improving the physical, chemical, and biological aspects of soil fertility. However, planning soil fertility interventions at any scale requires information about the soil nutrient budget – accounting the nutrients that enter the soil body and leave the soil through crop uptake and hydrological or atmospheric loses. Overtime, there have been different efforts to quantify this budget, thus, it is important to understand the state of the art and identify the gaps that need to be addressed to count with solid information and trends about availability (both natural and human added) of soil nutrients in the soils to guide better interventions.

The topics to be addressed under theme 1 are:

- Assessing, mapping and monitoring soil fertility/soil nutrients (soil nutrient budget)
- Applications of soil fertility data/information for decision making
- State of the art on the availability of soil nutrients/fertilizers (i.e. sources of phosphorous)

Theme 2. Sustainable soil management for food security and better nutrition

Healthy and nutritious food for crops, livestock, and human starts with healthy soils. Healthy soils play a key role in the implementation of schemes such as nutrition sensitive approaches. Nutrition-sensitive agriculture contributes to improving health outcomes, the production of diverse, safe, and nutrient-rich food, linked to sustainable soil management practices. In addition, the availability of micronutrients can be analyzed according to the physical, chemical, and biological conditions of the soil, and the geological context is determinant in the mineral composition of the soil and its natural capacity to supply nutrients. This, together with the adoption of an inclusive vision through helping most vulnerable people such as smallholders and promoting cost-effective and environmentally friendly soil management practices. Natural soil fertility and natural nutrient cycles can be improved and maintained through soil conservation practices, integrated agricultural systems, nature-based solutions, the rescue of traditional knowledge, and innovative approaches.

The topics to be addressed under theme 2 are:

- Nutrition sensitive agriculture
- Innovations on sustainable soil management and soil fertility
- Soil micronutrients and human health
- The role of fertilizers on cost-effective crop production and nutrition.
- Fertilizers use efficiency and innovations on the production of fertilizers (mineral and bio-products)
- State of the art on biological nitrogen fixation

Theme 3. Impacts of soil nutrient management on the environment and climate change

Practices and tools to improve fertilizers use efficiency and sustainability can help to reduce soil, water and air pollution, regulate water resources availability and quality, support a diverse and active biotic community, provide safe food and reduce GHG emissions. This theme will address the alternatives to improve nutrient use efficiency include integrated soil fertility management, nature-based solutions involving soil microorganisms; technology-oriented solutions and the quality assessment of fertilizers. Plant nutrition efficiency can also be enhanced through nutrient recycling or additions including mineral (chemical) fertilizers, organic fertilizers, and other soil amendments.

The topics to be addressed under theme 3 are:

- Status of soil, water, and air pollution derived from the overuse or misuse of fertilizers
- The role of fertilizers on climate change
- Fertilizers quality and its role in food safety and pollution

Theme 4. Governance of soil fertility/soil nutrients

Approximately one-third of the world's food is produced by smallholders, who paradoxically are part of a sector that has been historically marginalized and affected by poverty. In addition to poverty and food insecurity, other factors such as gender inequality and low crop profitability in a scenario of climate change and Covid-19, make soil fertility maintenance and enhancement a complex and challenging endeavor. There is a growing need to include soil fertility in the legal framework in articulation with crop and human nutrition, land tenure and land management.

The topics to be addressed under theme 4 are:

- Policies focused on improving soil fertility through the adoption of sustainable soil management
- Implementation of normative tools such as the International Code of Conduct for the Sustainable Use and Management of Fertilizers
- Gender sensitive tools and methods in fertilization programmes

5. Symposium structure

Panels

During the following three days, the event will open with a multisectorial panel that will address each of the four themes in complement to the scientific insight with the participation of different stakeholders in the corresponding topic for each day, governments, industry and farmers. One of the main objectives of the panels is to articulate the priorities and needs of the governments, and productive and industry sectors with the academia.

Parallel sessions

Once the panels have concluded, parallel sessions will be held for the four themes. The format of the parallel sessions will be determined by the conveners (in close collaboration with the organizing and scientific committees) to ensure the themes are adequately presented and discussed to explore the key aspects needed for the outcome document.

Side events

Side events will be organized including a photo contest under the theme "Soil nutrient deficiencies in crops and livestock".

Call for Abstracts

The Organizing Committee of GSOIL4N is currently accepting abstracts that will compete for oral and poster presentations during this Symposium. The abstracts should be written in English with a maximum of 3 000 characters (without spaces) and submitted directly on the [abstract submission portal](#) by **31 May 2022**. If you have any technical problems compiling the information in the abstract submission portal, please email us GSOIL4N@fao.org

The GSOIL4N Scientific Committee will revise all submissions and inform selected authors by 20 June 2022, and details for oral and poster presentations will be provided.

Participants

- Participants will include FAO Director-General, representatives from international organizations, scientists and practitioners working in related fields, representatives from NGOs, civil society, land users and representatives of Indigenous Peoples and local communities and industry and private sector representatives.
- Additionally, the symposium will call the attention of the private sector working on sustainable agriculture and technology development related to soil nutrition to collectively identify the optimal ways to scale up best practices and the promotion of existing and new technologies.

6. Symposium committees

The following Committees will be established:

Organizing committee

This committee will comprise representatives from FAO and GSP partners. It will oversee the overall organization of the symposium, guide the formats of the parallel sessions, and the finalization of the symposium outcomes.

Scientific Committee

The Scientific Committee will comprise representatives from the ITPS, and additional leading experts in the themes addressed in the symposium. This committee will be responsible for evaluating submitted abstracts, as well as ensuring the scientific quality of the parallel sessions and symposium outputs.

7. Workplan



8. Budget

Given the virtual format, the low costs (associated with simultaneous interpretation, publication of a book, staff to support the symposium) will be covered by extra budgetary resources of the Global Soil Partnership.