INSOILFER WORKING GROUPS

Concept note

Background

The International Network on Soil Fertility and Fertilizers (INSOILFER) was launched on 17 July 2023 through a virtual event, which saw an impressive turnout with over 1200 registered participants. The launch event commenced with keynote speakers' presentations and continued with a technical presentation introducing the network, outlining its objectives, and prioritizing activities. The recording of the INSOILFER launch, the event agenda, and the presentations are available **here**.

Channeling collective action toward the sustainable management of soil fertility and fertilizers

INSOILFER was established based on the recommendations of the Outcome Document of the Global Symposium on Soils for Nutrition (GSOIL4N). It is a vehicle to implement the International Code of Conduct for the Sustainable Use and Management of Fertilizers and the Voluntary Guidelines for Sustainable Soil Management. The network's primary goal is to channel collective action toward sustainable soil fertility and fertilizer management, with the vision of achieving healthy and fertile soils by 2030 and contributing to the transformation of agrifood systems.

The overall goals of this new network are:

1. Adoption and implementation of sustainable and balanced soil fertility management.
2. Ensure global food security through sustainable fertilizer use and promote soil fertility.
3. Avoidance of the underuse, misuse, and overuse of fertilizers.
4. Reduction of the environmental and health impacts of fertilizer use.
5. Evaluation and improvement of the safety and quality of fertilizers.
6. Promotion of the soil for national and global nutrition policy.

INSOILFER working groups

The establishment of three working groups is proposed to achieve these goals:

- WG1. Soil fertility and nutrient monitoring system
- WG2. Soil fertility and fertilizer management
- WG3. Fertilizer safety and quality assessment

The next steps: INSOILFER governance and working group formation

INSOILFER depends on building an inclusive and diverse community with stakeholders with different perspectives on soil fertility and fertilizer management.
The network welcomes participation from academia, government, farmers and farmers' associations, industry and private sector, laboratories, extensionists, and technicians. Membership in INSOILFER is free of charge. Active and voluntary participation from each member is encouraged.

The following steps to the operability of INSOILFER are:

- Setting general work areas and activities to be performed in the short, mid, and long term, such as webinars, training for technicians, policymakers, and farmers, publications, and meetings.
- Conformation of the working groups, for which separate meetings will be held from 27- 29 November 2023.
- Definition of the network's governance. A Chair, Vice-Chairs for each working group, Technical Committees, and Reference Institutions will be selected in the working group meetings.

Working group 1. Soil fertility and nutrient monitoring system

The formation of WG1 responds to recommendations of the Global Symposium on Soils for Nutrition (GSOIL4N) Outcome Document, including "Monitor soil nutrients and soil fertility and deepen the knowledge about soil nutrient budget." Based on this recommendation and the gaps and challenges identified during the GSOIL4N[1], the WG1 will focus on three critical aspects for establishing reliable and updated soil fertility monitoring systems.

1. **Improving the knowledge of the dynamics of the soil nutrient budget**. Obtaining reliable, updated, and readily available sources of information on soil nutrient dynamics represents one of the main challenges for developing and improving the knowledge of soil fertility and the nutrient budget (Figure 1). Sustainable soil fertility management and restoration requires a solid understanding of soil nutrient flows, stores, inputs and outputs, and the soil's physical, chemical, and biological properties that regulate nutrient availability (Figure 2). Progress in understanding soil nutrient dynamics must be accompanied by identifying key indicators for monitoring nutrient movement to serve as the basis for nutrient balance development and mapping.
2. **Supporting the decision-making on soil nutrient management, nutrient budget, and climate change mitigation at global, national, and local scales.** The activities and outcomes of WG1 will support the establishment of national soil fertility monitoring systems, and the development of tools for monitoring and evaluating soil fertility.

[1] The complete list of recommendations of the GSOIL4N Outcome Document are available **HERE**. The summarized recommendations include:

- Develop country-driven global soil nutrient and nutrient budget maps.
- Map and monitor soil fertility in a broader perspective by also considering the physical, chemical, and biological soil properties.
- Support countries with capacity development for conducting soil nutrient budget maps and national soil information and monitoring systems.
- Advocate for a global approach to facilitate the collation and availability of soil fertility data and information.
- Adopt a holistic approach that considers all aspects of soil nutrient inputs and outputs.

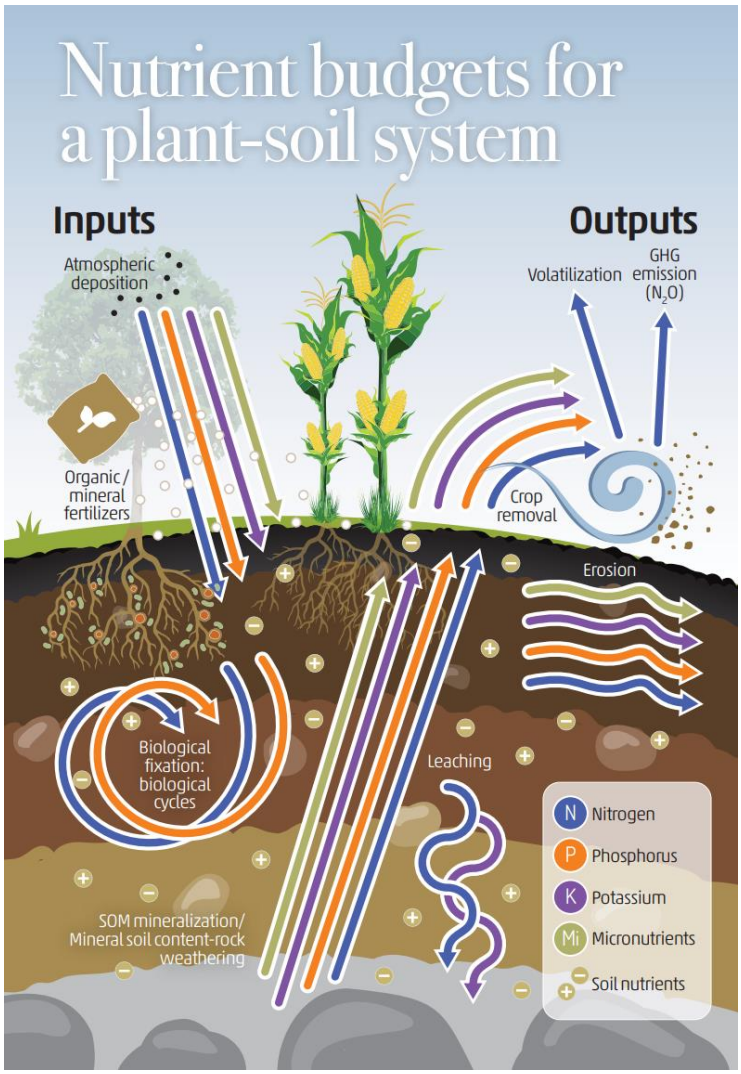

Figure 1. A schematic of nutrient budgets for a system showing the nutrient inputs and outputs. The arrows indicate input and output fluxes. The outputs include those nutrients harvested and removed from the system, such as crops, straw, and animal products, which are usually economically valuable products. Different colors represent different nutrients. Source: FAO. 2022. Soils for nutrition: state of the art. Rome. https://doi.org/10.4060/cc0900en

3. **Promoting collective ownership, openness, and innovation in creating novel data-sourcing pipelines** and analytical tools to make progress on the knowledge of soil fertility and fertilizers management.

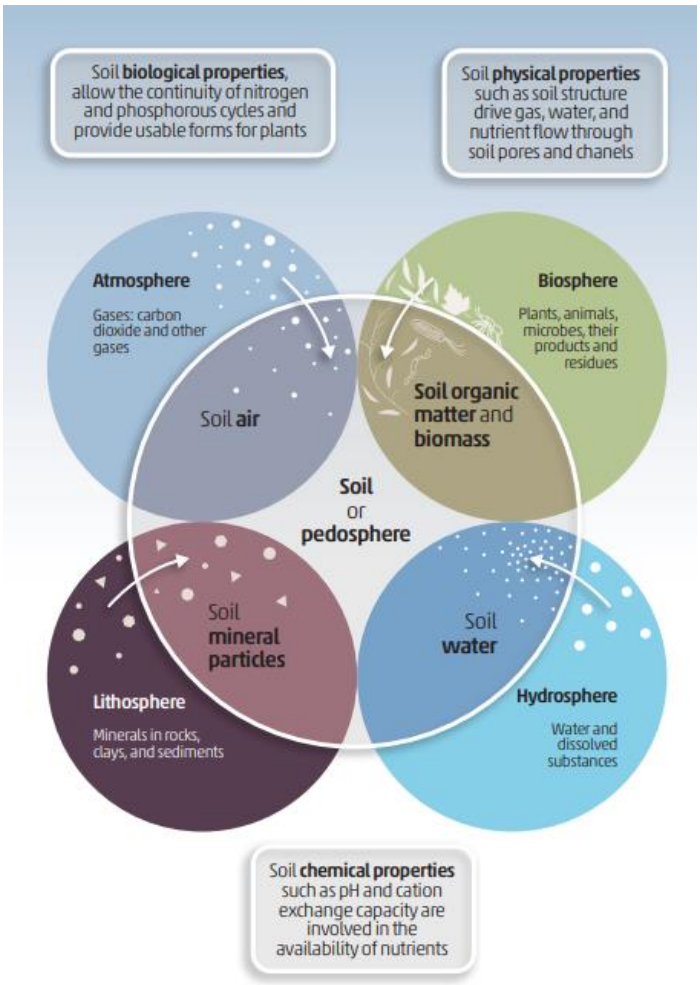

Figure 2. Physical, chemical, and biological soil properties, as well as the confluence of soil components including water, air, minerals, and biota make possible the continuity of relevant processes affecting directly or indirectly the nutrient availability for plants. *Source: FAO. 2022. Soils for nutrition: state of the art. Rome. https://doi.org/10.4060/cc0900en*

Table 1 describes WG1's proposed work areas, activities, and products in the short, medium, and long term. INSII- International Network on Soil Information System.

Table 1. Proposed areas of work, activities, and products of the WG1 in the short, medium, and long term. Soil-Land-Water Digital Integrated Information System (SoLaWISe); INSII- International Network on Soil Information System.

	Activities/outcomes (with the cooperation of INSII)		
Area of work	**Short-term**	**Medium-term**	**Long-term**
Improve the knowledge and enhancing/building capacities on soil fertility monitoring and soil nutrition plan development and evaluation.	ACTIVITIES: ***Webinar:*** Soil health as a prerequisite for crop production: The link between soil physical, chemical and biological properties and crop nutrition **Webinar:**	ACTIVITIES: **Serial workshops** for the identification and simplification of key indicators to define soil fertility status at local, regional, and global scales **Serial workshops** to review the models for the	Support for developing national and global soil nutrient budgets and soil fertility maps.

	Dynamic changes of soil nutrients: Understanding and evaluating soil nutrient (NPK, and micronutrients) fluxes, stocks, inputs and outputs at local, regional, and global scales **Communication and raising awareness material** about the factors driving nutrient availability and soil fertility	evaluation of soil nutrient dynamics and soil fertility evaluation Develop **online courses** on the interaction of soil fertility, sustainable soil management, and crop nutrition.	
	PRODUCTS: **Webinars** **Infographics** about the soil nutrient dynamics (for example, Ten facts about nitrogen, Ten facts about phosphorus, among others).	PRODUCTS: **Publication of a Booklet** How to measure soil fertility at multiple scales? Key soil fertility indicators **Publication of a review** Models for the Soil Nutrient Budget Assessment **Online course** for EduSoils Platform	PRODUCTS Support to the **development and launch** of the global soil nutrient budget map
Supporting the decision-making on soil nutrient management, soil nutrient budget, monitoring system, and climate change mitigation at global, national, and local scales	ACTIVITIES: Development of **practical field tools** to evaluate soil fertility status Development of **practical field tools** for issuing sustainable fertilizer recommendations	Calibration and testing of **practical field tools** to evaluate soil fertility status Calibration and testing of **practical field tools** for issuing sustainable fertilizer recommendations	
	PRODUCTS: Review of the key elements for the development of web tools and apps	PRODUCTS: Web tools for the soil fertility status assessment and sustainable fertilizer recommendations	
Establishment of a global soil nutrient monitoring system and promote a data-sharing partnership	ACTIVITIES: ***Conducting workshops and webinars about the*** integrated monitoring management among soil fertility, crop yield, and climate. Building up the soil fertility data-sharing partnership		
	PRODUCTS: Launch of the Soil fertility data sharing partnership Development of a **global soil nutrient monitoring** system in line with the SoLaWISe		

Potential collaboration opportunities

The WG1 will engage with other GSP technical networks, especially with the International Network of Soil Information Institutions (INSII). The WG1 can support the collection, updating, and standardization of knowledge of soil nutrient status and soil fertility indicators for developing the global nutrient map and the global nutrient budget.

Other potential partners and initiatives to engage with are the new global crop mapping initiative Soil-Land-Water Digital Integrated Information System (SoLaWISe), the Global Yield Gap Atlas (GYGA), the European Soil Observatory (EUSO), MARS - Monitoring of Agricultural Resources and contribution to GEOGLAM, and the Geospatial Platform of FAO Hand-in-Hand Initiative.

Working group 2. Soil fertility and fertilizer management

The WG2 will promote that sustainable soil management (SSM) and sustainable fertilization practices are widely known and disseminated at the farm scale, emphasizing innovations that optimize nutrient use efficiency.

The objective of WG2 is to promote and disseminate sustainable management of inorganic and organic fertilizers and other nutrient sources through integrated soil fertility management approaches, increasing fertilizer use efficiency, and implementing nature-based solutions, technological tools, and innovations. These objectives align with Recommendation 4 included in the GSOIL4N Outcome Document, which advocates for adopting SSM practices since they are the most cost-effective solutions to increase soil nutrient content and fertility. There is no single solution to all soil fertility problems, but a portfolio of alternatives can be employed. Therefore, WG2 will direct its efforts toward developing and implementing a portfolio of solutions to avoid the underuse, misuse, and overuse of fertilizers, greenhouse gas emissions, and environmental pollution. The activities of WG2 will focus on the following three main aspects:

1. The identification, compilation, and promotion of successful field-tested and calibrated soil management practices proven to increase fertility, crop nutrition, and crop yields in different types of soils, crops, and climates. Examples of these practices are zero or reduced tillage, cover crops, crop rotation, pulses, nutrition-sensitive agriculture, etc.
2. The identification and promotion of practices that, in addition to maintaining yields and preserving soil fertility, are aimed at reducing greenhouse gases and atmospheric pollution, especially of water. Examples of these practices are those based on the 4R approach, biofertilizers, precision agriculture, and other innovations.
3. The establishment of an environmentally friendly and nutrition-sensitive (not exclusively yield-oriented) fertilizer recommendation system.

Table 2 summarizes the work areas, activities, and outcomes of WG2.

Table 2. Areas of work, activities and outcomes proposed to be developed and implemented by the WG2.

	Activities / outcomes		
Area of work	**Short-term**	**Medium-term**	**Long-term**
Identification, description, and compilation of **locally adapted SSM practices** oriented to improve soil fertility, crop nutrition, and nutrient use efficiency	ACTIVITY: Series of ***webinars*** about: - Soil and crop management strategies - Zero or reduced tillage, soil recarbonization, cover crops, crop rotation, pulses - Nature-based solutions - Technology-oriented solution	ACTIVITY: -**Compilation of successful field-proven practices** oriented to improve soil fertility, crop nutrition, and nutrient use efficiency **into practice sheets.** Practice sheets include the use of organic and inorganic fertilizers and other alternative nutrient sources	ACTIVITY: Promote sustainable management of soil fertility at national and global levels. -**Mobilize resources** to improve soil fertility and fertilizer management in the field.

	- Innovations and alternative fertilizer sources - Nutrition sensitive agriculture	such as biofertilizers, biostimulants, micronutrient sources, and recycled nutrient sources -**Disseminate the practice sheets** to potential users and promote the adoption and implementation of SSM and fertilization practices -Training organization to improve soil fertility and fertilizer management among multiple stakeholders and with close collaboration with the Soil Doctors program.	-**Promote capacity building** for government and policymakers
	PRODUCTS: Webinars Raising awareness material	PRODUCTS: - **SSM and fertilization practices fact sheets** -Development of a **Manual of Soil fertility assessment and management and fertilization recommendations**	PRODUCTS: -Publication of a **Technical Manual of SSM and fertilization practices** based on the **SSM and fertilization practices fact sheets**
Avoiding underuse, misuse and overuse of fertilizers through the optimization of nutrient use efficiency and **fertilizer recommendations**	ACTIVITY: Enhancing/development capacities on generating sustainable fertilization recommendations Advocate for the adoption of fertilization approaches based on soil fertility evaluation	ACTIVITY: Development of a ***Manual of sustainable fertilization recommendations***	ACTIVITY: -**Database** compiling the SSM and fertilization practices to support decision-making tools such as apps and models - Development of a Fertilizer recommendation system
	PRODUCT: -Series of Workshops on the basis for generating sustainable fertilization recommendations	PRODUCT: Publication of a **Manual of sustainable fertilization recommendations**	PRODUCT: Launch of a **Fertilizer recommendation system** Decision-making tools development for the optimization of fertilizer application

Potential collaboration opportunities

The WG2 will engage with other GSP programs and technical networks, especially the Soil Doctors Program, the SOILEX and EduSoils platforms, the International Network on Soil Pollution (INSOP) and the International Network on Soil Biodiversity (NETSOB).

WG3. Fertilizer safety and quality assessment

The objective of WG3 is to monitor and improve the quality and safety of traditional (organic and inorganic) and innovative nutrient sources (biofertilizers, biostimulants, and recycled sources). The International Network on Fertilizer Analysis (INFA) has become the WG3.

WG3 focuses on harmonizing methodologies and protocols for the quality and safety assessment of fertilizers and alternative nutrient sources and building and strengthening the national capacities of laboratories. Table 3 describes the work areas, activities, and products of WG3 in the short, medium, and long term.

Table 3. Areas of work, activities, and products of the WG3 in the short, medium, and long term.

	Activities / outcomes		
Area of work	**Short-term**	**Medium-term**	**Long-term**
Harmonization laboratory analytical protocols for the safety and quality assessment of fertilizers	ACTIVITIES: Harmonization of standard operational protocols (SOPs) for: - The nutrient content (nitrogen, phosphorus, and potassium) of organic and inorganic fertilizers - The assessment of the heavy metal content of mineral fertilizers - PRODUCT: ***Publication of harmonized SOPs*** for organic and inorganic fertilizers' nutrient content (nitrogen, phosphorus and potassium).	ACTIVITIES: -Harmonization of standard operational protocols (SOPs) for the assessment of heavy metal content of mineral fertilizers -Capacity development for the adoption and implementation of the harmonized SOPs PRODUCTS: ***-Publication of harmonized SOPs*** for the assessment of heavy metal content of mineral fertilizers ***-In-person training*** for the adoption and implementation of the harmonized SOPs	ACTIVITY: Report of the adoption and implementation of the harmonized SOPs
Capacity development for quality assurance of analytical procedures and laboratory staff performance	ACTIVITY: -Exploring, enhancing/building capacities on quality assurance of analytical procedures and laboratory staff performance PRODUCTS: ***-Prospective survey*** on quality assurance practices ***-Webinar*** on laboratory quality assurance practices	ACTIVITY: -Exploring, enhancing/building capacities on **quality assurance of analytical procedures** and laboratory staff performance -**Launch global proficiency tests** for the quality assurance of laboratories' analytical practices PRODUCTS: ***-Publication of Practical Guidelines*** on Quality Assurance Analytical Procedures -***Publication of the Report*** of the Ring Tests -***In-person training*** to improve laboratories' quality assurance practices	ACTIVITY: ***Implementation and adoption*** of good analytical laboratory practices to improve quality assurance ***Global Ring Tests for different variables***
Regulations and policies on the safety and quality of fertilizers	ACTIVITIES: -Improve the knowledge of the national ***regulations for the importing and exporting*** of soil fertilizer samples PRODUCTS: ***-Database*** gathering national information on customs procedures for the import and export of fertilizer samples	ACTIVITIES: -Raising awareness and dissemination on the ***permissible limits of heavy metals*** in mineral fertilizers PRODUCTS: ***-Publication of Policy Briefs*** on the permissible limits of heavy metals in mineral fertilizers	ACTIVITIES: -Gathering of national information on the regulations for the use and management of fertilizers -Support members to develop national policies and regulation on fertilizer quality and safety.

Potential collaboration opportunities

The WG3 will engage with other GSP programs and technical networks, especially the Global Soil Laboratory Network (GLOSOLAN), the International Network on Soil Pollution (INSOP), the International Network on Soil Biodiversity (NETSOB), the Soil Doctors Program, and the Soil Import Legislation (SIMPLE) platform.

INSOILFER governance

The governance of INSOILFER will follow the structure of other GSP technical networks. A Chair of the network will be appointed along with three Vice-Chairs corresponding to the three working groups in the subsequent INSOILFER meetings. In addition each working group will have a technical committee and reference institutions to assist the Vice-Chairs (Figure 3).

Figure 3. Elements that make up INSOILFER.