



International Network on Soil Fertility and Fertilizers

Soil health as a prerequisite for crop production: the relevance of organic fertilizers

**Webinar report
January 30, 2024**

**FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS
Rome, 2024**

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1. Background

Soil health, defined as the continued capacity of a soil to function as a vital, living ecosystem that sustains plants, animals, and humans, plays a pivotal role in the achievement of the United Nations Sustainable Development Goals (SDGs). Accordingly, promoting soil health building practices is central to the Food and Agriculture Organization's (FAO) role as a custodian or contributing agency to SDGs, and its mandate to eliminate hunger, food insecurity and malnutrition. Indeed, these practices are increasingly needed by farmers and land managers, experimented with by scientists, and incentivized by governments. The [Voluntary Guidelines for Sustainable Soil Management](#) (VGSSM) identifies organic fertilizers (also cited as organic amendments in the VGSSM document) as a mean to address multiple soil threats, such as the loss of soil organic matter (SOM) content and soil biodiversity, soil nutrient imbalance, saline soil reclamation, soil acidification, and others.

In this context, the [International Network on Soil Fertility and Fertilizers](#) (INSOILFER) was established, together with six other technical networks, by the FAO's [Global Soil Partnership](#) (GSP). INSOILFER aims to promote soil health, address nutrient imbalances, and promote the adoption of soils for nutrition concept for making soils healthy and fertile by 2030 as a contribution to the transformation of agrifood systems. The network fosters the adoption and the implementation of sustainable soil fertility management, avoiding the underuse, misuse, and overuse of fertilizers, and reducing the environmental and health impacts of fertilizer use. ***“The soil health as a prerequisite for crop production: the relevance of organic fertilizers webinar”*** is part of INSOILFER's continuous efforts to enhance capacity building on sustainable soil management and bring together a large audience working on soil health aspects to discuss organic fertilizers and links to soil health. The webinar, held virtually on January 30, 2023, counted the participation of 263 participants from 123 countries from different regions of the world (Figure 1). Remarkably, this event is the first in a series of webinars that will be organized by INSOILFER across a spectrum of pertinent subjects related to soil health and fertility. Anticipating continued engagement, relevant audience are encouraged to stay informed and await forthcoming announcements regarding subsequent webinars within this enlightening series.

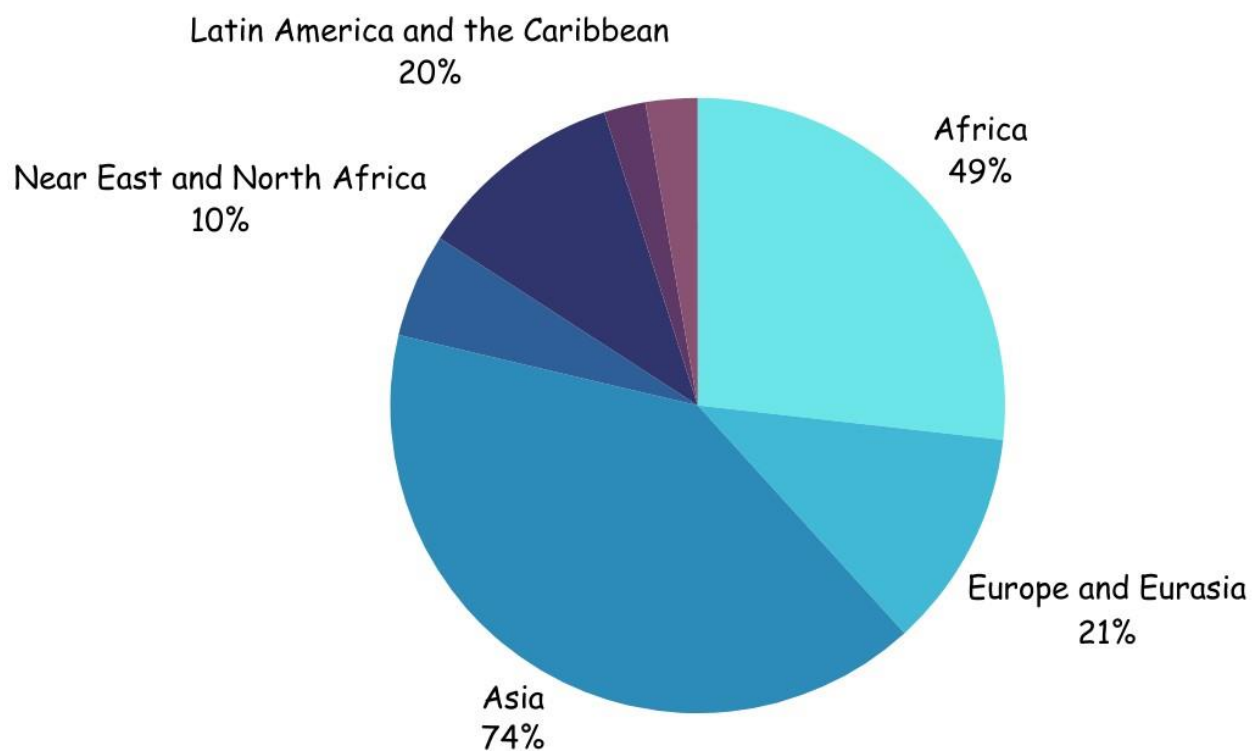


Figure 1. Regional distribution of participants.

2. Objectives of the webinar

The objectives of the webinar are:

- Support capacity development on sustainable soil management practices focused on boosting soil properties,
- Discuss the gaps and challenges in the use of organic fertilizers,
- Exchange knowledge and technology around the use of organic fertilizers,
- Support food security and sustainable agri-food systems,
- Link the webinar conclusions with INSOILFER working groups activities.

The webinar agenda, presentations and recordings are available for consultation [HERE](#).

3. Opening remarks

Mr. Lifeng Li, Director of the Land and Water Division (NSL), FAO

After welcoming webinar participants, Mr. Lifeng Li, Director of the FAO Land and Water Division (NSL), set the stage for a crucial dialogue and capacity development effort on the relevance of organic fertilizers for soil health and crop production.

Mr. Li first highlighted the collaborative essence of INSOILFER, bringing together a diverse spectrum of scientists, experts, extensionists, and institutions worldwide with a shared mission: identifying and analyzing emerging issues related to sustainable soil management and fertilizers and sharing knowledge. Mr. Li also highlighted FAO's commitment to promoting sustainable agricultural practices, safeguarding the planet's well-being, and ensuring the sustainability of agri-food systems.

Mr. Li then articulated the pivotal role of soil health, not only as an environmental concern but as a crucial element shaping the livelihoods of millions of farmers and the well-being of communities worldwide. Mr. Li also emphasized that embracing organic fertilizers represents a significant stride towards mitigating the adverse effects of chemical-intensive agriculture and contributes to the conservation of precious ecosystems and their services. Organic fertilizers contribute to the long-term health of the soil by promoting biodiversity, improving soil structure, and fostering microbial activity. These benefits, in turn, lead to increased water retention, reduced erosion, and enhanced nutrient cycling – essential factors for sustainable and resilient agriculture. Therefore, this webinar addresses the integral connection between soil health, crop production and organic fertilizers.

4. Keynote presentations

Dr. George Ndzana, INSOILFER Chair

Introduction to the webinar series: setting the scene.

Dr. Ndzana began his presentation by shedding light on the pivotal role that INSOILFER plays in safeguarding soil health through collaborative efforts on sustainable soil fertility and fertilizer management. Following this insightful overview, Dr. Ndzana presented the governance structure of INSOILFER, as illustrated in Figure 2. This visual representation provided a comprehensive insight into the

organizational framework of INSOILFER and its 3 working groups (WG), enhancing the audience’s understanding of how the network operates and collaborates to address crucial issues in soil management. Dr. Ndzana also briefly presented the initial work plans of the three WG (Box 1).

Dr. Ndzana stressed that capacity development is a cornerstone activity of INSOILFER. Therefore, this INSOILFER webinar series will cover a wide spectrum of member selected topics related to soil fertility and health. INSOILFER strives to ensure every member participates in shaping the learning agenda, ensuring webinars address specific needs and interests and accompany advances in science.

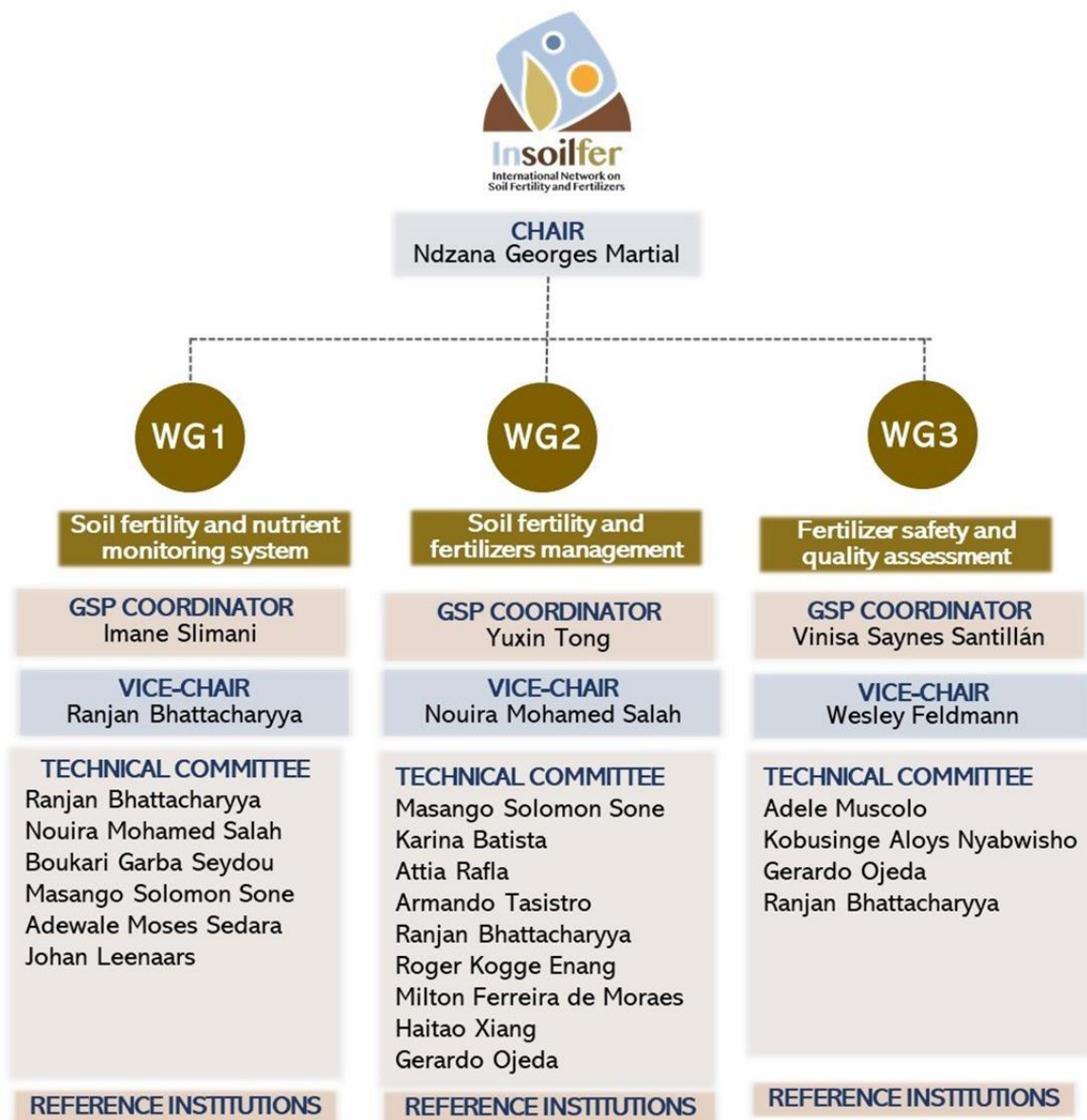


Figure 2. INSOILFER and its three WG governance.

Box 1: INSOILFER WG's and their working plan

INSOILFER comprises three working groups (WG), each with specific missions, governance, and working plan:

1. **WG1- Fertility and nutrient monitoring system:** this group strives to establish a comprehensive global soil nutrient monitoring system while fostering collaborative data-sharing partnerships. This group also aims to facilitate informed decision-making across various levels—global, national, and local—regarding soil nutrient management, soil nutrient budgets, monitoring systems, and climate change mitigation strategies. In addition, WG1 is committed to enhancing knowledge and building capacities on soil fertility monitoring.
2. **WG2- Sustainable soil fertility and fertilizer management:** this group focuses on identifying and describing locally adapted practices to enhance soil fertility, crop nutrition, and nutrient use efficiency. The group also aims to prevent underuse, misuse, and overuse of fertilizers through formulation of fertilizer recommendations. Additionally, WG2 focuses on capacity building for generating sustainable fertilization recommendations and advocates for adopting fertilization approaches based on thorough soil fertility evaluations.
3. **WG3-Quality and safety of fertilizers:** this group focuses on harmonizing laboratory analytical protocols for assessing the safety and quality of fertilizers. The group places a strong emphasis on capacity development, aiming to enhance skills in quality assurance related to analytical procedures and the performance of laboratory staff. WG3 also engages in formulating regulations and policies concerning the safety and quality standards of fertilizers. By addressing these aspects, WG3 aims to ensure standardized and high-quality practices in the fertilizer industry and promoting the safety and efficacy of fertilizers in agricultural applications.

Ms Vinisa Saynes Santillán, INSOILFER co-coordinator

The International Network on Soil Fertility and Fertilizers-INSOILFER: Goals and Potentialities

In her presentation about INSOILFER's goals and potentialities, Ms Saynes Santillán emphasized the network's foundational goals, including the restoration of soil health and nutrient balance by addressing the multifaceted challenges associated with the misuse, underuse, and overuse of fertilizers. In this context, she recognizes the FAO's [International Code of Conduct for the Sustainable Use and Management of Fertilizers](#) (Fertilizer Code) as a pivotal instrument to guide the judicious use of fertilizers. The Fertilizer Code provides not only essential recommendations, but also offers a locally adaptable framework and a voluntary set of practices tailored to the specific needs of multiple stakeholders, including governments, laboratories, and industry.

Ms Saynes Santillán also stressed that INSOILFER, through the work of its three WG, commits to tangible solutions. These include the establishment of a soil nutrient monitoring system, a soil recommendation system on best soil and fertility practices, and globally harmonized metrics for assessing fertilizer quality and safety. Ms Saynes Santillán concluded her presentation by emphasizing the potentialities of INSOILFER, which revolves around restoring and maintaining a balanced nutrient profile in the soil, improving nutrient use efficiency, increasing agricultural production while reducing environmental externalities, and addressing policy gaps on fertilizer regulation. She also emphasized the role of alternative nutrient sources, such as organic fertilizers, with that regard.

Pr. Adele Muscolo, University of Reggio Calabria

Soil health as a prerequisite for crop production: The relevance of organic fertilizers

In her presentation, Pr Adele Muscolo emphasized the role of organic fertilizers in advancing soil health and improving its capacity to support ecosystem functioning, which are otherwise diminished by the combined effect of chemical fertilizers and unsustainable soil management, soil degradation processes and climate change. Unlike chemical fertilizers, organic fertilizers, which consist of naturally derived raw materials from plants and animals, offer several advantages including promoting soil biodiversity, improving soil structure and aeration, increasing soil water retention, and mitigating climate change through carbon sequestration. Because organic fertilizers improve soil fertility and reduce nutrient loss, they also diminish the cost associated with fertilizer input and environmental externalities.

Pr. Muscolo also clarified that organic fertilizers deliver nutrients through two primary mechanisms: directly, by releasing nutrients into the soil solution and serving as an energy source for soil microbes, and indirectly, by enhancing soil

physical, chemical, and biological soil properties. She also emphasized that while chemical fertilizers feed the plants, organic fertilizers feed the soil, ensuring the continuous provision of soil nutrients to plants and microbes, and supporting plant vigor. However, organic fertilizers efficiency depends on various factors, including but not limited to the type and composition of fertilizers, crop systems (mono vs. poly cropping systems), and prevailing environmental conditions.

Pr. Muscolo highlighted that while several soil health indicators exist, those associated with soil microbial health and activity are the most important. This is because microbes regulate many important processes such as organic matter decomposition, nutrient cycling, salinity, disease suppression and soil aggregation. She also showed fascinating images illustrating how organic fertilizers contribute to a healthy rhizosphere environment—for example through fostering beneficial plant (roots) -microbes' symbiotic relationships.

Recent efforts to convert organic wastes into commercial fertilizers offer promise for reducing fertilizers environmental impact and enhancing soil fertility; this is an example of a circular economy approach. Technologies like anaerobic and aerobic digestion, along with biotechnology, produce end products with good properties, including digestate, compost, and vermicompost. In a lab experiment presented by Pr. Muscolo, waste-derived fertilizers showed a significant increase in organic matter content and microbial biomass compared to chemical fertilizers in alkaline sandy-loam soils. The utilization of organic fertilizers increases soil use efficiency, with by-products positively impacting soil properties and contributing to long-term fertility. In regions of the world with urgent food production needs and low environmental footprints, Pr. Muscolo recommended the use of combined mineral and organic fertilizers to expedite plant soil nutrient pools while enhancing soil microbial activity, composition, and diversity, which in turn ensure sustained nutrient provision and improved soil health.

In conclusion, Pr. Muscolo underscored the crucial role of healthy soils, which contribute significantly to promoting human health by providing continuous, high-quality, and nutrient-dense food.

5. Discussion

Following the presentations, a discussion ensued among the audience, guided by questions from participants through the Q&A chat box. Summarized below are the main questions and the corresponding answers provided by the speakers, centering around topics related to organic fertilization and INSOILFER.

Table 1: Questions on organic fertilizers use in agriculture.

Question: can organic fertilizers replace chemical fertilizers?
Answer by Pr. Muscolo Organic fertilizers can be used alone. According to Pr. Muscolo, research projects showed that the use of organic fertilizers significantly increased plant productivity and quality compared to chemical fertilizers. These results are consistent across tomato, onion, pepper, broccoli, nuts, olive trees and the quality of olive oil. However, good management practices are required. These practices include the use of high-quality fertilizer and determining fertilizer rates based on soil properties.
Question: <i>why soil health is not synonymous of soil fertility?</i>
Answer by Pr. Muscolo Soil health encompasses the overall condition and functionality of the soil, considering physical, chemical, and biological aspects. On the other hand, soil fertility specifically refers to the soil's ability to provide essential nutrients for plant growth. Although fertile soil is capable of productive yields, it is not necessarily a healthy soil. A healthy soil goes beyond fertility, showcasing resilience, microbial diversity and biodiversity, high food quality, and overall ecosystem functionality.
Question: <i>how to ensure manure can be safely used in agriculture?</i>
Answer by Pr. Muscolo Manure requires stabilization for safe use. Unlike compost, which utilizes controlled decomposition at elevated temperatures to effectively reduce pathogens, the application of fresh manure can introduce these pathogens to the soil, posing potential risks to both crops and environmental health.
Question: <i>how to choose organic fertilizers of good quality?</i>
Answer by Pr. Muscolo Be sure to use a "clean" fertilizer that does not have heavy metals and pathogens.

Question: how do you use wastewater sludge as an organic fertilizer?
Answer by Pr. Muscolo Be sure to ensure a proper treatment of wastewater to align with permissible thresholds for pathogens and metals.
Question: how to enhance the capacity of smallholder farmers to produce in-house organic fertilizers?
Answer by Pr. Muscolo It depends on the availability of in-house raw material (e.g. food and house waste, crop residues, etc.) to produce organic fertilizers.

Table 2: questions on INSOILFER

Question: how does INSOILFER support soil nutrient budgeting, monitoring, and mapping?
Answer by Ms. Saynes Santillán WG1 of INSOILFER deals with monitoring and mapping soil nutrients. WG1 aims to determine methodologies on how to identify and locate nutrient budgets globally, considering the different nutrient levels in various parts of the world. Dedicated group meetings will be convened to explore these topics more in detail.
Question: how does INSOILFER address the issues of greenhouse gas emissions and water deficiency?
Answer by Ms. Saynes Santillán This work will be addressed by WG2 of INSOILFER. This group will compile, identify and disseminate sustainable soil management practices that will simultaneously increase crop yield and reduce environmental externalities including the emissions of greenhouse gases.
Question: what protocols are in use to assess the quality of both organic and inorganic fertilizers
Answer by Ms. Saynes Santillán WG3 is developing and harmonizing protocols for the assessment of the quality of both organic and inorganic fertilizers. Currently, WG3 is developing protocols on the determination of total nitrogen, phosphorus, potassium and heavy metal contents and this year work will be dedicated to biofertilizers.

Question: how to involve partners in INSOILFER?

Answer by Dr. Ndzana

As we collaborate with reference institutions in each country, INSOILFER welcomes partnerships with other entities. Everyone is encouraged to reach out to INSOILFER to explore and plan specific activities, such as capacity development webinars, contributing to the goal of ensuring sustainable fertility management.

6. Conclusion

The webinar was concluded by Mr. Yuxin Tong, INSOILFER Co-Coordinator and Global Soil Partnership Secretariat by recalling and highlighting key messages:

- 1) Replacing chemical fertilizers with organic fertilizers is possible. Organic fertilizers were shown to surpass their chemical counterparts in ensuring agricultural productivity and food quality.
- 2) Combining chemical and organic fertilizers can maximize the benefits for soil productivity and health.
- 3) Adopting and improving soil management practices is key to ensure the efficacy of fertilizers while reducing environmental externalities.
- 4) Ensuring the fertilizers, we use are of a good quality is critical for the safety of the environment and the food we consume.
- 5) INSOILFER is open to everyone!
Please join us at this [registration link](#).
- 6) and lastly, Mr. Tong encouraged the audience to stay informed and await forthcoming announcements regarding subsequent webinars on soil fertility.

We sincerely apologize to the audience for being unable to address all questions within the allocated time. Your understanding is greatly appreciated.

Annex 1: Agenda of the webinar

Webinar “Soil health as a prerequisite for crop production: The relevance of organic fertilizers”

30 January 2024, 13:00 – 14:30 CET



| [REGISTRATION LINK](#)

The [International Network on Soil Fertility and Fertilizers](#) is pleased to invite you to the webinar “Soil health as a prerequisite for crop production: The relevance of organic fertilizers” that will take place online on Tuesday 30 January 2024, 13:00 – 15:00 (Central European Time).

This is the first in a series of webinars that will be organized by INSOILFER to enhance capacities on the sustainable management of soil fertility and fertilizers. The first webinar will focus on the relevance of soil properties and organic amendments to soil health and crop production.

Objectives of the webinar:

- Support capacity development on sustainable soil management practices focused on boosting soil properties.
- Discuss the gaps and challenges in the use of organic fertilizers.
- Exchange knowledge and technology around the use of organic fertilizers.
- Support food security and sustainable agro-food systems
- Link the webinar conclusions with INSOILFER working groups activities

Agenda

Moderator: Mr Yuxin Tong, INSOILFER Co-Coordinator, GSP Secretariat, FAO

13:00-13:10	Opening remarks <i>GSP Secretariat, FAO</i>
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13:10- 13:20	Introduction to the webinar series: setting the scene <i>Dr Georges Martial Ndzana, INSOILFER Chair</i>
13:20- 13:30	The International Network on Soil Fertility and Fertilizers-INSOILFER: Goals and Potentialities Ms Vinisa Saynes Santillán, GSP Secretariat, FAO
13:30- 14:00	“Soil health as a prerequisite for crop production: The relevance of organic fertilizers” Dr Adele Muscolo, University of Reggio Calabria, Italy
14:00- 14:25	Q & A session and open discussion
14:25- 14:30	Conclusions and closure of the webinar

Annex 2: List of participants

Full name
Nkiruka ODOH
Reymond Tamodra
Alireza Esmaili Falak
Edwind Lasum
Ibrahim Mosaad
Ivy Joy Mabao
Aruna srikantha Jayawardana Herath Mudiyansele
ANNET MWANGI
Pako Dick
Doreen Meso
Kobusinge Aloys Nyabwisho
Gabrielle De Souza
OLUWATOSIN ODERINDE
Isabelle Verbeke (FAO)
Hristina Poposka
Amira Hachana
Ndzana Georges Martial
Adele Muscolo
Muhammad Khalid Rasheed
Fuat Kaya
KARINA BATISTA
Samson Mang'oka
Dr. Hana'a Burezq
Jhanilla Saumat
June Mark
Dr Mohammad Iqbal Bhat
Bhairava Machunuru
Vinisa SaynesS/FAO (SaynesSantillan, Vinisa)
ROY BOSQUE
Lifeng Li (FAO)
Windee Lusotan
Roger Kogge Enang
Gerald June Cabangil
Sharalyn Trinidad
Tong, Yuxin

Tanie Sisi
Zhivka Gancheva
Daisy Myint
Jaypee Patentes
Jeyrald James Tacio
Trecia Casinillo
EDFRANC MASUMPAD
INASS ZAYANI
Mary Angeline Balderas
Rosa Martinez
Wesley Feldmann
Khin Mu
Victor Chude
Purissima Juico
Muhammad Norhelmi Ahmad
Anas Abubakar Dogo
Alexey Bogomolov
Armando Tasistro
Shahista Abutova
Washington Mutatu
JOHN JACINT LAAG
Aung Kyaw Thu
Poulouma Louis Yameogo
Elvis Weullow
Gretchen Arizala
Yiyi Sulaeman
Beatrice Sadinis
Eva Karpati Dr
Knowledge Mushonga
Aliyah Cabilin
Grace Enojada
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Pape gora Kane
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Nkole Mwamba
isabelle kowalewski
Danilo Lucchesini
FELIZARDO JR ARADOR
Antonietta La Terza
El Mayad
Cherry Jones Alimpoos
Eike Lepmets
Zhivka Gancheva
Ludmila Vorotyntseva
Eugene RURANGWA
Bibiána Kotzianová
Ogutu Omori
Shafar Jefri Mokhatar
Selebalo Ramakhanna
Agustín García
Emilda Edwin Samaie
Adriano Sofo
Salifou GOUBE MAIROUA
Anupam Pandey
noura Al Ameri
Bouhsane Naima
Lea Ann Marisee Flores

Anabela Cachada
Samuel Kwasi Benefo
Stanko Milić
Stephen Ahenda
Javidan Guliyev
Vinai Pitiyont
Williams Egbe
Bella Anis
Osama Abu-Libda
Femilyn Tangcogo
Attia Rafla
Fatma Béjaoui
Irae Guerrini
Jorge Perez Peña
Sanjay Swami
Kristine Balucos
Ramakgwale Mampholo
Matthew Idu
Verónica Esteva Jiménez
Benjamin Labo
RodriguezEugenio, Natalia
Gabriel Adebawale Adewoye
Rahina Kausar
Sevinc Madenoglu
Fatimata Saba
Edwin Grisales
Florfinia Sanchez
sebastian II Ilegado
Girmay Darcha
Benedicta Essel Ayamba
Arwin Arribado
Joseph Uponi
Yara Khairallah
Grace Ajayi
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Tshering Yangchen
Marnus Cherry
Joy Eloiza Rosales

Virgie Celestial
Joël Jordan Dzokou Kontchou
Maria Dulce Alibangbang
JENNIFER ATAY
Sanjay Kumar Raina
Jacques BAZEMON
Godwin Sabah
Denisse Zamorano
Roman Kramme
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Caroline Heinzl
Valery Aguilar
José Víctor Tamariz Flores
Shahid Ahmed
TRENCHARD IBIA
Ricualdo Alouidor
Hong Wang
Mathew Sani Amana
Gayanthi Rahubaddhe
JACQUES TAVARES
Gerardo Ojeda
Iryne Gepiga
Wutem Ejue
Emmanuel Nnabuihe
Chomar Htwe
Josephine Arbes
Hameedullah Ahmadzai
Syed Waqar ALi Shah
Sambo Pheap
Susana Araujo
Merima Jasarevic
Ali Madi
Mary Odukoya
CAROLINE KUNDU
Riccardo Gambini
Antónia Neto
Shabbar Shah

Rose Ndango
Gunsham Seeborun
Sikandar Mahmood
Baoluo Ma
Aimee Christine Deligero
Tomohiro Ban
Mathieu Mal
umar Rahman
Sunil Manandhar
Seheno Rinasoa
Camilo Shaw
Uriel Ignacio
Olivier Lépine
Listher Jay Alison
Paul Kristian Berjuega
Lucia Juárez Rodríguez
Juan Miguel Guerrero
Allan Octat
Aliyu Mahmud
Long Vu Van
Avelin Chen
Lucile Sever
Pedro Pato Martins
Oksana Haskevych
HE LI
Azamat Yershbulov
Sasirekha Munikumar
Paula Fernandes
Hany Tatwany
Edvard Fosdahl
D Kigiri
kelvin harrison
Grace Glend Gabisay
mohamed eida
Liza Jofre
Yevhenii Ulko
Aboyeji Christopher
SMILY SMILY

Shermark Navarro
Jesús Rodríguez
Theophilus Isimikalu
Vladimir Sanut
Patrrarat Teamkao
Yeslem Hamoud
Martin Barare
CArolina Mancho
Mahmoud Aminu
Dionisio Bucao
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Oscar Chichongue
Vincent Aduramigba-Modupe
Claudia Hidalgo
Elizabeth Abankwa
Adrienne Zabate
Onja Ratsiatosika
Francis Asare
Clément N'CHO
Amitava Rakshit
Basil Nwangwu
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Zeyede Aregahegn
Bryan Caliguiran

Ebrima Touray
Hannah Corpuz
Mohammad Rafi Salihzada
Ana Arriaga
Silvia Ramos
Francisca Sosa