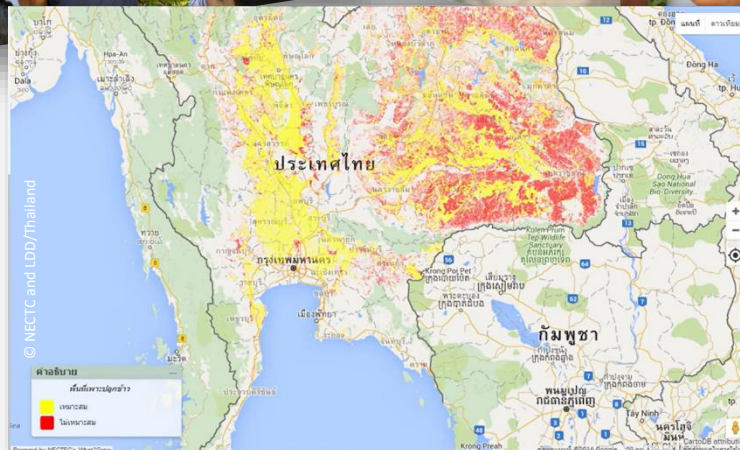




Food and Agriculture
Organization of the
United Nations

Asian knowledge hub on sustainable soil and land management

Learn, share, inspire



Webinar on “Labs and kits: insights on soil analysis”

Date: 7 and 8 November 2023

Time: from 1 to 3PM GMT+7 (Bangkok time)

Platform: Zoom©

Language: English

Introduction

In 2023, the FAO's regional office for Asia and the Pacific (RAP) developed a knowledge hub to facilitate the exchange of knowledge and experiences on sustainable soil and land management in the Asian region. Thus, (i) to enhance the capacity of individuals and organizations in implementing sustainable soil and land management practices, (ii) to facilitate the identification of knowledge and technology gaps that can boost research and development activities, (iii) to encourage the adoption of proven methods while inspiring innovation in sustainable soil and land management, and (iv) to support projects' formulation and implementation activities. In this regard, the hub is an integral component of the FAO's strategy to advance sustainable soil and land management in Asia.

The hub reports and describes countries' original engagements to assess, monitor, preserve, restore or enhance soil health over time as well as United Nations contributions to the topic in terms of equipment, online applications, certification systems, training systems, awareness raising systems and others. Please note that the hub does not report about projects and research studies. By aligning with the principles of collaboration and shared learning, the hub has the potential to drive positive change in agricultural and environmental practices.

The information in the hub were collected using a participatory approach involving the public sector, non-profit sector, academic and research institutions and intergovernmental organizations, and they are meant to support the work of a large range of stakeholders including farmers, local communities, extension agents, policy makers, project managers, researchers and academia, and even the private sector. Being an open-access, live tool, stakeholders have the ongoing chance to submit contributions to FAORAP for review and potential incorporation into the hub.

The hub has information organized into five categories depending on their core scope:

SCOPE 1: Soil assessment, monitoring and mapping, including soil sampling, soil analysis, data analysis and interpretation, and digital soil mapping;

SCOPE 2: Policy, including charters, guidelines and recommendations developed to support countries on policy development. Instruments to support countries on achieving and reporting on international targets are also reported under this scope;

SCOPE 3: Investment, intended as actions and tools that trigger investments at the national, regional and global levels;

SCOPE 4: Field activities, including capacity building activities for the transfer on knowledge, data, information and technology to farmers and other land users; and

SCOPE 5: Communication, including awareness raising, technical and scientific cooperation, and networking activities.

The webinar on “Labs and kits: insights on soil analysis” is organized under scope 1 on soil assessment, monitoring and mapping. This webinar is one among a series of online events orchestrated to facilitate the use of the knowledge hub within the region.

Please note that the online platform hosting the hub is currently under development. However, the specifics regarding the subjects to be covered during the webinar are contained within this document.

This webinar is organized in collaboration with the [Global Soil Laboratory Network \(GLOSOLAN\)](#) of the FAO, its Asian branch ([SEALNET](#)) and the [Center of Excellence for Soil Research in Asia \(CESRA\)](#).

Webinar's objectives

1. To break preconceptions and myths around soil analysis;
2. To support countries on the development of reliable soil testing kits (STKs) by closing the gap between STKs and soil laboratories;
3. To initiate the discussion on soil testing kits harmonization at the regional level;
4. To encourage critical thinking regarding the integration of soil analysis in project formulation and execution; and
5. To collaboratively brainstorm regional essential tools for leveraging soil data to attract investments.

Who can participate?

Participation to the webinar is open to all stakeholders interested on the topic. This webinar is of special relevance to soil chemists, researchers, students, laboratory technicians, extension agents and farmers.

How to participate?

To register for the upcoming webinar on “**Labs and kits: insights on soil analysis**” please follow the registration process outlined below:

1. Click on the provided link to access the registration form: https://fao.zoom.us/webinar/register/WN_1bLiduZUT7uHM3HDyFCadQ
2. Fill out the registration form with accurate and complete information. Make sure to provide your name, email address, organization (if applicable), and any other required details.
3. Once your registration is confirmed, you will receive a confirmation email containing the webinar details, including the Zoom link, date, time, and instructions on how to join the webinar.

Please ensure that the email address you provide during registration is correct and regularly checked to receive important updates and notifications.

We look forward to your participation in the webinar and your contribution to the discussion on promoting soil health and sustainable management practices.

Should you have any questions or require further assistance, please do not hesitate to contact Ms Lucrezia Caon, Land Management Officer, FAORAP at lucrezia.caon@fao.org

Programme

DAY 1	
1:00 – 1:05PM	Welcome remarks <i>Lucrezia Caon, Land Management Officer, FAORAP</i>
1:05 – 1:20PM	The importance of soil analysis and data quality in decision making <i>Nopmanee Suvannang, Intergovernmental Technical Panel on Soils</i>
1:20 – 1:30PM	Soil laboratories vs soil test kits: ROUND 1
SOIL LABORATORIES	
1:30 – 1:50PM	The Global and the Asian Soil Laboratory Networks (GLOSOLAN and SEALNET) <ul style="list-style-type: none">- Methods of analysis- Data quality and assurance- Capacity building <i>Filippo Benedetti, GLOSOLAN Coordinator and Pushpajeet Lokpal Choudhari, SEALNET Chair</i>
SOIL TESTING KITS (STKs)	
1:50 – 2:40PM	Countries' experiences in STKs PART 1: <ul style="list-style-type: none">- Thailand (10 minutes)<ul style="list-style-type: none">o Soil Test Kit <i>Kamarin Nimnualrat, Soil Scientist, Office of Science for Land Development, Soil Mineralogy and Soil Micromorphology Research Division, Land Development Department</i>- India (15 minutes)<ul style="list-style-type: none">o Soil Test Kit (Mridaparikshak) <i>Sanjay Srivastava, ICAR-IISS, Bhopal</i>o Biological Soil Health Kit <i>S.R. Mohanti, ICAR-IISS, Bhopal</i>- Indonesia (15 minutes)<ul style="list-style-type: none">o Smart Soil Sensing Kit <i>Adha Fatmah Siregar, Indonesian Agency for Agricultural Instrument Standardization, Ministry of Agriculture</i>o Lowland Soil Test Kit (LSTK) and Upland Soil Test Kit (USTK) <i>Ladiyani Retno Widowati, Indonesian Institute of Soil and Fertilizer Standardization</i>- Philippines (10 minutes)<ul style="list-style-type: none">o Soil Test Kit <i>Shirley S. Buduan, Section Head, Bureau of Soil and Water Management</i> <i>Moderator: Lucrezia Caon, Land Management Officer, FAORAP</i>
2:40 – 3:00PM	Question and answers

DAY 2

1:00 – 1:10PM	Recap from day 1 <i>Lucrezia Caon, Land Management Officer, FAORAP</i>
1:10 – 1:40PM	Challenging question: Can STKs be harmonized at the regional level? Panel Discussion <ul style="list-style-type: none">• Shirley S. Buduan, Section Head, Bureau of Soil and Water Management, Philippines• Ladiyani Retno Widowati, Indonesian Institute of Soil and Fertilizer Standardization, Indonesia• Sanjay Srivastava, ICAR-IISS, Bhopal, India• Kamarin Nimnualrat, Soil Scientist, Office of Science for Land Development, Soil Mineralogy and Soil Micromorphology Research Division, Land Development Department, Thailand <i>Moderators: Filippo Benedetti, GLOSOLAN Coordinator and Pushpajeet Lokpal Choudhari, SEALNET Chair</i>
1:40- 2:10PM	When can STKs replace soil laboratory analysis? Tips and tricks on STKs development, maintenance and use <ul style="list-style-type: none">• Shirley S. Buduan, Section Head, Bureau of Soil and Water Management, Philippines• Adha Fatmah Siregar, Indonesian Agency for Agricultural Instrument Standardization, Ministry of Agriculture, Indonesia• Sanjay Srivastava, ICAR-IISS, Bhopal, India• Kamarin Nimnualrat, Soil Scientist, Office of Science for Land Development, Soil Mineralogy and Soil Micromorphology Research Division, Land Development Department, Thailand <i>Moderator: Gina Nilo, Director of the Bureau of Soil and Water Management, Philippines and Lucrezia Caon, Land Management Officer, FAORAP</i>
2:10- 2:45PM	Scenario based game <p>FAO would like to assess the impacts (water quality, erosion and floods control, climate change, biodiversity, pollution, nutrient content of crops, etc.) of different sustainable soil management practices in different agroecological zones in Asia with a focus on cash crops. This will allow to select the right practice to implement under specific circumstances and sites.</p> <ul style="list-style-type: none">• What parameters (chemical, physical, biological) shall be considered in soil and plants?• Can soil test kits be used to lower the cost of the analysis and speed up the delivery of results?• For how long shall monitoring activities (analysis) be performed? E.g. analysis every 1, 2, 3 or 5 years• How to ensure the long-term sustainability of this activity? <p>Would you like to engage in this activity? Do you have a project that can be connected to this work?</p> <i>Moderator: Lucrezia Caon, Land Management Officer, FAORAP</i>
2:45 – 2:55PM	Soil laboratories vs soil testing kits: ROUND 2
2:55 – 3:00PM	Closing remarks

Insights about the webinar's subjects

Please be aware that the copyright holder should be duly credited for the information presented in this section of the document.

➤ Global Soil Laboratory Network (GLOSOLAN)

Country of origin: United Nations

Year of development: 2017

Copyright: Global Soil Partnership, FAO

Scope: To build and strengthen the capacity of laboratories in soil analysis and to respond to the need for harmonizing soil analytical data.

Users: soil chemists (soil laboratories)

Beneficiaries: decision makers, farmers and land users in general.

Brief description: The Global Soil Laboratory Network (GLOSOLAN) was established in 2017 to build and strengthen the capacity of laboratories in soil analysis and to respond to the need for harmonizing soil analytical data. Harmonization of methods, units, data and information is critical to (1) provide reliable and comparable information between countries and projects; (2) allow the generation of new harmonized soil data sets; and (3) support evidence-based decision making for sustainable soil management.



GLOSOLAN is organized in regional and national soil laboratory networks that help downscaling activities and better respond to country requests on soil analysis. The work of the network is organized around six thematic areas:

1. Standard operating procedures: harmonization of methods and development of transfer functions;
2. Quality assurance and quality control: development of guidelines and organization of proficiency tests at the global and regional level. The network also supports countries in organizing national proficiency tests;
3. Equipment: provision on guidelines on equipment purchasing, maintenance and use. The network occasionally provides its members with equipment depending on the availability of financial resources;
4. Health and safety: provision of guidelines, training and personal protection equipment;
5. Capacity development: provision of in person and online trainings, which recordings are available on the GLOSOLAN website. GLOSOLAN also established a platform to connect laboratories that offer and require training. In this regards, it is promoting the establishment of scientific collaborations; and
6. Soil spectroscopy: GLOSOLAN launched a dedicated initiative (GLOSOLAN-Spec) in 2020.

All laboratories that carry out soil analysis are welcome to join GLOSOLAN. All laboratories registered in GLOSOLAN are indicated on an [interactive map](#). At the moment of their registration in GLOSOLAN, all laboratories receive a letter and a certificate of registration. Please note these documents DO NOT certify the proficiency of laboratories in soil analysis. Therefore, they cannot be used to state that a laboratory is certified under GLOSOLAN or has a good proficiency in soil analysis.



Limitations: willingness of soil laboratory experts to share their knowledge and experience as well as to dedicate time to the writing of GLOSOLAN documents and training material, and to contribute to in person and online training. The availability of qualified laboratories to prepare soil samples for the GLOSOLAN proficiency test (PT) can also hamper the organization of global, regional and national PTs. Language barriers can also limit the impact of GLOSOLAN in some regions and countries. Financial resources are often too limited to properly support countries on procurement and in the organization of laboratory specific training events.

Notes on its development: the establishment of the network was included in the [Implementation Plan for Pillar five of the Global Soil Partnership](#) in 2017 and thereafter established to respond to the urgent request of the Asian Soil Partnership to have an operative Asian Soil Laboratory Network (SEALNET).

Supportive material: Please visit <https://www.fao.org/global-soil-partnership/glosolan/en/>. GLOSOLAN's interactive map is available at <http://surl.li/iszki>

Contacts: Please contact the GLOSOLAN coordinator, Mr. Filippo Benedetti at Filippo.Benedetti@fao.org

➤ Soil Test Kit

Country of origin: Thailand.

Year of development: 2012.

Copyright: Land Development Department, Ministry of Agriculture and Cooperatives.

Scope: rapid and accurate testing, accessible and self-testing

Users: Land Development Department (LDD) officials and volunteer soil doctors

Beneficiaries: farmers

Brief description: LDD has developed a rapid soil test kit (LDD Test Kit) accessible to smallholder farmers. The kit consists of (1) a soil pH test kit (2) a macronutrients soil test kit, and (3) a salinity soil test kit. Overall, the kit enables farmers to measure soil pH, electrical conductivity (EC), nitrogen (N), phosphorus (P) and potassium (K) by themselves. LDD officials provide the kit to Volunteer Soil Doctors (see Sheet S4.9).

Limitations:

- One test kit can analyze 50 soil samples.
- Chemical reagents expires in one-year time.
- Caution: Phosphorous test kit is not suitable for calcareous soils

Notes on its development: the Office of Science for Land Development Department developed the kits.

Supportive material: N/A.

Contacts: please contact Mrs Kamarin Nimmualrat, Soil Scientist at LDD, Office of Science for Land Development, Soil Mineralogy and Soil Micromorphology Research Division at osd_5@ldd.go.th

➤ Soil biological health kit

Country of origin: India.

Year of development: 2022.

Copyright: patent applied.

Scope: rapid soil biological health assay.

Users: Soil testing Personnel, Farmers, extension workers.

Beneficiaries: farmers.

Brief description: soil health kit contains one air-tight glass bottle (8 cm height, 6 cm diameter, 210 ml volume) and a color changing gel probe. Soil respiration indicator (SRI) gel is the probe that will assess the substrate-induced respiration of soil, and thereby the soil health status. First, the soil has to be amended with glucose (5%) and urea (1%) and transferred to the given air-tight glass bottle. Then, the color-changing gel pad has to be inserted in the soil with sufficient moisture. Under air-tight incubation conditions, the gel changes its color from pink to magenta, lavender, orange, and yellow, after 6-8 hours, depending upon the soil respiration rate. The color change index (scale of 0 to 6) can be referred with the given reference color chart and based on the index number, the soil health can be grouped as 'low', 'medium', and 'high'. This color index also recommends suitable practices to improve or sustain the soil health.

Limitations: qualitative assay. Calibration is required for other soils prior to use

.Notes on its development: the kit was conceptualized by the coordinator of All India Network Project on soil biodiversity and biofertilizers (AINP SBB). Kit was developed by TNAU center with suggestions from the coordinator.

Supportive material: none.

Contacts: Director, ICAR Indian Institute of Soil Science, Bhopal 462038.



Photo credits: ICAR, India

➤ Mridaparikshak (soil testing minilab)

Country of origin: India.

Year of development: 2016.

Copyright: patent applied 2522/DEL/2015, Indian Council of Agricultural Research.

Scope: to facilitate soil test based nutrient recommendations specific to crop and soil. Preparation of soil fertility maps.

Users: state soil testing personnel, government organizations, autonomous bodies, NGOs engaged in soil testing.

Beneficiaries: farmers.

Brief description: Mridaparikshak is a mini laboratory. It gives the soil test values of 15 soil health parameters: pH, electrical conductivity (EC), organic carbon, available nitrogen, phosphorus, potassium, sulfur, iron, manganese, zinc, copper and boron, gypsum requirement, lime requirement and calcareousness. Subsequently, a soil health card can be generated which can be sent to farmers either electronically or by post in the form of hard print.



Mridaparikshak. Photo credits: Nagarjuna Agrochemicals Pvt. Ltd.

Limitations: it uses the analytical methods applicable to India, calibrations and fertilizer recommendation equations are specific to India.

Notes on its development: it was developed from collaborative/contractual projects with Industry.

Supportive material:

- Mridaparikshak A MiniLab for Soil Health Assessment (2017), Success Story, Folder, ICAR-Indian Institute of Soil Science, Nabibagh, Berasia Road, Bhopal-462038 (India), P 6.
- <https://www.youtube.com/watch?app=desktop&v=FDUvYEGlLw>;
- <https://www.youtube.com/watch?v=VAcSLcATMdY>;
- <https://www.youtube.com/watch?v=WJGx-NzdFQk>;
- <https://www.youtube.com/watch?v=YGPUjiXnghM>

Contacts: please contact the Director of the ICAR-Indian Institute of Soil Science, Nabibagh, Berasia Road, Bhopal-462038 (India) at **email address missing**

➤ Smart Soil Sensing Kit

Country of origin: Indonesia

Year of development: 2019

Copyright: Balai Pengujian Standar Instrumen Tanah dan Pupuk, Badan Standardisasi Instrumen Pertanian (Indonesian Agriculture Instrument Standard Agency)

Scope: Rapid soil analysis

Users: Stakeholder involved in the agricultural sector (government agency, fertilizer company, plantation, etc)

Beneficiaries: farmers, Ministry of Agriculture

Brief description: the kit is based on the use of near-infrared spectroscopy technology (NIR). It can be used for measuring soil chemical and physical properties and it is equipped with a software for providing fertilizer recommendations for rice, maize and soybean production. This soil sensing kit comes with a spectral sensing device 91 mm x 178 mm x 62 mm wide with a diameter of collected light beam of 6 mm. The kit weighs 1 kg. The application coming with the kit is suitable for use on the smartphone.



Limitations: Tested and validated for processed soil samples (air dried, sieved). Limitations related to the use of NIR technologies apply.

Notes on its development: The kit was developed with the budget of the Ministry of Agriculture. Updates and validation is needed for improving the accuracy of measurement and the quality of the recommendations on plantation and horticulture crops.

Supportive material: please consult Wartini Ng, Husnain, L Anggria, AF Siregar, W Hartatik, Y Sulaeman, E Jones, and B Minasny. 2020. Developing a soil spectral library using a low-cost NIR spectrometer for precision fertilization in Indonesia. Geoderma Regional 22 (2020) e00319

Contacts: please contact Dr. Adha Fatmah Siregar, Head of Technical Service at the Indonesian Institute of Soil and Fertilizer Standardization at adha_siregar@yahoo.com

➤ Lowland Soil Test Kit (LSTK)

Country of origin: Indonesia

Year of development: 2005

Copyright: Balai Pengujian Standar Instrumen Tanah dan Pupuk, Badan Standardisasi Instrumen Pertanian (Indonesian Agriculture Instrument Standard Agency)

Scope: Rapid soil analysis

Users: extension agents

Beneficiaries: farmers

Brief description: this is a rapid soil test kit placed in a portable bag with dimension of L = 32 cm, H = 16 cm; W = 16 cm. It is composed by reagents with low to moderate concentrations that allow measuring soil nitrogen, phosphorous and potassium content as well as soil pH. This kit was developed by the Indonesian Soil Research Institute and its quality is regularly controlled on batch production. Quality control is ensured by comparing kit's measurements with soil standard analysis value. The LSTK comes with a guidance book or instructions accessible also on the Youtube channel of TVTani.



Limitations: This Kit is not suitable for peat soil and acid sulphate soil. Each LSTK allows to conduct 50 analyses of each parameter. The expired date is about 1-2 years after the seal is open, the quality of reagents depends on how the kit is stored. Recommendations for storage include placing it in an aerated area, keep it at room temperature, and not to expose it to the sunlight.

Notes on its development: The kit was developed with the budget of the Ministry of Agriculture.

Supportive material: please visit <http://www.youtube.com/watch?v=o4H4J5TtuL8> and consult

Irawan, A Kasno and Nurjaya, 2021. Financial benefits of using soil test kit of PUTS for determining dosage of lowland rice fertilizer. IOP Conf. Series: Earth and Environmental Science 648 (2021) 012039, IOP Publishing, doi:10.1088/1755-1315/648/1/012039.

ASEAN Soil and Nutrient Management Guidelines. 2017. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. ISBN (e-book) 978-616-445-746-1. Page 56-57

Widowati, LR. 2011. Nitrogen Management on Agricultural Land in Indonesia. Proc. of Int. Seminar on Increased Agricultural Nitrogen Circulation in Asia: Technological Challenge to Mitigate Agricultural N Emissions. Taipei, Taiwan, Sep. 27-28, 2011

Contacts: please contact Dr. Ladiyani Retno Widowati, Director of the Indonesian Institute of Soil and Fertilizer Standardization ladiyanirwidowati@gmail.com

➤ Upland Soil Test Kit (USTK)

Country of origin: Indonesia

Year of development: 2007

Copyright: Balai Pengujian Standar Instrumen Tanah dan Pupuk, Badan Standardisasi Instrumen Pertanian (Indonesian Agriculture Instrument Standard Agency)

Scope: Rapid soil analysis

Users: extension agents

Beneficiaries: farmers

Brief description: this is a rapid soil test kit placed in a portable bag with dimensions of L = 32 cm, H = 16 cm; W = 16 cm. It is composed by reagents with low to moderate concentrations that allow measuring soil phosphorous, potassium and soil organic carbon content as well as soil pH and lime requirements. This kit was developed by the Indonesian Soil Research Institute and its quality is regularly controlled on batch production. Quality control is ensured by comparing kit's measurements with soil standard analysis value. The USTK comes with a guidance book or instructions accessible also on the Youtube channel of TVTani.



Limitations: the kit is not suitable for peat soil, acid sulphate soil and lowland soil. Each USTK allows to conduct 50 analyses of each parameter. The expired date is about 1-2 years after the seal is open, the quality of reagents depends on how the kit is stored. Recommendations for storage include placing it in an aerated area, keep it at room temperature, and not to expose it to the sunlight.

Notes on its development: The kit was developed with the budget of the Ministry of Agriculture.

Supportive material: please visit <http://www.youtube.com/watch?v=yfzNKZcXjOQt=34s> and consult

ASEAN Soil and Nutrient Management Guidelines. 2017. Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH. ISBN (e-book) 978-616-445-746-1. Page 56-57.

Musyadik Musyadik. 2019. Identifikasi Status Hara Tanah pada Lahan Kering sebagai Dasar Pemupukan Kedelai di Kecamatan Andoolo Kabupaten Konawe Selatan. Vo.8, No. 2. (2019). Desember. <https://doi.org/10.20956/ecosolum.v8i2.7796>. <http://journal.unhas.ac.id/index.php/ecosolum/issue/view/758>

Widowati, LR. 2011. Nitrogen Management on Agricultural Land in Indonesia. Proc. of Int. Seminar on Increased Agricultural Nitrogen Circulation in Asia: Technological Challenge to Mitigate Agricultural N Emissions. Taipei, Taiwan, Sep. 27-28, 2011.

Contacts: please contact Dr. Ladiyani Retno Widowati, Director of the Indonesian Institute of Soil and Fertilizer Standardization at ladiyanirwidowati@gmail.com

➤ Soil testing kit

Country of origin: Philippines

Year of development: 1984

Copyright: None. However, the use, production and distribution of the kit was included in the approved function of the LSD-Rapid Soil Test Section.

Scope: rapid soil test for qualitative analysis of soil pH, nitrogen (N), organic matter, phosphorus (P) and potassium (K) for soil fertility assessment and fertilizer recommendation.

Users: Soil laboratories, agricultural extension workers (AEW), farmers

Beneficiaries: Farmers

Brief description: The kit is a quick and handy tool for soil analysis. Testing can be done directly in the field and results are obtained within an hour. Results are interpreted and used as a basis in making fertilizer recommendations for the right amount and kind of fertilizer needed to apply for a particular crop planted in the area.

The STK is a small bag of approximately 8 inches x 2.54 inches x 6.2 inches. Inside the bag are the reagents, procedures and fertilizer usage guide for various crops.



Limitations: STK is qualitative analysis for soil pH, organic matter, N, P, K only. The results are interpreted as low, medium or high. It is best used for monitoring soil fertility but not recommended for the conduct of scientific research wherein actual amount of nutrients are required. The kit can analyze 25 soil samples with reagents expiring within 6 months.

Notes on its development: The STK is a product of research from the Department of Soil Science, University of the Philippines, Los Baños, Laguna (UPLB) in cooperation with the National Food and Agricultural Council. The technology was transferred to the BSWM through Memorandum of Agreement.

Supportive material: NA

Contacts: please contact Gina P. Nilo, Director BWSM at ginapnilo@gmail.com, Maribel Jalalon Chief Laboratory Services Division (BSWM-LSD) at Maribel.jalalon@bswm.da.gov.ph and Shirley Buduan Head, Rapid Soil Test Section - the BSWM-LSD Section (responsible for the production and distribution of the STK and the related training on use) at Shirley.buduan@bswm.da.gov.ph.