Food and Agriculture Organization of the United Nations

INSOILFER Working Group Meetings

Annual Meeting of the INSOILFER Working Group 3. Fertilizer safety and quality assessment

27-29 November 2023

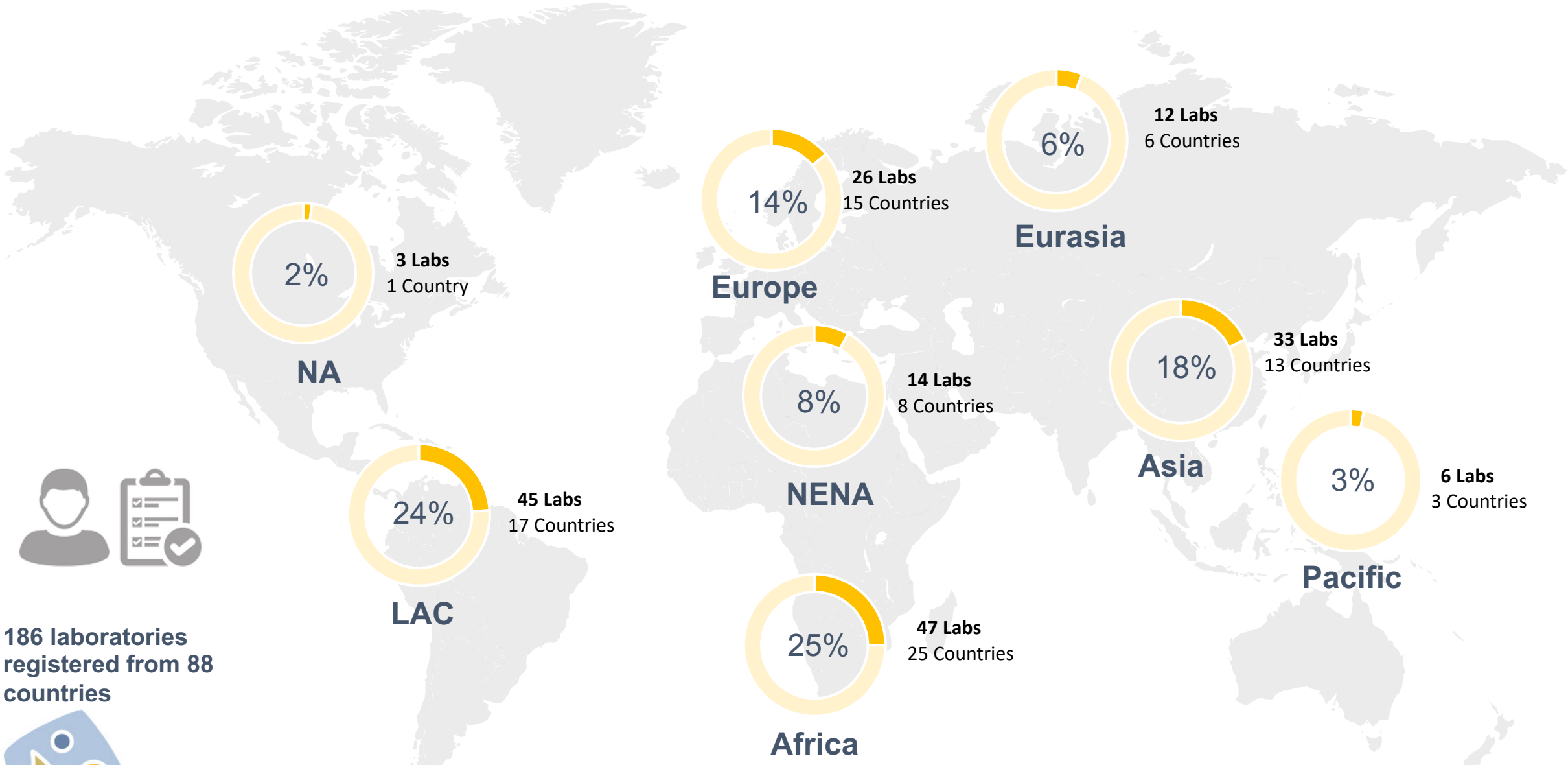
Dr Wesley Feldmann – INFA Chair

Insoilfer
International Network on Soil Fertility and Fertilizers

GLOBAL SOIL PARTNERSHIP

Introduction

- *"Investing in harmonized fertilizer quality assessments for sustainable soil and fertilizer management"*
- Launched in December 2020
  - Similar to GLOSOLAN in objectives
  - Three meetings from 2020, 2021 and 2022
- Objectives defined as:
  - Harmonisation
  - Capacity development
  - Regulatory affairs
- Members have grown over time and contribute to all aspects of the network



186 laboratories registered from 88 countries

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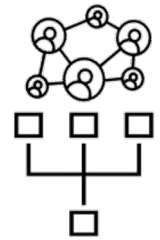
Harmonisation



- Focus on harmonisation of fertilizer methodologies for nutrient analysis:
  - Nitrogen (N)
  - Phosphorus (P)
  - Potassium (K)
  - Collaboration for heavy metal determination with INSOP
  - Future expansion of scope
- Methodology of harmonisation is clear, functional and extensive
  - Nitrogen via Kjeldahl complete for publication
  - Methods for P and K are underway
- Harmonisation leads to more reliable results leads to effective decision making

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Capacity development

- Development of laboratory skills and infrastructure is critical for effective function
- Focus on development of guidelines for:
  - Laboratory sample preparation
  - Quality control procedures
  - Collaboration with other networks to produce targeted guidelines
- SOPs are planned to be converted to video format in future

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Regulatory affairs

- Idea to have a database detailing all fertilizer quality standards for import and export per country or region
- Collaboration with:
  - Member laboratories
  - FAO focal points
  - Fertilizer organisations
- Important to keep information current and updated
- Similar venture to GLOSOLAN
  - SOILEX platform as a base

Summary

- The network has grown in laboratory number per region
  - Please be encouraged to join as we near 200 members

- The harmonisation process is under way for NPK + heavy metals
  - We plan to have these methods completed for 2024

- We are open to future collaboration, ideas and assistance
  - The members of the network are critical to the success of the network

SOP Harmonisation Process and Summary

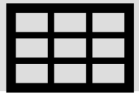
SOP Harmonisation

- SOPs currently being harmonised:
  - Nitrogen – Kjeldahl method
  - Nitrogen – Combustion (Dumas) method
  - Phosphorus – Water soluble
  - Phosphorus – Acid soluble
  - Potassium – Water soluble
  - Heavy metals – Acid digestion
- Harmonisation uses data gained from the network to form the final SOP

Harmonisation Process

1. Methods selected for harmonization

2. Data sheets developed to simplify data capture of method specifics



3. Data sheets distributed to and filled out by network members

4. Harmonization into final data set

5. SOP draft development and review (internal and external)

6. Publication and adoption by labs

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Harmonisation Process

1

Methods selected for harmonization

N P K

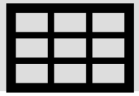
Harmonisation Process

1

Methods selected for harmonization

2

Data sheets developed to simplify data capture of method specifics



Templates for method specifics

Name and last name	Email address	Country	Institution/Institute name	Fertilizer name or type	Fertilizer form	Sample preparation procedure	Sieve size for analysis (mm)	Sample weight (g)	Equipment used for analysis	Ammoniacal, Nitrate or Total	Reagents Used	Chemical Manufacturers for Reagents	Catalyst/s added	Catalyst/s weight (g)	Volume and concentration of sulphuric acid (ml)	Salic we
Contact Person	*xxxx@gmail.com*	*Your country*	*Your institute*	*The name of fertilizer most commonly analysed: MAP, Urea, (can also put the NPK ratio of a blend or compound fertilizer), etc*	*The form of fertilizer most commonly analysed: granular, powder, liquid, etc*	*The preparation procedure used before analysis, e.g.* *1. Grinding for x minutes* *2. Sieving with size x* *And any other steps included*	*e.g. <0.5 mm*	*e.g. 1 g*	*The list of equipment used in the analysis, e.g.* *1. Grinding mill* *2. Digestion block* *3. Distillation apparatus* *4. Titration apparatus* *And any other equipment used*	*The parameter measured*	*List all reagents and amounts used in a stepwise fashion e.g.* *1. Acid (H_2SO_4)* *2. Catalyst mixture* *3. Mix indicator (eg. methyl red+bromocresol green+95% ethyl alcohol)* *4. Boric acid indicator mixture* *5. NaOH concentration* *6. HCl Concentration* *7. Na_2CO_3 Solution* *8. Methyl orange indicator* *And any other reagents used*	*The chemical manufacturers for the reagents used in the analysis*	*Type or combination of catalysts*	*e.g. 5 g*	*e.g. 20 ml*	*e.g. 1 g*

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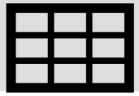

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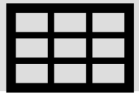

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Define per method step

Step	Breakdown	No. of Labs	Lab Code	Prevailing Practice	Remarks
	Organic + compost	8	1, 2, 3, 4, 5, 13, 18, 23		
Fertilizer type	Inorganic (mineral-based)	19	3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 19, 20, 21, 22	Inorganic	Gives relevant information on what types of fertilizers labs are testing
	Total	**27**			
	Liquid	15	1, 2, 5, 6, 7, 11, 12, 13, 14, 15, 19, 20, 21, 22, 23		
Fertilizer form	Granular + powder	23	1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23	Granular + Powder	
	Composted	8	1, 2, 3, 4, 5, 13, 18, 23		
	Total	**46**			
Sample preparation procedure					
	≤0.5 mm	14	4, 5, 6, 7, 10, 11, 12, 13, 14, 16, 20, 21, 22, 23	≤0.5 mm	
Particle size	≤2 mm	8	2, 3, 8, 9, 15, 17, 18, 19		
	>2 mm	1	1		

Summarize into method steps

Fertilizer type	Fertilizer form	Sample preparation procedure	Particle size	Sample weight	Equipment	Ammoniacal/ Total	Reagents	Catalyst added	Catalyst weight	Volume of sulphuric acid	Concentration of sulphuric acid	Mixing time	Digestion temperature	Digestion time	Distillation procedure	Titration procedure
Inorganic	Granular + powder	Listed	≤0.5 mm	≤1	Listed	Both	Listed	Copper Sulphate and Potassium Sulphate (1:10) or Devarda	5.0	50.0	>95%	1 hr	380	2 hrs	Listed	Listed

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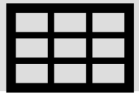

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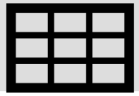

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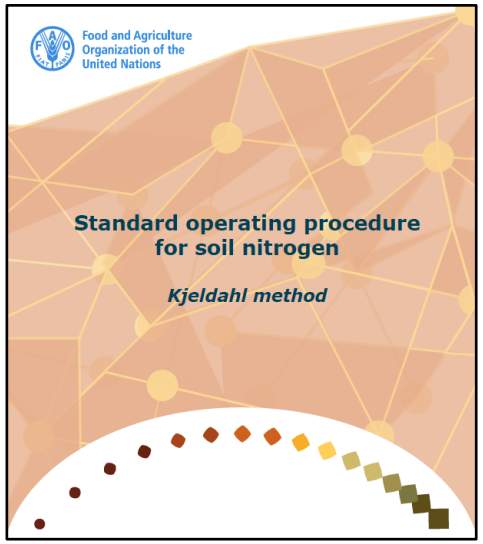
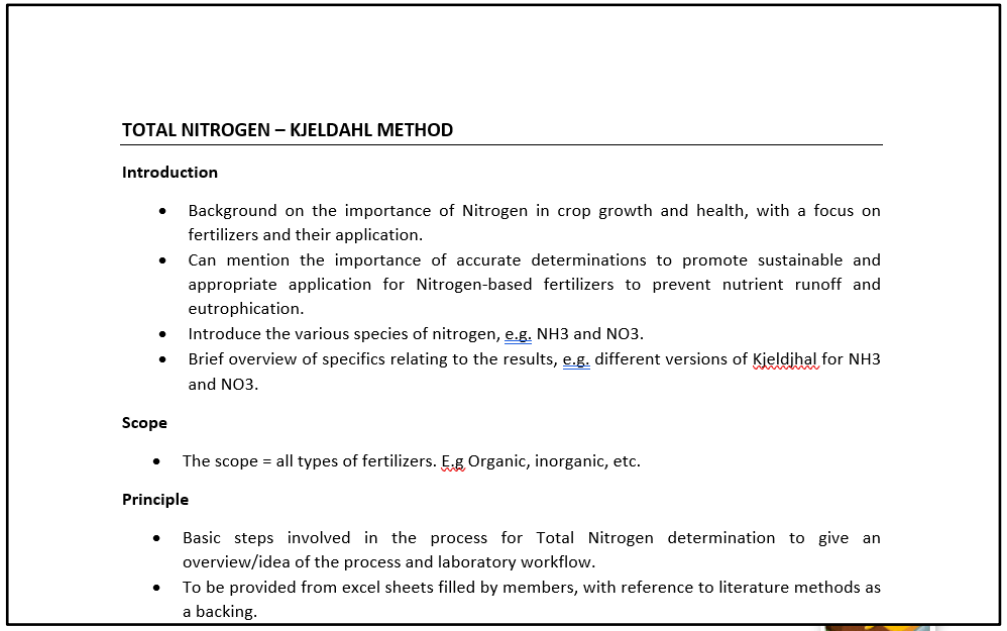
SOP Template

- The objective and final product of the work will be FAO published SOPs
- A working draft has been developed for review
  - Major sections and supporting points
  - Currently under review
- Harmonized data to be included in draft
- Sent to the network for review
- Identify technical experts for additional review
- Submitted for publication via FAO





TOTAL NITROGEN – KJELDAHL METHOD

Introduction

- Background on the importance of Nitrogen in crop growth and health, with a focus on fertilizers and their application.
- Can mention the importance of accurate determinations to promote sustainable and appropriate application for Nitrogen-based fertilizers to prevent nutrient runoff and eutrophication.
- Introduce the various species of nitrogen, e.g. NH3 and NO3.
- Brief overview of specifics relating to the results, e.g. different versions of Kjeldihal for NH3 and NO3.

Scope

- The scope = all types of fertilizers. E.g Organic, inorganic, etc.

Principle

- Basic steps involved in the process for Total Nitrogen determination to give an overview/idea of the process and laboratory workflow.
- To be provided from excel sheets filled by members, with reference to literature methods as a backing.

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SOP Status Summary

- SOPs currently being harmonised:
  - Nitrogen: Kjeldahl method – Complete
  - Nitrogen: Combustion (Dumas) method – Final draft
  - Phosphorus: Water soluble – Preliminary draft
  - Phosphorus: Acid soluble – Preliminary draft
  - Potassium: Water soluble – Preliminary draft
  - Heavy metals: Acid digestion – Final review (INSOP collaboration)
- Harmonised SOPs is the first step in leading to quality results, which can be used for effective decision making


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Thank you
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