GEAVET TRAINING PROGRAMME FOR CSA

CLIMATE SMART AGRICULTURE:

NIGERIA

UNIT I.2. SOIL TESTING, ANALYSIS AND INTERPRETATION

ENGLISH VERSION

GEAVET Project n° 101129027

Open Educational Resources

PART I – LEARNING MATERIAL

1. Introduction

Healthy soils are the foundation of sustainable agriculture and food security in Nigeria, Issues such as declining soil fertility, nutrient depletion, and poor fertiliser application continue to limit crop productivity and threaten environmental balance. Soil testing is a critical agricultural practice that enables Nigerian farmers to understand the nutrient and chemical composition of their soils. It helps address widespread issues such as soil nutrient depletion, acidity, and erosion that limit crop productivity. This unit covers the importance of soil testing in optimising fertiliser use, reducing costs, and improving yields. The training curriculum on Soil Testing, Analysis, and Interpretation is designed to equip farmers, students, extension agents, and agribusiness professionals with the skills to assess soil health, conduct basic analyses, and interpret results for informed agricultural decision-making. Delivered through an interactive virtual platform, the curriculum features video lectures, case studies, and virtual lab demonstrations tailored to Nigeria's diverse agro-ecological conditions. It emphasises practical learning, guiding participants through soil sampling techniques, laboratory testing procedures, and result interpretation for crop-specific recommendations. It also introduces digital tools and climate-smart soil management practices to promote sustainable and efficient use of agricultural inputs. Learners will engage in self-paced modules, live discussions, and collaborative exercises that connect theory with field application. By the end of the course, participants will be able to effectively use soil information to improve productivity, reduce waste, and contribute to sustainable land use throughout Nigeria.

2. Soil Testing

Soil testing is the scientific process of analysing soil samples to determine their physical, chemical, and biological properties, such as pH, nutrient content, texture, organic matter, and salinity levels. It provides essential information on soil fertility status and helps identify nutrient deficiencies or toxicities that affect crop growth.

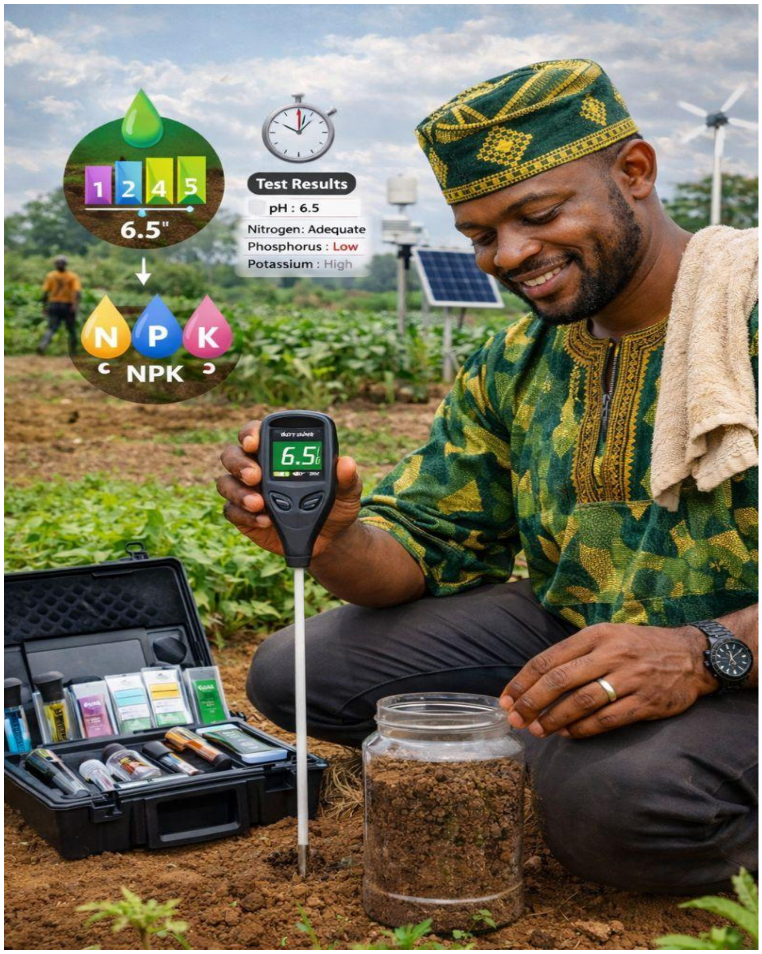

Image 5. An A.I.-generated Image Showing Soil testing

Through soil testing, farmers and agricultural professionals can make informed decisions about fertilizer types, application rates, and soil management practices suited to specific crops and field conditions. This process serves as the foundation for precision agriculture, enabling efficient use of resources and sustainable land management.

2.1. Relevance of Soil Testing to Climate-Smart Agriculture (CSA) in Nigeria

Soil testing is highly relevant to Climate-Smart Agriculture (CSA), an approach that aims to sustainably increase agricultural productivity, enhance resilience to climate change, and reduce greenhouse gas emissions.

Soil testing enhances resilience to climate variability by promoting soil health through appropriate amendments and sustainable practices such as organic matter replenishment and pH correction. This, in turn, supports better water retention and carbon sequestration in soils, which are vital for adapting agriculture to changing climatic conditions. Soil testing is also fundamental to regenerative and organic farming systems that emphasise biological nutrient cycling over synthetic inputs. In essence, soil testing is the foundation for climate-smart agriculture by fostering sustainable resource management, improving yield stability, enhancing soil carbon storage, reducing climate impact, and supporting environmental stewardship in farming systems.

By providing accurate information on soil nutrient status, soil testing helps farmers optimise fertiliser use, thereby reducing over-application of nitrogen and phosphorus that contribute to emissions and water pollution. It also guides the adoption of conservation practices such as cover cropping and organic amendments, which improve soil structure and carbon sequestration.

The relevance of soil testing aligns closely with the three main pillars of Climate-Smart Agriculture:

- ➢ **Productivity:** By identifying and addressing soil constraints, testing enhances crop yield and input efficiency.
- ➢ **Adaptation:** It promotes soil health and resilience, enabling farmers to withstand drought, erosion, and nutrient depletion.
- ➢ **Mitigation:** Soil testing supports sustainable nutrient management that reduces greenhouse gas emissions and increases soil carbon storage.

In summary, soil testing serves as a practical entry point for implementing climate-smart strategies in Nigeria's agricultural systems. It helps farmers produce more with fewer resources, adapt to changing climatic conditions, and contribute to global climate action through sustainable soil management.

2.2. Relationship between Soil Testing, Analysis and Interpretation in Profitable CSA

Soil testing, analysis, and interpretation are interconnected processes that form the scientific foundation of profitable CSA. Together, they enable farmers to make informed, data-driven decisions that improve productivity, reduce costs, and promote environmental sustainability.

Soil testing is the first step, which involves the collection of representative soil samples (soil sampling) from the field to determine the current status of nutrients and soil health indicators. This raw data alone, however, cannot guide agricultural decisions without proper analysis. Soil analysis is the laboratory stage where the collected samples are examined for key properties such as pH, organic matter content, nitrogen, phosphorus, potassium, micronutrients, and salinity levels. The analytical results quantify the availability of nutrients and highlight imbalances or deficiencies that may limit crop performance.

The next critical stage is interpretation, where laboratory results are translated into practical, field-level recommendations. This step bridges the gap between scientific research and practical application by providing farmers with a clear understanding of how test results relate to their specific crops, soil types and local climatic conditions.. This knowledge empowers farmers to make informed decisions that enhance crop productivity and sustainability. Proper interpretation ensures that fertiliser types, quantities, and timing are optimised, thus minimising waste and maximising crop response.

In the context of Climate-Smart Agriculture, this integrated approach supports all three CSA pillars, namely productivity, adaptation, and mitigation. Accurate interpretation of soil test data boosts productivity by improving nutrient-use efficiency and yield. It enhances adaptation by promoting soil health and resilience to drought and erosion. It also aids mitigation by reducing unnecessary fertiliser use, thereby lowering greenhouse gas emissions.

Thus, the synergy between soil testing, analysis, and interpretation not only improves soil fertility management but also ensures profitable and sustainable farming systems in Nigeria, where efficient input use and climate adaptation are vital for long-term agricultural success.

2.3. Inventory for Soil Testing, Analysis and Interpretation in Profitable CSA in Nigeria

Developing an effective inventory for soil testing, analysis, and interpretation is essential for strengthening Nigeria's capacity for evidence-based and climate-smart agricultural practices. An inventory in this context refers to the comprehensive list of materials, equipment, human resources, institutions, and digital tools required to support soil testing activities. It ensures the availability of resources and infrastructure needed for accurate, timely, and reliable soil data generation and interpretation.

A. Institutional Infrastructure

At the institutional level, Nigeria has several organisations that provide soil testing and analysis services. These include the Institute of Agricultural Research and Training IAR&T, National Root Crops Research Institute NCRI, Soil Science Society of Nigeria SSSN, National Agricultural Extension and Research Liaison Services NAERLS, and various state Agricultural Development Programmes (ADPs). Additionally, many Universities of Agriculture and private laboratories contribute to soil testing through research, teaching, and extension activities. These institutions collectively form the backbone of the country's soil testing network.

B. Instrumentation

From a technical and equipment perspective, the inventory includes laboratory instruments such as pH meters, spectrophotometers, atomic absorption spectrometers, flame photometers, conductivity meters, centrifuges, soil augers, ovens, and analytical balances. Reagents and chemicals for nutrient determination, such as sulfuric acid, phosphates, and indicators, are also key components. Portable soil test kits and mobile soil testing facilities have been introduced in some regions to improve accessibility, particularly for smallholder farmers.

C. Human Resource

The human resource inventory comprises trained soil scientists, laboratory technologists, extension agents, and data interpreters capable of translating laboratory findings into actionable recommendations. Continuous capacity building through online and field-based training ensures that personnel remain updated on emerging analytical techniques and data interpretation standards.

D. Digital Infrastructure

The digital infrastructure supporting soil testing in Nigeria is expanding. Platforms such as SoilDoc, Africa Soil Information Service AfSIS, and FAO's Global Soil Partnership GSP provide data repositories and digital tools for soil data management, mapping, and decision-making. Integrating these platforms with local extension systems allows for real-time access to soil information and climate-smart recommendations.

In summary, Nigeria's inventory for soil testing, analysis, and interpretation encompasses institutional frameworks, laboratory equipment, skilled personnel, and digital tools that collectively support sustainable land management. Strengthening and coordinating these components will enhance national soil health monitoring, promote efficient fertilizer use, and foster profitable Climate-Smart Agriculture for improved food security and environmental resilience.

2.4. Planning and Layout for Soil Testing, Analysis, and Interpretation System

The planning and layout component of the *Soil Testing, Analysis, and Interpretation Curriculum* is a critical section that guides learners in understanding how to design, organize, and implement a functional soil testing system suited to Nigeria's agricultural landscape. Within this curriculum, participants are introduced to both the conceptual and practical framework for establishing soil testing operations from field sample collection to laboratory analysis and data interpretation with emphasis on efficiency, cost-effectiveness, and climate-smart agricultural relevance.

A. Planning Phase within the Curriculum

The planning module in the curriculum trains learners to assess available resources, identify laboratory and field requirements, and develop a soil testing strategy that aligns with regional agro-ecological conditions. Learners will study how to:

- Map out existing soil testing centres and recognise capacity gaps.
- Plan sampling schedules based on crop calendars and climatic conditions.
- Identify partnerships with research institutes (e.g., IAR&T, NAERLS, and ADPs).
- Prepare budgets for equipment, materials, and personnel.

Through interactive tools and case studies, participants will simulate the planning of soil testing projects, considering both centralised laboratory models and community-based mobile soil testing systems that enhance accessibility for smallholder farmers.

B. Layout and Operational Design

The curriculum provides a practical framework for understanding the physical and procedural layout of a soil testing and analysis system. Learners will explore typical laboratory design structures, including:

- Soil Sampling
- Sample Reception and Drying Room
- Grinding and Sieving Section
- Chemical and Nutrient Analysis Laboratory
- Data Processing and Interpretation Unit
- Waste Disposal and Storage Areas

Figure 1. Soil sampling Augers
Source: M'One Drilling

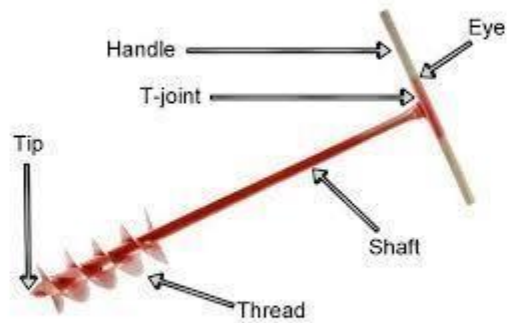

Figure 2. Parts of the Auger
Source: Wonkee Donkee Tools

Digital diagrams and videos will illustrate how samples move from one section to another in a logical sequence, emphasising workflow optimisation and contamination prevention.

C. Field Layout and Calculation Exercise

Let's consider a 10-hectare maize farm in Oyo State. For soil testing:

- The field is divided into 5 uniform blocks based on soil colour and slope (2 hectares each).
- One composite sample is collected from each block by mixing soil from 5–10 spots at a depth of 0–20 cm.
- In total, 5 composite samples represent the entire farm.

Each sample is analysed for nutrients like Nitrogen (N), Phosphorus (P), and Potassium (K).

Calculation for Fertilizer Recommendation (Simplified):

If soil analysis shows:

Available N = 0.08%, Required N for maize = 0.25%

Available P = 10 mg/kg, Required P = 20 mg/kg

Available K = 100 mg/kg, Required K = 150 mg/kg

Then the nutrient deficit = Required – Available.

To calculate fertilizer needs:
For instance, if using Urea (46% N)**:**

Required Urea=(0.25-0.08)×100000.46=369.6 kg/ha

This means about 370 kg of Urea per hectare is needed to meet the nitrogen requirement. Similar calculations are performed for phosphorus (using SSP or DAP) and potassium (using MOP).

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PART 2 - CURRICULUM

Learning Objectives

<table>
<tr><th>KNOWLEDGE</th><th>SKILLS</th><th>ATTITUDES</th></tr>
<tr>
<td>Student is able to:
Explain the principles and purpose of soil testing in agriculture.
Identify major soil parameters commonly tested (pH, texture, organic matter, nutrients, salinity).
Describe procedures for sample collection, preparation, and analysis.
Understand how soil test results are used for decision-making in soil fertility and land management.</td>
<td>Student is able to:
Collect representative soil samples from the field using correct tools and procedures.
Prepare soil samples (drying, sieving, labeling, storing) for laboratory testing.
Conduct basic laboratory analyses:
Soil pH (potentiometric method)
Soil texture (mechanical method or feel method).
Organic matter (loss-on-ignition or Walkley-Black method)
Electrical conductivity (salinity).
Macronutrients (N, P, K) using simple rapid test kits or standard procedures.
Record and organize soil test results in tabular format.
Interpret laboratory results to make practical soil</td>
<td>Student is able to:
Accuracy, neatness, and consistency in conducting soil tests.
Demonstrate responsibility and safety awareness in handling laboratory equipment and chemicals.
Cultivate teamwork and cooperation during field and lab activities.
Show professional integrity in recording and reporting data.
Build a positive attitude toward solving agricultural problems using scientific evidence.</td>
</tr>
</table>

	management recommendations.	

Transversal Skills

- **Communication Skills**
    - Ability to present soil test results clearly in oral and written forms.
    - Simple, non-technical language when communicating findings to farmers or non-specialists.
- **Teamwork and Collaboration**
    - Working effectively in groups during field sampling and laboratory analysis.
    - Sharing roles, responsibilities and respecting contributions of others.
- **Problem-Solving and Critical Thinking**
    - Interpreting soil analysis results to propose practical solutions.
    - Applying logical reasoning to diagnose soil fertility issues.
- **Numeracy and Measurement Skills**
    - Calculating concentrations, interpreting numerical results, and converting units.
    - Summarizing results into charts/tables for easier interpretation.
- **Digital Literacy**
    - Using spreadsheets or basic software for data recording and analysis.
    - Searching online resources to compare soil test standards and guidelines.
- **Safety and Environmental Awareness**
    - Observing laboratory safety rules and handling equipment and chemicals.
    - Recognizing environmental implications of soil fertility and management practices.
- **Work Ethics and Professionalism**
    - Accuracy and honesty in recording, analyzing and reporting soil test results.
    - Respecting confidentiality of data provided by farmers or institutions.

Digital Skills Associated with Drip Irrigation Installation and Maintenance Practices

- **Data Entry & Management**
    - Using Microsoft Excel, Google Sheets, or similar software to input, organize, and store soil test results.

- Applying formulas for calculations (averages, percentages, unit conversions).
- **Data Analysis & Visualization**
    - Creating tables, graphs, and charts to represent soil test results.
    - Using statistical tools or simple data analysis software to interpret results.
- **Report Writing & Presentation Tools**
    - Preparing soil analysis reports with **Word processing software** (MS Word, Google Docs).
    - Designing presentations with **PowerPoint or Canva** to communicate findings to different audiences.
- **Geospatial & Mapping Skills** (Introductory Level)
    - Using **Google Earth or simple GIS apps** to identify and map sampling locations.
    - Recording sample points with **GPS-enabled smartphones**.
- **Use of Laboratory Digital Tools**
    - Operating digital instruments such as pH meters, EC meters, and spectrophotometers.
    - Understanding how to retrieve and process digital readings.
- **Online Research & Information Literacy**
    - Searching for soil reference values, interpretation guides, and extension materials online.
    - Evaluating credibility of digital sources (databases, scientific websites).

Green Skills Associated with Drip Irrigation Installation and Maintenance Practices

- **Sustainable Soil Management Awareness**
    - Understanding how soil testing guides balanced fertilizer use, preventing over-application and environmental pollution.
- **Waste Reduction & Safe Disposal**
    - Proper handling and eco-friendly disposal of laboratory chemicals and residues.
    - Minimizing waste during sample preparation and analysis.
- **Resource Efficiency**
    - Using water, electricity, and lab materials efficiently during practical work.
    - Promoting recycling or re-use of suitable lab materials where safe.
- **Environmental Protection Practices**

- Recognizing the impact of soil degradation (erosion, salinity, nutrient mining) on ecosystems.
- Applying soil test results to recommend environmentally sound land management.

- **Health, Safety & Sustainability Mindset**
  - Following lab safety rules to protect self, others, and the environment.
  - Promoting a culture of responsibility for ecological well-being.
- **Systems Thinking**
  - Seeing the soil as part of a larger agro-ecosystem connected to water, plants, animals, and climate.
  - Understanding how sustainable soil practices contribute to food security and environmental resilience.

Implementation plan of pedagogical activities (Scheme of work / Session plan)

Duration: 3 hours 40 minutes				
Description of participants: Secondary school leavers, diploma trainees, or vocational learners with basic exposure to farming systems, crop/soil management, or laboratory science, but limited hands-on experience with modern soil testing techniques, between the ages of 18-35 years. The participants should be those who are preparing to work as agricultural technicians, extension agents, lab assistants, or farm managers, where soil analysis and interpretation skills are directly applicable and who often lack digital skills for data analysis and green skills for sustainable land management; hence, the curriculum integrates transversal, digital, and environmental competencies.				
Activity 1: Field Sampling & Sample Preparation (1 hour 10 minutes)				
Sub-Activity	**Timing**	**Training Methods/Activity**	**What do trainers do**	**What do participants do**
1.	15 min	Introductory briefing & safety orientation	● Explain objectives, demonstrate safety & correct sampling tools	● Watch videos and take notes
2.	20 min	Field demonstration: soil sampling procedures	● Demonstrate step-by-step soil sampling in different locations	● Practice soil sample collection in groups
3.	20 min	Sample preparation in the laboratory (drying, sieving, labeling)	● Guide preparation steps & demonstrate labeling standards	● Carry out drying, sieving & proper labeling after watching videos
4.	15 min	Group reflection & discussion	● Facilitate debrief on challenges & sampling errors	● Share experiences, discuss lessons learned
Activity 2: Laboratory Soil Analysis (1 hour 25 minutes)				
1.	15 min	Demonstration of equipment use (pH meter, EC meter, glassware)	● Demonstrate safe operation & calibration	● Watch videos and take notes

2.	25 min	Practical demonstration: Soil pH, EC, texture tests	● Supervise & assist groups with tests	● Perform tests in groups, record data
3.	30 min	Practical demonstration: Organic matter & NPK analysis	● Explain procedures, troubleshoot errors	● Conduct analyses, handle reagents safely
4.	15 min	Lab safety & waste disposal training	● Demonstrate eco-friendly disposal	● Apply correct disposal of chemical residues
Activity 3: Data Interpretation and reporting (1 hour 5 minutes)				
1.	20 min	Demonstration on data entry & analysis (Excel/Sheets)	● Teach digital recording & simple statistics	● Input and organise soil test results
2.	25 min	Interpretation exercise	● Provide interpretation frameworks & guidelines	● Analyse data to identify soil fertility status
3.	20 min	Report writing session	● Guide report format & language	● Draft reports with recommendations

Materials (What trainers need to have prepared):

Section 1: Field Sampling & Sample Preparation

- **Field tools & equipment**
    - Soil augers, spades, core samplers
    - Buckets and sample bags (clean, labelled)
    - Permanent markers, tags, and field notebooks
    - GPS device or smartphone with location app (for sample point recording)
    - Measuring tape for sampling depth
    - Protective gear (gloves, boots, safety goggles, lab coats)
- **Sample preparation items**
    - Drying trays or oven
    - Sieves (2 mm standard mesh)

- Labels/stickers for sample identification
- Airtight containers or polythene bags for storage

Section 2: Laboratory Soil Analysis

- **General lab materials**
    - Lab coats, gloves, goggles, aprons
    - Distilled water
    - Glassware (beakers, pipettes, burettes, funnels, measuring cylinders, flasks)
    - Weighing balance (digital)
    - Wash bottles and brushes
- **Specific test equipment**
    - Soil pH test: Digital/analog pH meters, buffer solutions for calibration
    - Electrical conductivity (EC): EC meter or conductivity cell
    - Texture analysis: Hydrometer set, sedimentation cylinders, mechanical shaker, stopwatch.
    - Organic matter: Muffle furnace or Walkley-Black reagents ($K_2Cr_2O_7$, H_2SO_4), burettes, titration setup.
    - Nitrogen (N**):** Kjeldahl apparatus or rapid N test kits.
    - Phosphorus (P): Colorimeter or spectrophotometer, standard reagents
    - Potassium (K): Flame photometer or atomic absorption spectrometer (if available), or simple rapid test kits.
- **Safety materials**
    - First aid kit
    - Fire extinguisher
    - Waste disposal bins (for chemical & general waste)

Section 3: Data Interpretation & Reporting

- **ICT materials**
    - Computers/laptops (with Excel or similar spreadsheet software installed)
    - Projector and screen (for presentations)
    - Internet access (for research on soil interpretation standards)
- **Stationery & learning aids**
    - Flip charts/whiteboard & markers
    - Handouts or interpretation guides (soil test standards, fertilizer recommendation charts)

○ Templates for soil analysis reporting.
Other notes:

PART 3 –ACTIVITY GUIDE

DESCRIPTION OF ACTIVITIES

1. Field Sampling & Sample Preparation

The objectives of this activity are to equip learners with practical knowledge and skills for proper soil sampling and sample preparation, which are fundamental for accurate soil testing, analysis, and interpretation. Learners will understand the importance of representative soil sampling in assessing soil properties such as texture, moisture, and nutrient content, which directly influence irrigation decisions, crop management, and overall soil fertility management.

The activity aims to develop learners' competence in selecting appropriate sampling points, using soil sampling tools correctly, and avoiding contamination or sampling errors. Learners will gain hands-on experience in field procedures for collecting soil samples at recommended depths and quantities. In the laboratory, learners will learn how to prepare soil samples by air-drying, sieving, and labeling for subsequent testing.

Emphasis is placed on maintaining hygiene, safety, and proper handling of equipment and soil samples. The activity also encourages teamwork, observation, and critical thinking through group reflection and discussion on challenges encountered and lessons learned. By the end of the activity, learners are expected to confidently collect, prepare, and document soil samples suitable for reliable analysis and interpretation to support informed soil management and irrigation decisions.

1. Aim of the activity: To develop practical skills in soil sampling and sample preparation techniques.

2. Duration: 70 mins

3. Step-by-step instruction of the task/practical exercise/case study:

- **Introductory Briefing & Safety Orientation**: The facilitator explains the objectives of soil sampling, safety precautions, proper use of sampling tools, and importance of accurate sample handling.

- **Field Demonstration: Soil Sampling Procedures:** Learners observe and practice selection of representative sampling points, proper soil depth measurement, and use of augers or spades to collect soil samples without contamination.
- **Sample Preparation in the Laboratory (Drying, Sieving, Labeling):** Collected samples are air-dried, sieved to remove debris, and labeled with location, depth, and date to ensure proper identification for testing.
- **Group Reflection & Discussion:** Learners discuss challenges, share observations, and reflect on the significance of accurate sampling and preparation in soil testing and irrigation planning.

References/Sources/Further materials

2. Laboratory Soil Analysis

The objectives of this activity are to equip learners with the practical skills and understanding necessary to conduct soil testing accurately and interpret results for informed agricultural decision-making. Learners will gain familiarity with essential soil testing equipment, including pH meters, EC meters, and laboratory glassware, and understand proper handling, calibration, and maintenance practices to ensure precise measurements.

The activity focuses on measuring key soil properties such as pH, electrical conductivity (EC), texture, organic matter, and essential nutrients (NPK). Learners will develop the ability to prepare soil samples correctly, perform tests systematically, record observations accurately, and interpret results in the context of soil fertility, irrigation suitability, and crop productivity. Emphasis is placed on understanding the significance of these soil parameters for optimal crop growth and effective irrigation management.

Additionally, the activity introduces laboratory safety and proper waste disposal procedures, teaching learners to work safely with equipment and chemicals while minimizing environmental impact. Through guided demonstrations and hands-on practice, learners are encouraged to observe, analyze, and discuss results collaboratively. By the end of the activity, learners are expected to confidently perform basic soil tests, interpret analytical results, and make practical recommendations for soil and nutrient management.

1. Aim of the activity: To develop skills in soil testing, analysis, and interpretation techniques.

2. Duration: 85 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Demonstration of Equipment Use (pH Meter, EC Meter, Glassware):** The facilitator introduces soil testing equipment, explains their functions, and demonstrates correct handling, calibration, and cleaning. Learners observe and take notes.
- **Practical Demonstration:** Soil pH, EC, and Texture Tests Learners prepare soil samples and perform pH and EC measurements. Soil texture is determined using hand-feel or sedimentation methods. Results are recorded and discussed.
- **Practical Demonstration:** Organic Matter & NPK Analysis: The facilitator demonstrates procedures for estimating soil organic matter and testing NPK content using standard kits. Learners record observations and link findings to soil fertility status.
- **Lab Safety & Waste Disposal Training:** Learners are instructed on laboratory safety, proper PPE use, careful handling of glassware and chemicals, and environmentally safe disposal of soil residues and test wastes.

References/Sources/Further materials

3. Data Interpretation and Reporting

This activity is designed to equip learners with practical skills to manage, analyze, and interpret soil testing data for informed agricultural and irrigation decisions. Learners will understand the importance of accurate data entry, organization, and management to ensure reliable analysis. The activity focuses on using spreadsheet software such as Microsoft Excel or Google Sheets to record soil test results, perform calculations, and generate visual summaries such as tables, charts, and graphs.

Through guided exercises, learners will develop the ability to interpret soil parameters including pH, electrical conductivity, texture, organic matter, and nutrient content (NPK), identifying patterns, deviations, and implications for crop growth and irrigation planning. Learners will also gain experience in writing concise, clear, and structured reports that communicate findings effectively to stakeholders, including recommendations for soil management, fertilizer application, and irrigation adjustments.

Emphasis is placed on accuracy, logical reasoning, and clear presentation of data. The activity also fosters problem-solving, critical thinking, and collaborative discussion among learners. By the end of the activity, learners are expected to confidently perform data entry, analyze results, interpret findings, and produce professional soil testing reports that inform practical decision-making in agriculture and irrigation management.

1. Aim of the activity: To develop learners' skills in analyzing, interpreting, and reporting soil data.

2. Duration: 65 min

3. Step-by-step instruction of the task/practical exercise/case study:

- **Demonstration on Data Entry & Analysis (Excel/Sheets):** The facilitator demonstrates how to enter soil test data into a spreadsheet, perform calculations (e.g., averages, percentages), and generate charts or tables for easy interpretation.
- **Interpretation Exercise:** Learners analyze provided soil test datasets to identify soil pH levels, nutrient status, salinity issues, and texture classification. Discussions highlight implications for irrigation and crop management.
- **Report Writing Session:** Learners draft structured reports summarizing methods, results, analysis, and recommendations. The facilitator reviews and provides feedback on clarity, accuracy, and professionalism.

References/Sources/Further materials