Teaching Manual for Soil Testing and Field Setting

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Institute: Booker Washington Institute
Duration: (3 days)
Audience: Local Farmers, Undergraduates, and Extension Officers

Topic: HOW TO IMPROVE AGRICULTURAL PRODUCTS USING FIELD SETTINGs AND LABORARORIES IN LIBERIA

Training Objectives:

1. To allow extension officers, local farmers, and undergraduates in Liberia are knowledgeable and build up the requisite skills in soil testing and field setting.
2. To transfer the new innovations acquired by the participants to the Liberian farming group in the Liberian Communities through" Training of Trainer (TOT) Workshops", and Farmer's Network, for successful farming and sustainability.
3. To allow the participants determine the quantities and qualities of the nutrients in the soil for better crop production.
4. To calculate the different percentages of nutrients (NPK) in the soil and determine the soil PH level.

Document's Introduction

This manual is solely for training purpose. It is to help trainers impact some knowledgeable skills to students, extension officers, and local farmers on field settings and Laboratory exercises using laboratory equipment to test soil for successful farming. Moreover, it enables the participants to see actual fact on calculating the nutrients contents and

knowing the accurate amount of percentages involved in the soil. As a result, the farmers on their farms and the students on the project fields will produce qualities and quantities agricultural products into the Liberian markets.

Training Background

Liberia is one of the less producing under developed countries in agriculture in Africa. This is due to lack of adequate technology facilities to improve the agricultural products like Soil testing. For this reasons, the Liberian local farmers cultivate on soils that are depleted. This causes the farmers not to yield maximum return from their farms. As a result, the country inputs more food than produce. Therefore, with this training manual and the requisite training in both classroom and field, the idea of testing the soil before planting will spread out in the country. This will make positive impact in Liberian communities by excellent improvement in providing qualities and quantities agricultural products in Liberia. In addition, the local farmers and student's agriculture's projects will yield fruitful results.

Day 1 Itinerary:

Welcome the participants
Introduction of participants
Classroom lecture continues
Introduction of topics:

I. Definition (soil testing, field setting, laboratory)
II. Important
III. Describe and explain the different types of soil
IV. Explain how the results are applicable in the field.
V. Review to see if the participants are well taken in

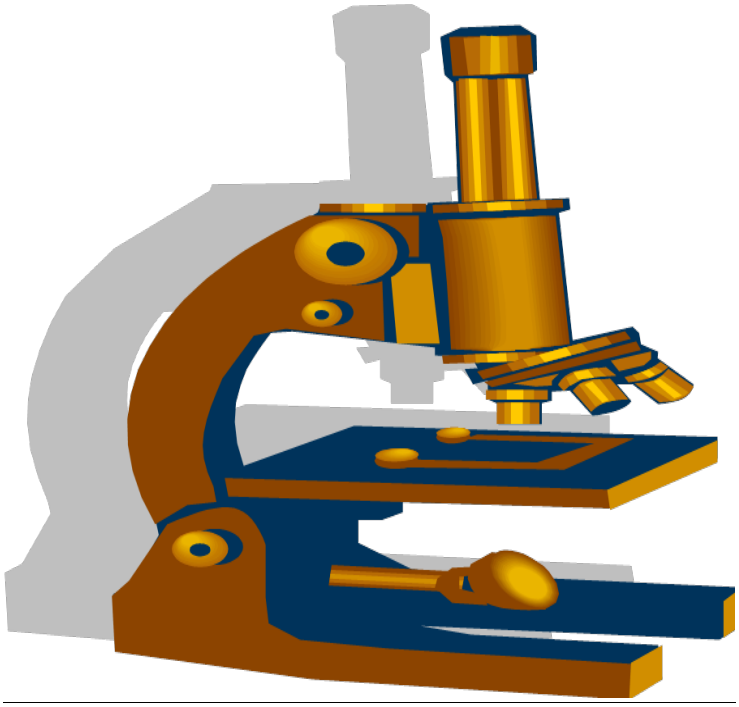
Materials: black/ white board, marker, duster, pen, note books etc.

Day 2 itinerary:

Procedures to use in the laboratory

1. **For Soil testing**
   I. Set up instruments
   II. Give the rules govern the lab.
   III. Explain the usages of the instruments
   IV. Carry on lab demonstration

Materials to use: microscope, Petri dish, microwave, baker, centrifuge, cylinder, PH-level, electronic skills, electronic oven, distributor set, computers, magnetic mixers, triple beam, duster, white board,marketc.



Day 3 itinerary:

Procedures use in the field

1. Select experimental site
2. Select consumable crops to plant for testing
3. Plant the crops
4. Review by explaining to participants the benefits of field trial.
5. Carry on evaluation

Materials/inputs: demonstration site, cutlasses, hoes, pangolins, shovels, files, water cans, measurement tape, seeds, fertilizer, compost, insecticide, fungicide etc.

Context for day one class lecture

At the end of day one, students should be able to;

1. Describe the different types of soil
2. Distinguish the properties of the different types of soil.
3. Differential the different between field setting and laboratory
4. Explain the important for soil testing.
5. Describe how the cause of moisture in the soil.

Definition:

1. Field setting – this is a site use to carry on field trial of different tests are practically demonstrated without using laboratory equipment but the application of laboratory results are realized.
2. Laboratory – it is a place or building where scientific work using equipment for a desire outcome.

Why do you carry on laboratory soil testing before planting is important?

1. This will enable the students and the local farmers to have perfect control on what to plant in the field.
2. The farmers will be able to predict their outcome of the expected products and will be able to acquaint with the quantity of the soil nutrient level.
3. Students and local farmers will select the correct site with the requisite soil needed for a particular crop on hand.
4. It will help to produce maximum amount needed.
5. To determine available nutrients in the soil.

What is the meaning of soil?

Soil is the upper layer of the earth in which plants gather their nutrients for growth. It is also a black or dark material consisting of a mixture of organic remains, clay, and rock particles.

What are the different soil types for testing?

All soils can be tested for Agricultural purposes to acquaint with their nutrients capacity. The soils involved are: loamy soil, clay loamy, silty, clay and sandy soils are required for testing.

1. **Loamy soil** – this is a perfect soil with high nutrients with good structure, well drain that can retain moisture. The loamy soil is easy to cultivate and is consider very lucky if you have this soil. So, when the nutrients are depleted due to over cultivation, it is easy to replenish the nutrient back to the soil before planting the crops (vegetables).

2. **Clay soil** – this soil has moderate nutrients as compared to loamy soils. It is good for vegetable but need some amendment of fertilizer or compost to meet the desired quantity of nutrients needed for plant absorption. This soil can be used for perennial crops. The clay soil feel lumpy when very wet. Rock-hard when dry, drains poorly and has few spaces. It is heavy to cultivate but if improved, plant grow well as it holds more nutrients them may other soils.
3. **Silty soil** – this soil is smooth and soapy to the touch and well drained. It has the ability to retain moisture, richer in nutrients and easier to cultivate than clay soil and heavier than sand. The structure is weak and easily compacted. It can be a very good soil when well managed.
4. **Sandy soil –** it is free draining soil that has gritty to the touch and easy to cultivate. The soil dries wet rapidly and lack nutrients which easily washed through in wet weather. This soil is known as hungry soils.
5. **Peaty soil** – this soil contain a much higher properties of organic matter, dark in color because the soil is acidic. The natural inhabits decomposition. This means, there are few nutrients. This soil is highly water retentive and may require drainage if the water table is near the surface.

Soil moisture content

The amount of water in the soil is influenced by

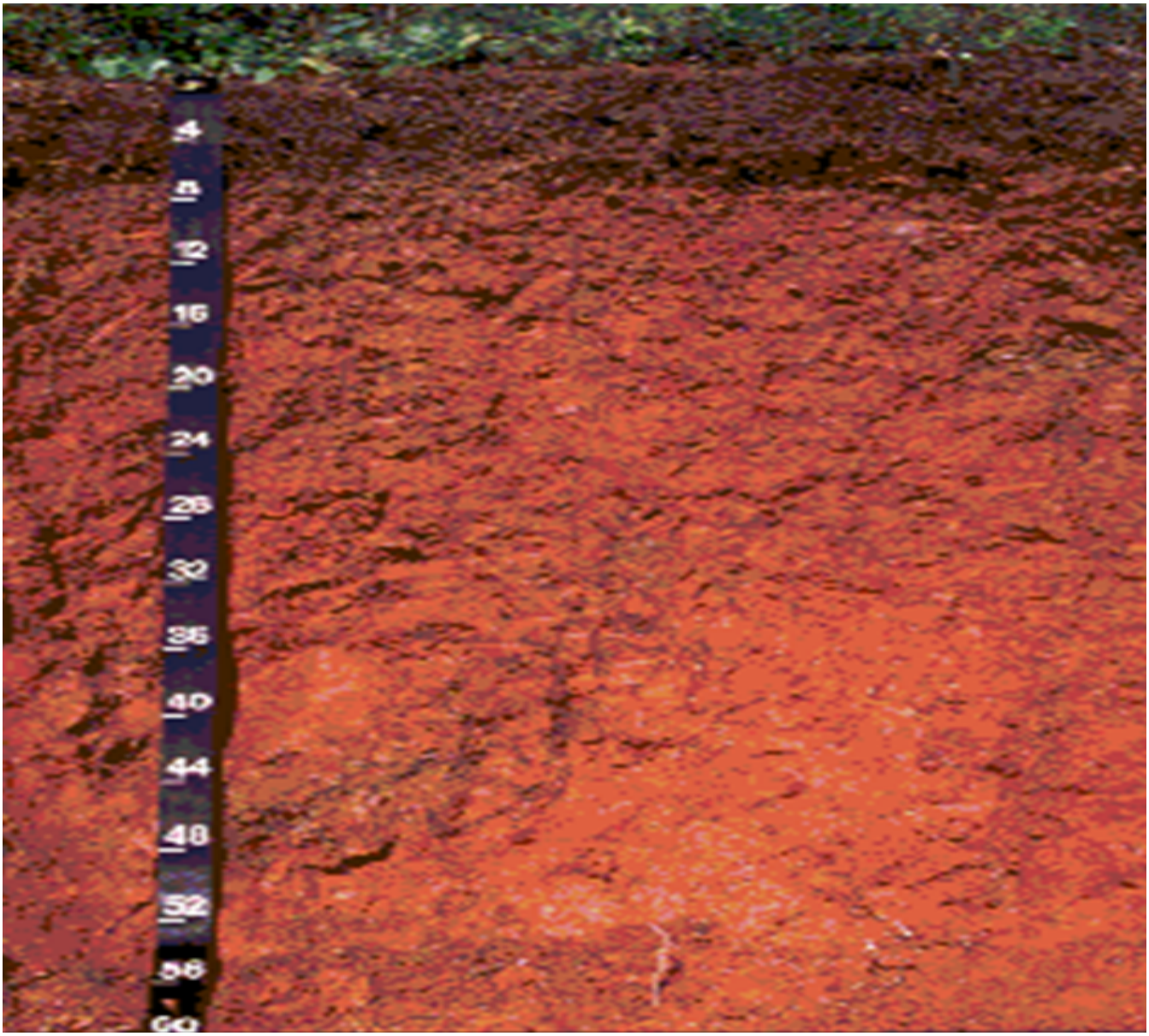
a. Local annual rainfall
b. Soil types
c. Aspect of the soil use

d. Water table – the point in the soil at which water drains away.
e. Shady of north facing covers often damp soil.
f. Much of rainfall

Note: if your soil is too extreme, improve moist soil by digging in lots of bulky organic manure. Today, it's install a drainage system.

<u>Closure for day one</u>: Review major points of lecture discuss in class and let them see clear pictures of different types of soil.

These are photos of loamy (photo 1), and sandy loam soil (photo 2.)



This clay soil mixed with compost and fertilizer for in richness.

This is clayey loam soil that had been tested.

This loamy soil contains different particles like plant and animal remains

Context on day two:

At the end of this day, the participants should be able to;

1. Demonstrate soil testing.
2. Describe the PH method procedures.
3. Outline the soil testing method
4. Distinguish the soil PH for different prospective of the soil.
5. Use the PH strips method

Soil testing- this is a way forward to identify the nutrients level into the soil and also to describe if the chosen soil is acidic, basic, salty, or neutral by making soil analysis. With this level, acidic soil is ideal for the type of crops grown in Liberia. During this process, the students or the local farmers are requiring to go in the laboratory for hand on teaching. This will allow the students and the farmers to have good knowledge on either to add nutrients or not. Also, to apply the amount of nutrients needed for application.

Procedures to follow in soil testing:

The facilitator should explain and demonstrate the followings;

1. How to set up the equipment in the lab.
2. The procedure and safety rules to follow in the laboratory
3. The functions of each equipment
4. How these materials are used in the lab.
5. How soil can be filter into a separate plastic or paper cups.
6. How to insert test strip into resultant solution.
7. How to compare color to the color chart provided with the strips.
8. Show how the instruments are packed and stored.

Different methods use for soil testing

1. PH ---- use water
2. Lime – mehich 3
3. Extractable P, K, Ca, and Mg – Mehilch 3
4. Ca exchange capacity ---- Summation
5. Organic matter – loss on irrigation
6. Total C ----- combustion
7. Nitrate N ---- specific ion electrode

8. Particle size analysis – hydrometer method
9. Soluble salts – electrical conductivity
10. Ammonium N – specific ion electrode

Soil pH testing procedure

1. Fill the two soil spots half full with same soil.
2. Has to be finely ground
3. Preferably wet but not too wet
4. Saturate soil with indicator but do not overfill
5. Choose indicator as follows:
   a. Bromocresol green PH 3.8 – 5.4
   b. Chlorophenol red PH 5.2 – 6.9
   c. Bromthymol blue PH 6.0 – 7.6

For the color cards

1. Allow at least 1-3 minutes to react.
2. Tilt the plates to get excess indicator with corresponding color card specific original indicator to be used.

pH test strips method

1. Put 1-3 teaspoonful of soil into plastic container.
2. Fill to same volume with distilled water.
3. Stir vigorously for one minerals.

Characteristics of soil pH

PH is one characteristics of soil that is measured of whether the soil is acidic r ericaceous – PH between 1 and 7. For different measurement of soil PH, the PH level is used as an indicator.

1. Neutral, PH exactly 7, eg. some clay soils
2. Alkaline or lime with a PH between 7 and 14. Eg, chalky soil

For Liberia, acidic soil is the best with a PH between 4 and 6.5. This helps most plants to grow effectively at this point where nutrients are most easily available. But some are ericaceous, they need acid soil.


Seed placement into potting mix

These pictures are tested soil used in polyene bags to trial test in field setting for experimental purposes.

This is a photo that distinguishes between different types of soil structures to be tested for PH levels, nutrients for field setting.

Closure for day two:

The facilitator will;

Monitor student and local farmer's responses to ensure that the class has fulfilled lesson's objective by instructing them to repeat classroom activities, where necessary.

Ask students or farmers to do presentation by setting up their own equipment to test the soil. This is done by critical analysis by the facilitator.

Method(s) of Evaluation:

Ask individual student and farmer oral questions and monitor their responses.

Closure:

Reviews major points discussed.

Day three outline:

The Procedures in field setting should be of the following:

1. Select demonstration site
   The site should be selected by the facilitator together with the students or the participant local farmers.
2. The site selected should be accessible to the participants not too far from the laboratory.
3. The soil from the site should be tested to know the nutrient percentages or PH level before sowing seeds or seedlings on the

soil. With this, the participants will determine either to add nutrient such as fertilizers, compost or not.

4. Select crops that are of short duration like vegetables to enable save time for onward cultivation on a large scale.
5. Cultivate the land and sow seeds or seedlings for experimental purpose.

Revision before closure:

1. The facilitator should briefly explain to the participants the benefits integrating laboratory and field works.
2. Entertain questions and answers from the group.
3. Give assignment to the students and farmers to construct their individual own demonstration site to be monitor.

REFFENCES:

1. Folder: Technical , Teaching in field settings and laboratory MEAS – document
2. Google search
3. Individual Inputs
4. Personal Inputs