LECTURE 17

SOIL TESTING

Soil Testing, STL Functions

Soil Testing

Soil testing is defined as a 'programme for procedural evaluation of soil fertility by Rapid chemical analysis particularly to assess the *available nutrient status and reaction* of a soil'.

A **soil test** is a chemical method for estimating nutrient supplying power of a soil. Compared to plant analysis, the primary advantage of soil testing is its ability to determine **the** nutrient status of the soil before the crop is planted.

The result of a soil test is known as **soil test value**. A soil test value measures a *part of the total nutrient supply in the soil and* represents only as an index of nutrient ability.

Soil test do not measure the exact quantity of a nutrient potentially taken up by a crop. To predict nutrient needs of crops a **soil test must be calibrated against the response of crops** in nutrient rate experiments in greenhouse and fields. Thereafter, interpretation and evaluation of the soil test values primarily form the basis for fertilizer recommendation.

Soil test programmes have the following objectives:

- To provide an index of nutrient availability
- To predict the probability of profitable response to fertilizer

- To provide a basis for fertilizer recommendation
- To evaluate the soil fertility status and a county soil area or a statewide basis by the use of the soil test summaries.

Phases of Soil Testing programme

1. Collecting the soil samples
2. Extraction and determining the available nutrients
3. Calibrating and interpreting the analytical results
4. Making the fertilizer recommendation and management

Soil sampling

The most critical aspect of soil testing is *obtaining a soil sample* that is **representative of the field**. There is always a considerable opportunity for sampling error. If a sample does not represent a field, it is impossible to provide a reliable fertilizer recommendation.

The soils are normally **heterogeneous**, and wide variability can occur even in a uniform fields. Intensive soil sampling is the most efficient way to evaluate variability. The sampling error in a field is generally greater than the error in the laboratory analysis.

Soil Unit: It is an area of soil t[illegible] [illegible]ted by a composite sample. After the soil unit is determined, the soil samples are collected throughout the area. The number of samples for combining into each representative composite sample varies from 5-20 samples in an area of an acre. Usually a composite sample of one kg of soil is taken from a field.

The size of the area may be sometimes even less for areas that vary in appearance, slope, drainage, soil types, past treatment These areas are to be sampled for separately. The purpose of the procedure of making a composite sample is to minimize the influence of any local non-uniformity in the soil.

Normally for all field crops, sampling soil up to 15 cm depth is practiced. For deep-rooted crops and tree crops samples up to 1-2 m may be necessary. While sampling, first a uniform portion is taken from the surface to the depth desired. Second, the same volume is obtained from each area.

Preparation of the composite soil sample in the laboratory

It involves the following steps: Drying, grinding, sieving, mixing, partitioning, weighing, and storing. Uniform mixing and sampling is done by **Quartering Technique**:

The soil sample is coned in the center of the mixing sheet. Cone is flattened and divided through the center with a flat wooden sheet. One half is moved to the side quantitatively. Then each half is further divided into half, the four quarters being separated into separate 'quarters'. Two diagonally 'opposite quarters' are discarded quantitatively. The two other are mixed by rolling. This process is repeated, until 250-500 g composite soil material is obtained.

For micronutrient analysis – sampling and processing of samples should alone be done only with stainless steel materials, plastic, or wood to avoid contamination.

The soil test values calibrated nutrient functions are advocated to the farmers as a package of nutrient management that aims at **judicious use of fertilizers**. Ultimately any soil testing and interpretation must involve ‘**economics’** because it is used to make a fertilizer recommendation to achieve an economic goal that would give ***maximum profit per hectare*** of land.

Extraction and determining the available nutrients

Many chemical extractants have been developed for use in soil testing. The ability of an **extractant** to extract a plant nutrient in quantities related to plant requirements depends on the reactions that control *nutrient supply and availability*. The extractants commonly used in soil testing programmes are given below.

Plant nutrient	**Common extractant**	**Nutrient source extracted**
NO_3^-	KCl, $CaCl_2$	Solution
NH_4^+	KCl	Solution - Exchangeable
Available N	$KMnO_4$ - NaOH	Mineralizable Organic N
$H_2PO_4^-$/ HPO_4^{2-} (Available P)	NH_4F - HCl (Bray-p)	Fe/ Al mineral solubility
	$NaHCO_3$ - P (Olsen-P)	Ca mineral solubility
K^+(Available K)	NH_4OAc-K	Exchangeable
Ca^{2+}, Mg^{2+}	EDTA	Exchangeable
SO_4^{2-}	$CaCl_2$	Solution AEC
Zn^{2+}, Fe^{3+}, Mn^{2+}, Cu^{2+}	DTPA	Chelation

$H_3BO_3^0$	Hot water	Solution
Organic C	Chromic acid	Oxidizable C

SOIL TESTING LABORATORY

Soil Testing Laboratories of the Department of Agriculture funded by State Government are functioning at identified centres in each district. Soil testing services are also extended to the farming community in the Soil Laboratories operated by Central government and Agricultural Universities.

The major functions of State Soil Testing Laboratory are:

- Analysis of soil samples which are collected from the farmers by the Assistant Agricultural Officers for texture (by feel method), lime status, Electrical conductivity, pH and available N, P and K status at lower charges/ sample; and advocating fertilizer recommendation for different crops. Available micronutrients will be analyzed on request.

- Analyzing irrigation water samples for EC, pH, cations, and anions; Assessing their quality based on different parameters; and suggesting suitable ameliorative measures for different soil condition and crops.

- Adopting two villages for a particular period by each soil testing laboratory; collecting and anal 10 (4/8) and irrigation water samples at free of cost and advocating the recommendations.

- Collection of benchmark water samples from the wells marked in a particular block/ water shed/ taluk. After analyzing the water samples for different properties, water quality map will be prepared.

- Based on the soil test value for the soil samples collected during the particular year they are rated as low, medium, and high; and village fertility indices will be prepared.

- Conducting trials related to soil fertility to solve the site-specific problems.

Functions of mobile soil testing laboratory

- The staff of the Mobile STL will visit the villages, collecting and analyzing the soil and irrigation water samples in the village itself and giving recommendations immediately.

- Showing the audio-visual programmes through projectors in the villages educating the importance of soil testing, plant protection measures and other practices related to crop production.

- In addition, Mobile STL is carrying out other regular functions of stationary soil-testing laboratory.