

# SOIL SURVEY, SOIL TESTING AND FERTILISER RECOMMENDATION

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*Modern agricultural practices, particularly the determination of fertilizer doses, are based on soil surveys and soil testing in order to ensure maximum returns for the cultivator's investment*

## SOIL SURVEY

SOIL surveys have been in progress for many years in different countries, but the organisation of soil survey work in the form of a

National Soil Survey was first developed in the United States of America. In India, soil survey on a countrywide scale was initiated by the Indian Agricultural Research Institute in 1953. Recently, a

number of States in India have started soil surveys as an integral part of their agricultural development programmes. A standard soil survey with uniform procedure and technique was initiated by the Indian Agricultural Research Institute, New Delhi in the form of an All India Soil Survey Scheme. Schemes for a detailed soil survey of the coconut-growing regions in Kerala started functioning from 1959 and 1960, at the Central Coconut Research Stations at Kayangulam and Kasaragod respectively. While the soil survey of Kasaragod is more fundamental in character, the survey at Kayangulam is conducted for the specific purpose of correlating the soil conditions in tracts where the coconut palms are healthy and in those where they are affected by the wilt (root) disease, with the incidence of disease. These schemes adopt the technique and procedure of the All India Soil Survey.

### Objectives of soil surveys

The function of a soil survey is to classify, locate on a base map and describe the nature of soils as they occur in the field. According to the system followed in the United States, the soils are classified into series and types, on the basis of their profile characteristics. The objectives of soil surveys are on the one side fundamental in character and immediate and utilitarian on the other. According to the first, the objectives include prediction of soil behaviour under defined use and management. In agriculture and in forestry the ultimate aim is to predict the yield and quality of crops and trees from a specific soil under defined management. According to the second, the major objective of soil survey is to expand human knowledge of the environment. The fundamental

objective may not have any immediate benefit.

### Nature and types of soil surveys

Depending upon the type of land to be covered and the objectives kept in view, soil surveys may take different forms. However, all soil surveys have certain basic elements in common. For example, information such as climate, topography, geology, agriculture etc. in respect of the area surveyed is collected in all surveys and on the basis of this a broad soil map of the area is prepared. By using aerial photographs it is possible to analyse systematically the whole tract to be surveyed and plan the field work in advance, taking into account the indications of physiography that have been studied on the photo. But the necessity of traversing the field to map the soils cannot be avoided.

There are three main types of soil survey.

#### (1) *Reconnaissance survey*

This type consists in mapping associations of soils in the scale of 1" : 1 mile or 1" : 4 miles. The field work involves the examination of one soil profile, depending on soil heterogeneity, in every 2-6 miles and one surface sample by auger upto 1 foot depth every 440 yards upto 1 mile. The soil boundaries are marked by traversing and partly by extrapolation.

#### (2) *Detailed reconnaissance survey*

This survey consists in carrying out reconnaissance survey in selected areas and demarcating soil series or associations

on the map. Afterwards a detailed soil survey (16" : 1 mile or 8" : 1 mile) of about 5 to 10 per cent of each soil area containing the soil series, is carried out.

### (3) Detailed soil survey

This survey is carried out by demarcating soil series and soil phases in the scale 16" : 1 mile or 8" : 1 mile, on maps. For this, pits are dug at required intervals according to the nature of the soil and soil profiles examined for delineating the boundaries of soil types and phases. Soil samples are also collected for physico-chemical examination in the laboratory.

### Uses of soil surveys

The uses of soil surveys were studied in the United States a few years back by a Sub-Committee of the National Soil and Fertiliser Research Committee. More than two dozen uses were found which can be grouped under five headings as follows :-

1. Production of plants on soils,
2. Land valuation,
3. Engineering uses of soils,
4. Planning and conduct of Research and
5. General education on natural resource.

Under the production of plants on soils are the applications of soil survey in making recommendations for crops and trees. For this, soil samples collected during the soil survey representing different soil types and crops are analysed for available nutrients, soil reaction and physical characteristics.

## SOIL TESTING

The economic situation in India requires very judicious use of fertilizers. It is a fact that more and more fertilizers must be utilised for increasing agricultural production. But the important factor is that the cultivator should get the maximum return for the money spent. Soil testing is the practical and best method for evaluating the fertility status of soils and for the economic use of fertilizers. In this direction soil testing laboratories are rendering great service.

The soil testing service was started in India under the Indo-United States Operational Agreement in 1952. With the assistance of the U.S. Government, 24 soil testing laboratories were started in the country. One of the above laboratories was set up at the Agricultural College, Vellayani which started functioning in 1957. For the first three years these laboratories were directly under the I.A.R.I. On completion of this period most of these laboratories were handed over to the concerned States. In Kerala two more soil testing laboratories were set up later, one at the Rice Research Station, Pattambi under the package programme and the other under the Revenue Board. The services of these laboratories are available to all cultivators in the State free of charge through the Extension Wing of the Agricultural Department.

## FACTORS OF FERTILIZER RECOMMENDATION

Fertilizers for a particular crop are recommended on the basis of the results of soil testing and the relationship between the nutrient status of the soil as

determined in the laboratory and the crop response in the particular field. This response cannot be ascertained from the nutrient status of the soil and the applied nutrient alone. It depends upon many factors such as plant variety, plant population, climate, soil moisture conditions and management practices. It is impossible to work out a mathematical formula for giving recommendations. But by conducting a sufficient number of field trials in respect of different crops under varying soil and climatic conditions and management practices it is possible to arrive at accurate relationships between the nutrient availability in the soil and crop response to added fertilizers. This relationship is the basis on which recommendations are made regarding fertilizers. The various factors which should be considered in making such recommendations are as follows:-

(1) As different methods of analysis extract different quantities of nutrients from a given soil, the interpretation of the analytical values should be in relation to the particular method used.

(2) Soil moisture, slope, drainage and effective depth influence the availability and absorption of applied nutrients by plants. These factors also

affect the type, amount and mode of application.

(3) Physical properties, such as texture and structure of soil, influence the analytical values and the availability of applied nutrients.

(4) The crop variety and the population affect the utilisation of applied nutrients.

(5) The response of applied fertilizer will be much better on a farm under good management practices than on a poorly managed one even though the analysis may show same availability of nutrients on both.

(6) The cost of fertilizer in relation to the value of the produce should be taken into consideration.

(7) The time and method of application of different fertilizers must correspond to the requirement of the crop at different stages of growth.

### Ratings and fertilizer recommendations

The following rating chart used by the soil testing laboratories in India are based on pot culture correlation experiments and the results of a few field trials conducted by the I.A.R.I.

Nutrient	Low	Medium	High
Organic carbon (as a measure of available nitrogen)	Below 0.5 per cent	0.5-0.75 per cent	Above 0.75 per cent
Available P <sub>2</sub> O <sub>5</sub>	Below 20 lbs./acre	20-50 lbs./acre	Above 50 lbs./acre
Available K <sub>2</sub> O	Below 125 lbs./acre	125-300 lbs./acre	Above 300 lbs./acre

### ACIDITY (pH)

Acidic	— pH below 6.0
Normal to most common crops	— pH 6.0 – 8.5
Tending to become alkali soil	— pH 8.5 – 9.0
Alkali soil harmful for growing crops	— pH above 9.0

### CONDUCTIVITY (Total soluble salts in milli mhos/cm.)

Below 1	— Normal
1-2	— Soluble salt content critical for germination
2-3	— Salt content critical for growth of salt sensitive crops
Above 3	— Severe injury to crops

The Department of Agriculture in each State has formulated and generalised fertilizer recommendations for different crops. These recommendations are based on the results of fertilizer experiments conducted on the State Research Farms and simple fertilizer trials

conducted on farmers' fields. For example, the Fertilizer Workshop Seminar held at the Agricultural College and Research Institute, Vellayani, in 1959, recommended the following doses of nutrients for coconut palms in Kerala :-

	N (lbs/tree) per year	P <sub>2</sub> O <sub>5</sub> (lbs/tree) per year	K <sub>2</sub> O (lbs/tree) per year
For sandy and sandy loam soils	0.5	0.25	1.00
For other areas	0.5	0.5	1.00

### Soil test and fertilizer recommendation report

A sample of soil test reporting is given below. The main part of the report is the recommendation for fertilizer application. Straight fertilizers with alternatives wherever possible are

recommended. An alternative mixture is also suggested in case one or more of the straight fertilizers are not available. However, the most important thing to note is the dosage of N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O recommended per acre or per tree. Fertilizers available in any particular area should be adjusted to get this dose.

### SOIL TEST REPORT

Name of Farmer.....  
 Village.....Survey No.....Taluk.....  
 District.....  
 Lab. No. of sample.

## RESULTS OF ANALYSIS

	Value	Rating
pH	5.00	Acidic
Conductivity (Total soluble salts)	3.5 milli mhos	Very high
Organic carbon	0.4 per cent	Low
Available phosphorus	15 lbs/acre	Low
Available potassium	75 lbs/acre	Low

### RECOMMENDATIONS

Crop — Coconut Irrigated/Rainfed

#### 1. Soil Amendments

(a) Lime 5 cwts/acre/year

(b) Gypsum.....cwts/acre/year

NOTE: Lime should be applied at least one week before application of basal dressing of manures and fertilizers.

Super phosphate ...2.3 kgs/tree/year

or

Bonemeal ... 1.8 „ „ „

Muriate of potash ...1.2 „ „ „

or

4.5 kgs. 8:8:16 mixture/tree/year.

#### 2. Manures

Apply 15 kgs. of farmyard manure/ compost/green manure to each tree per year. This can be applied in basin trenches around the tree.

#### OTHER REMARKS

Repeated washings with fresh water during rainy season by opening drainage channels may be effected.

#### 3. Fertilizers

Ammonium sulphate...1.8 kgs/tree/year

or

Urea ... ..0.9 „ „ „

Thus modern agricultural practices should be based on results of soil surveys and soil testing, for these will assure maximum returns for the money spent by the farmer.