T.R.I. ADVISORY CIRCULAR No.SP 7

Issued in: May 2009

Serial No. 01/09

Soil Analysis

(This Circular cancels Advisory Circular No. S3, Serial No. 5/84, issued in 1984)

1. Introduction

Nutrient status of soil can be determined by soil analysis. The corrective measures to amend or improve nutrient deficiencies can be based on results of such analysis. However, soil analysis only may not be adequate to make recommendations as there are several other factors that govern the availability of nutrients.

Soil analysis may be resorted to, when it is suspected that the soil is the primary cause for poor performance of tea bushes. Other factors such as fertilizer application, cultural practices, *etc.* should have been correctly adhered to. Under such circumstances, a complete analysis of soil is likely to reveal the factor which causes poor growth.

For Site Specific Fertilizer Recommendation (SSFR), soil analyses are compulsory because SSFR mainly depends on soil nutrient status.

For soil analysis to be reliable for decision making, soil should have been sampled correctly. Therefore, due regard must be paid to the sampling procedure outlined below.

2. Sampling for nutrient analysis

The collection, preparation and delivery of a soil sample are important steps in the analytical operation.

2.1 Time of sampling

For the estimation of soil pH levels and/or nutrient status, sampling should be carried out after a minimum period of 6 weeks following the last ground fertilizer application. At the time of sampling, soil should be relatively moist. Sampling should be avoided during severe drought and heavy rainfall seasons. In the case of SSFR, representative soil samples should be obtained annually to determine the nutrient status. Samples for SSFR can be obtained during March/ April and September/October from the South-West quarter, and during September/October, from the North-East quarter.

2.2 Tools and the procedure

The ordinary post-hole auger is the best sampling tool. Its combined cutting and digging edge makes it most serviceable for general use even on hard ground. The stem should be marked at intervals of 15 cm (6 inches) so that the depth of sampling can be ascertained at a glance. Except in gravely areas, it is possible to sample up to a depth of 60 cm (24 inches) with the above soil auger, if necessary. As an alternative, the *alavangoe* normally used for digging planting holes is satisfactory for the purpose. For collecting soil from depths below the reach of the soil auger, it is necessary to dig pits. For diagnostic purposes, sampling to a depth of 15 cm (6 inches) would be sufficient. The leaf litter on the soil surface (not incorporated in the soil)

should be cleaned before sampling. While collecting soils from the second and lower depths with an auger, contamination of the samples with the top soil can be minimized by lightly scraping the outer part of the soil core with a knife.

2.3 Technique of sampling

One of the most important aspects of soil testing is the technique of obtaining a soil sample that is representative of the area. The errors in sampling a field are generally greater than the errors in laboratory analysis. The size of the area from which one sample may be taken varies greatly, but usually ranges from 2 to 10 hectares (5 to 25 acres). A field may be marked into blocks depending on the area, topography, drainage, past cultural practices, *etc.* Areas that vary in appearance, slope, drainage, soil-type should be sampled separately (Figure 1). Localized areas with extremely poor soil or crop growth should be marked separately and sampled.

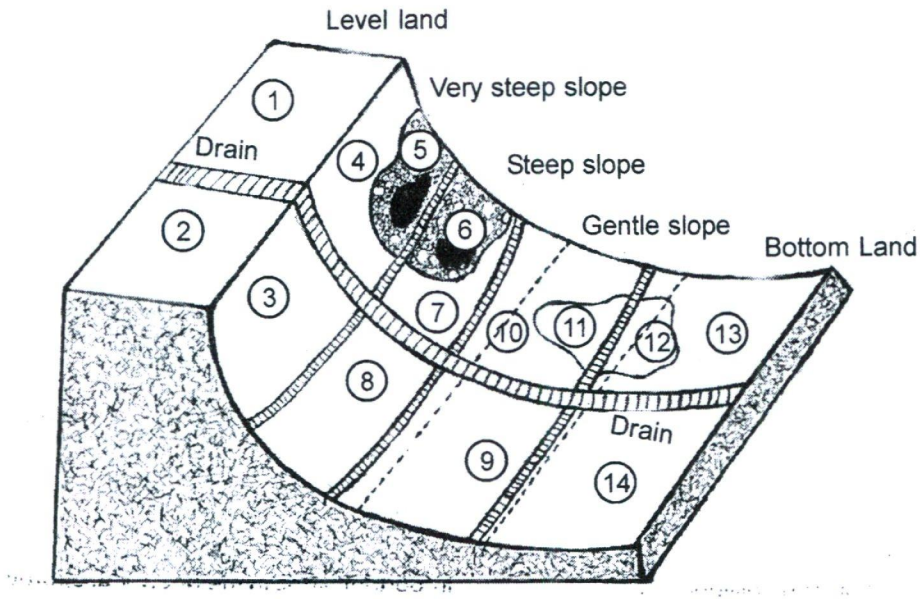

Figure 1. Demarcation of an area into blocks to obtain representative soil samples of the area (numbers within the circulars are blocks)

2.4 Number of samples

Using the auger, a large number of core samples should be collected randomly in a zigzag manner as shown in Figure 2. It is advisable to take cores from points closer to the plants where root activity is high, rather than the middle of the rows. Sampling should not be done near roads, paths, drains or other non-representative or abnormal areas. The number of soil cores to be taken would depend on the area which the composite soil sample is expected to represent. Each sample should contain soil from cores taken at several places in the field. This procedure is to maximize the influence of uniformity in the soil smaple. From small or experimental plots, it would suffice to take about 10 cores. When sampling a large field, it should first be divided into blocks of about 2 hectares (5 acres) and 15 to 20 cores should be taken from each block.

- The soil cores from each block should be collected on an aluminium/plastic tray or a piece of polythene sheet or brown paper
- When soil is collected for trace element analyses, the tray should be lined with a polythene sheet

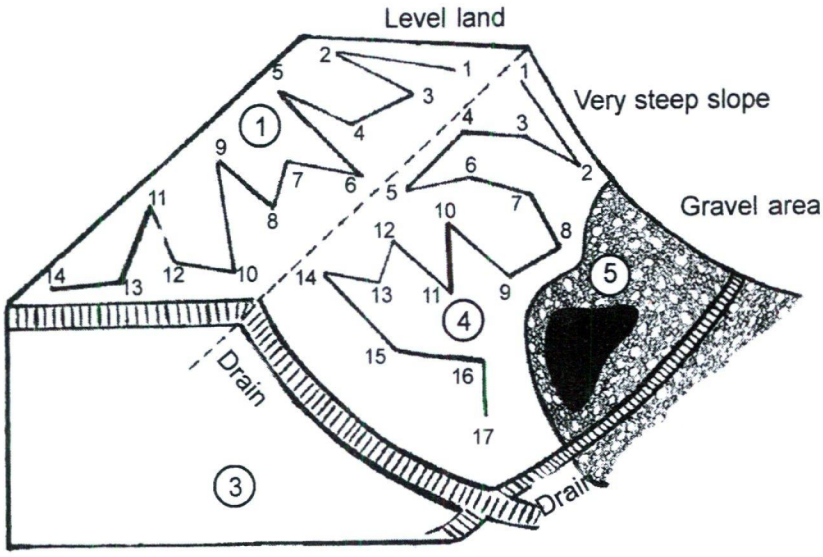

Figure 2. Soil sampling in a zigzag random manner to obtain a composite sample

- The soil should be thoroughly mixed, breaking-up any lumps and spread into a layer
- Small portions from the layers are taken at random and transferred into a clean polythene bag in order to provide a sub-sample of about ½ kilogram (1 lb)
- The bag should be closed immediately by tying and labelled with a waterproof marking pen, giving details of location (estate, field and block), depth of sample, date *etc*. The samples should then be despatched to the laboratory without undue delay

3. Sample despatch

The samples should be sent directly to the Head, Soils and Plant Nutrition Division, Tea Research Institute of Sri Lanka, Talawakelle or to the regional laboratories located at following addresses depending on the convenience for transport.

- Soils and Plant Nutrition Laboratory, Walahanduwa, Galle
- Soils and Plant Nutrition Laboratory, Research, Advisory and Extension Centre, PO Box, 130, Hantana, Kandy

It is necessary that the total cost of analysis should be paid prior to commencing analysis. Payments could be made through cheques, postal or money orders drawn in favour of "Tea Research Institute of Sri Lanka" and forward to the Head, Soils and Plant Nutrition Division, Tea Research Institute of Sri Lanka, Talawakelle or to the regional laboratories at Hantana, Kandy and Walahanduwa, Galle. Money could also be paid at the cash counter of the Tea Research Institute or its centres at the time of submission of samples for analysis.

T.R.I. ADVISORY CIRCULAR No.SP 8

Issued in: May 2009 Serial No. 02/09

Analysis of Fertilizer Samples

(This Circular cancels Advisory Circular No. F6, Serial No. 6/92, issued in August 1992)

1. Introduction

The Institute undertakes analysis of fertilizer samples to determine their nutrient contents for ensuring quality. The values so obtained may differ from those expected of their chemical composition for the following reasons:

1. Adulteration
2. Presence of excess moisture. Straight fertilizers or fertilizer mixtures which are hygroscopic or contain hygroscopic components, could absorb moisture and become a slurry, if stored under humid conditions
3. Inadequate mixing of the components of a fertilizer mixture
4. Segregation of particles of different sizes in the bag containing the mixture during transport and storage
5. Presence of impurities
6. Incorrect sampling procedure
7. Analytical errors. This is relatively small

For the results of analysis to be meaningful, it is necessary that great care be taken when sampling is carried out. It is only then the samples would be representative of the bulk of the fertilizer or fertilizer-mixture sampled. Thus, it is important that the following procedure be strictly adhered to in sampling.

2. Sampling

The number of fertilizer bags to be collected at random for sampling should be determined based on the amount of fertilizer bags in a given store as per Table 1.

Table 1. Guide to determine the number of bags to be sampled

Stock of fertilizer	Percentage of the minimum number of bags taken for sampling	Number of bags
Less than 2 bags	100	sample both bags
2-5 bags	60	2
6-10 bags	40	3
11-20 bags	20	3
21-60 bags	5	2
61-200 bags	4	3
201-500 bags	3	8
501-1000 bags	2	13
1001 or more bags	1	20

The accepted procedure for obtaining a representative sample of fertilizer is described below.

3. Methods of sampling

3.1 Use of a shovel

The bags to be sampled should be selected at random and should be emptied separately on a clean dry surface and blended using a shovel and one shovelful taken from each. The shovelfuls so taken should be then thoroughly mixed and any lumps broken up. From this mixture, a sub sample should be drawn by the process of quartering.

3.2 Use of a sampling probe

1. Use a sampling probe (details given below) to draw samples from fertilizer bags
2. Lay bags horizontally, open one end and pass the probe diagonally from one end to the other and remove the core
3. From lots of ten bags, take one core from each bag
4. For lots of more than ten bags, select ten bags at random and then take one core from each bag
5. When it is necessary to sample only lots of less than ten bags, take ten cores but at least one core from each of the bags
6. For bulk fertilizer, draw at least ten cores from different points
7. From this, subsamples should be drawn by the process of quartering as described below

The sampling probe could be constructed by taking 0.9 m (3 feet) long 5 cm (2 inches) internal diameter conduit piping or PVC tubing. Cut one end of the tubing obliquely to get a sharp pointed edge (Figure 1).

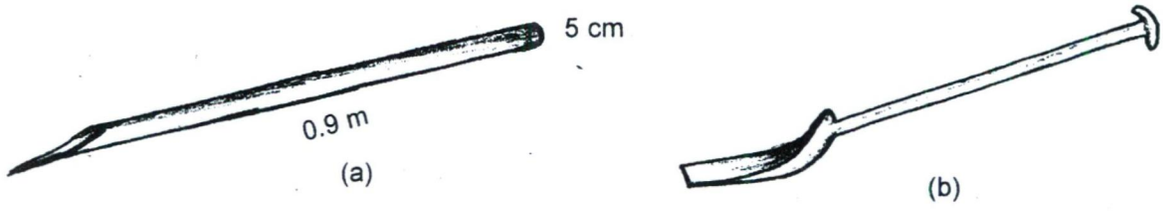

Figure 1. A diagramatic sketch of a sampling probe (a) and a shovel (b)

4. Subsampling by the process of quartering

It is required to reduce the quantity of fertilizer to a manageable size prior to submission for analysis. Therefore quartering should be adopted as explained below to subsample the collected fertilizer (Figure 2).

a. Heap the fertilizer to form a 'cone' on a clean sheet of paper or polythene
b. Flatten the cone and divide into two sections through the centre with a metal spatula or wooden plank
c. Divide each half once more and separate the four quarters into four separate piles or quarters
d. Reject one set of diagonally opposite quarters and mix the remainder
e. Continue the quartering and rejection until the desired quantity of sub sample is obtained
f. Collect the final remainder as representative sub sample

One kilogram of sub sample is quite sufficient, of which only one-third need be sent for nutrient analysis, one-third should be sent to the supplier and the balance must be retained by the customer.

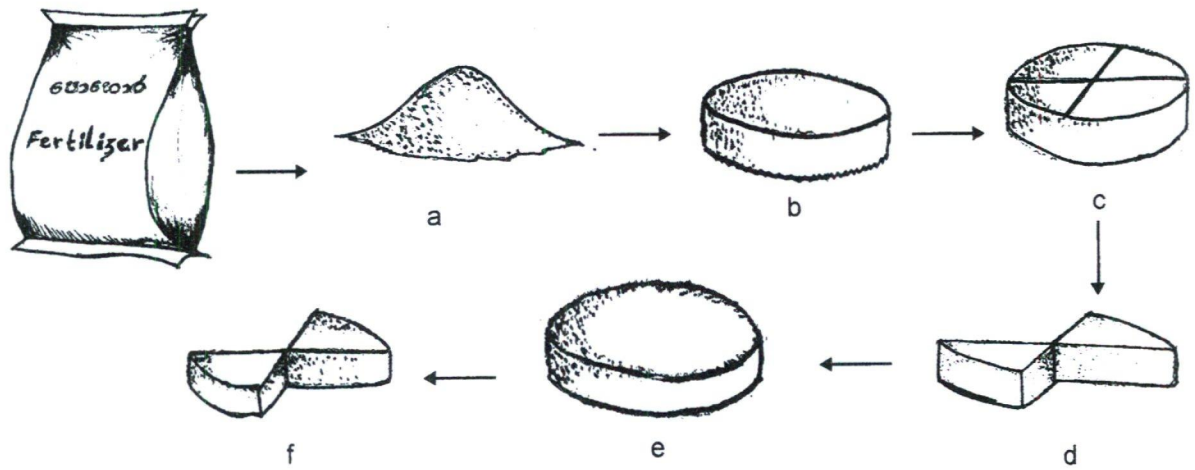

Figure 2. Subsampling by quartering

5. Labelling

The samples should be carefully and correctly labelled giving the name of the estate, type of fertilizer and the date on which the samples was taken. It must be ensured that the label does not come into contact with the fertilizer sample. This precaution is taken to avoid the labels becoming illegible at the time of arrival at the TRI laboratories or its centres.

6. Sample despatch

The samples should be sent directly to the Head, Soils and Plant Nutrition Division, Tea Research Institute of Sri Lanka, Talawakelle or to the regional laboratories located at following addresses depending on convenience for transport.

- Soils and Plant Nutrition Laboratory, Walahanduwa, Galle
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The analysis is being done on the strict understanding that neither the Tea Research Board nor the Tea Research Institute of Sri Lanka will be involved in any litigation, nor will any officers employed by the above Board or any of its Divisions or its centres be required to answer summons to witness in any legal action or dispute arising from the results of this or any other analysis of these or similar samples.

T.R.I. ADVISORY CIRCULAR No.SP 9

Issued in: May 2009

Serial No. 03/09

SAMPLING FOR FOLIAR ANALYSIS OF TEA

(This Circular cancels Advisory Circular No. F7 Serial No. 7/92 issued in August 1992)

1. Introduction

Plant growth is dependent on the nature of the medium in which they grow as well as on other agro-climatic factors. They extract their nutrient requirements from the soil and for healthy growth, the important nutrients should be freely available in the right proportions. Either a deficiency or an excess of any one or more of the nutrients can have a profound influence on the healthy growth of the plant. A nutrient deficiency or excess will in the first instance, show up in the foliage of the plants as distinct and characteristic symptoms. Chemical analysis of the foliage of the plants would, therefore, serve to confirm the visual observations and also give a reasonably good index of their nutrient status.

If tea growers strictly follow the fertilizer recommendations of the Tea Research Institute of Sri Lanka, the need for routine analysis would not arise. Foliar analysis is, however, recommended in instances where growth abnormalities are suspected to be due to nutritional problems.

2. Leaf sampling

For most leaf analysis, it is the first mature leaf (Figure 1) that is collected and it is from the axil of this leaf that the pluckable shoot emerges. This is usually found on the plucking table, whilst those below, and consequently shaded should be avoided.

1. When sampling an experimental plot, one or two leaves are taken from each bush in the plot to provide a composite sample of about 100 leaves
2. When sampling is carried out on a field scale, a large number of widely distributed bushes should be sampled, taking one leaf from each bush
3. In order to get a representative sample, it is preferable to randomly select bushes from different rows
4. Bushes growing in abnormal areas such as close to roads and drains and those in bare patches should be avoided
5. It is best to avoid collecting leaf samples following a period of prolonged heavy rainfall or during extreme droughts

3. Sampling and packing procedure of leaf samples

1. Leaf sampling should be avoided in the early part of first year and the latter part of final year of the pruning cycle. Under low country conditions where certain fields are maintained on a 2 year cycle, sampling should be done in the 2nd half of first year or 1st half of 2nd year
2. It is absolutely essential to note that sampling should be done only after a minimum period of 6 weeks following the last ground application of fertilizer
3. From each block of 2 ha, collect about 100 leaves at random selecting only the first mature leaf at the plucking table (Figure 1)
4. Do not collect more than one leaf per bush

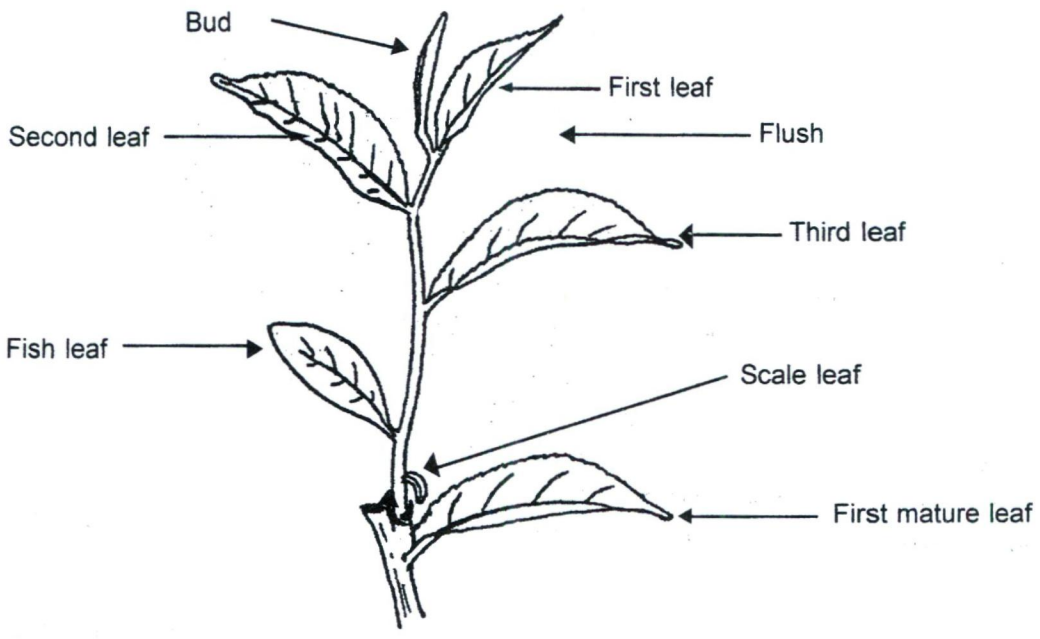

Figure 1. Diagrammatic sketch of shoot showing leaf to be sampled

5. Pack the samples in polythene bags
6. Label each sample clearly and ensure that the label is not in contact with the sample. This precaution is taken to avoid the labels becoming illegible at the time of arrival at the TRI laboratories or its centres. The labels should contain details of the field and the block number, seedling or VP tea, year of last prune, length of the pruning cycle and the date of the last fertilizer application

4. Sample despatch

The samples should be sent directly to the Head, Soils and Plant Nutrition Division, Tea Research Institute of Sri Lanka, Talawakelle or to the regional laboratories located at following addresses depending on the convinience for transport.

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