SENDING LEAF SAMPLES FOR PLANT NUTRIENT ANALYSIS TO THE CHEMISTRY SECTION LABORATORY

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INTRODUCTION

Collecting leaf samples and sending them to a laboratory for analysis may help you find out why your plants are not growing well.

For healthy growth, plants need a balanced supply of 13 mineral nutrients (plant foods) from the soil. Clear signs of a deficiency (shortage) of any of these nutrients do not show until both the growth of the plant and the crop yield are greatly reduced. But a farmer may suspect that his crop is not growing well. In this case, the farmer can collect leaf samples and send them for plant analysis. Analysis of the samples could identify nutrient deficiencies before they become serious.

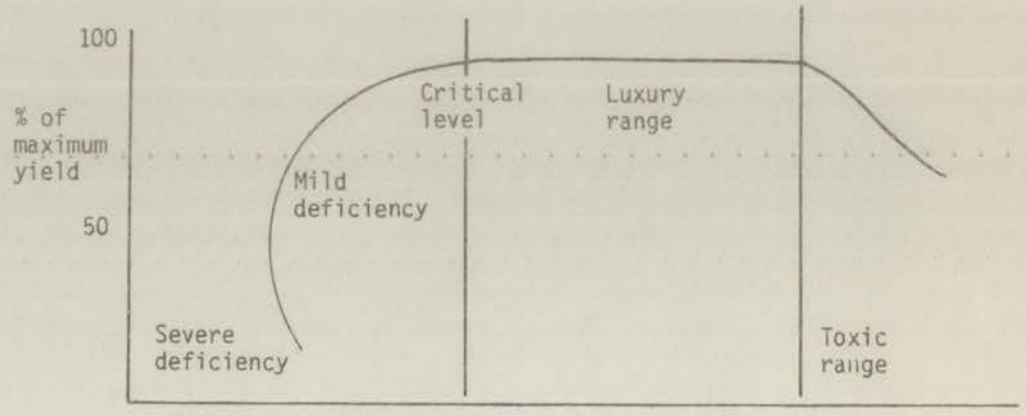
Experienced agronomists can sometimes recognise nutrient deficiencies by studying the colour and shape of the leaves. However it is best to use plant analysis to identify nutrient deficiencies because the symptoms may be caused by a deficiency of more than one nutrient.

Plant analysis is only useful if the correct leaves are collected, and certain information about the crop is provided. This article shows how to collect and send plant samples for analysis.

CHOOSING THE RIGHT LEAF

Research has been carried out in Papua New Guinea and in other countries to determine 'critical levels' of plant nutrients. A critical level is a certain amount of a plant nutrient in a standard leaf. If the nutrient in the leaf is below this amount there is a good chance of increasing the yield of the crop if the particular nutrient is applied.

The diagram below shows how the nutrient content in a standard leaf is related to the yield of the crop. When the deficiency is serious, applying the plant nutrient will improve the growth of the plant more quickly than the nutrient is taken up by the leaf. Therefore, the concentration of



This diagram shows how the nutrient content in a standard leaf is related to the yield of the crop.

nutrient in the leaf decreases. When the deficiency is mild, application of the plant nutrient increases both growth, and the level of the nutrient in the leaf. If the concentration of any of the plant nutrients in the leaf is above the critical level, there is no need to apply extra fertilizer.

Because the nutrient content of leaves varies with age, it is very important to collect the correct leaves. Young leaves have higher levels of nitrogen, phosphorus and potassium compared with old leaves. Old leaves have higher levels of calcium, manganese and iron. The standard leaf recommended for many crops is the youngest mature leaf. In most food crops this is the third leaf.

COLLECTING LEAF SAMPLES

The leaf samples you collect must be representative of the area in which your crop is growing. By representative, we mean that the samples must be taken so that they give a good idea of what the whole crop is like. You should first divide your land into blocks with reasonably uniform soil. The plants should be the same age and variety and should have had the same fertilizer treatment. If the block to be sampled is greater than 1 ha (about the size of two football fields), then you should collect samples from each hectare.

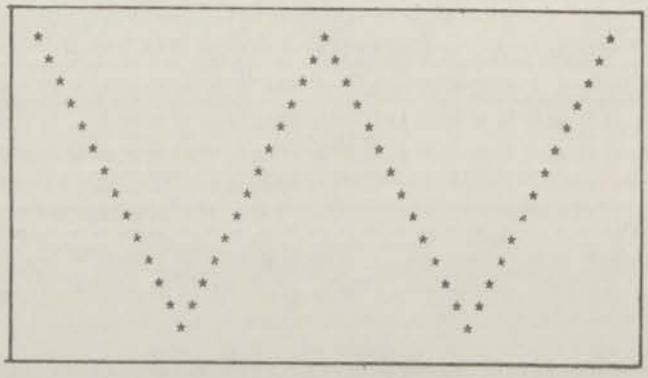
Do not collect leaves from the following kinds of plant:

1. Plants growing next to roads or fences
2. Plants which are suffering from drought
3. Plants which are suffering from flooding
4. Diseased plants
5. Plants which have severe insect damage
6. Plants which are overgrown with weeds.

These conditions can change the way in which the plants take up nutrients. They may lead to nutrient deficiencies which are not related to the amount of nutrients in the soil.

If some plants are growing poorly and some well in the same area, collect a sample from the plants with poor growth and another from the plants with good growth. The two samples can then be compared.

To collect a representative sample, you should follow the sampling pattern given in the diagram below:



*The correct pattern for collecting samples from a field. Each * represents a sampling point.*

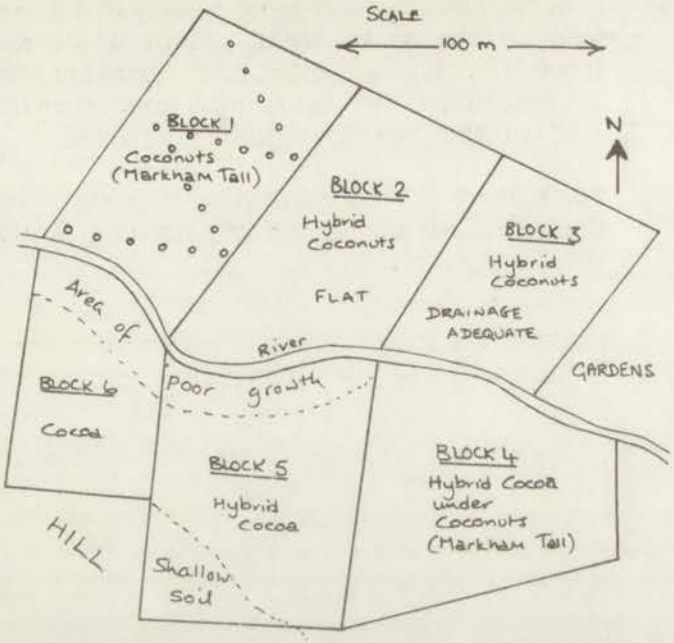
We need about 20 g of dried plant material for analysis. This is equivalent to about 200 g of fresh leaves, or leaves from 20 to 50 plants, depending on the size of the leaf.

When you have collected your leaves, dry them, if possible in an oven at 70°C for 24 hours. If you do not have an oven, the leaves can be air-dried instead.

A diagram of the area sampled should be sent with the samples. Mark the following things on your diagram:

- where each sample was taken
- where different varieties are planted, if the plants are not all the same variety
- any areas where the soil is shallow
- any areas with poor drainage
- any areas where plants are growing poorly.

An example of a diagram of a sampling area is shown below.



An example of a diagram of the area sampled. In this example, the farmer divided the area into 6 blocks and took a sample each one. In addition he took samples from the area of poor growth along the river bank in blocks 5 and 6. The positions of the plants from which he took samples in Block 1 are marked 0. In the final diagram this would be marked for all 8 samples taken.

INFORMATION REQUIRED FOR INTERPRETING RESULTS

The nutrient content of leaves is affected by many factors. These include:

- age
- variety
- whether the plant is flowering or fruiting
- soil type
- fertility
- depth of soil
- drainage and slope of the land
- presence of weeds

Age of plant

It is important to know the age of the plant for annual crops such as sweet potato and peanuts. The levels of the important nutrients nitrogen, phosphorus and potassium in the leaves fall as the plants get older.

Variety

In some crops, the variety affects the amount of nutrients needed by the plant. For example, new hybrid cocoa and coconut varieties that are being distributed by D.P.I. have a greater demand for nutrients, because they can produce higher yields than the old varieties.

Soil properties

We need to know how deep the plants grow in the soil. The growth of roots deep in to the soil can be restricted by poor drainage, for example, the subsoil may be always waterlogged, or there may be a very hard layer of soil. For tree crops, a deep soil allows for a large volume of roots, which will help the tree extract nutrients in areas of low fertility.

Weeds

The ability of a crop to take up nutrients from the soil can be affected by weeds. This is especially true for young crops. Crops that are overgrown with weeds often look unhealthy because the weeds are stronger and use up large amounts of water and nutrients. Weeding is a lot of work, but it is important if you want your crop to yield well.

All this information is very important to help Chemistry Section interpret (understand) the result of their analysis of your sample. A form is available from Chemistry Section on which you can record the information. The form is reproduced on the opposite page.

Leaf samples may be collected to find out which fertilizers are necessary. In this case a knowledge of the fertility of the soil is also useful. The soil should be collected from the same area as the leaf samples. An article in Harvest Vol. 11 No. 1, by K. Thiagalingam, gives instructions on how to

PLANT ANALYSIS REQUEST FORM

NAME:.....

POSTAL ADDRESS:.....

LOCATION OF CROP:.....
(Village, District, Province, Map Ref)

SAMPLE IDENTIFICATION:.....

REASON FOR REQUEST:.....

SAMPLE DETAILS TICK BOXES ☐

CROP SAMPLED (and variety if known) _____

DATE OF SAMPLING: _____

AGE OF CROP: _____

SYMPTOMS OF SUSPECTED
PLANT NUTRIENT DEFICIENCY: _____

PREVIOUS LAND USE: _____

SLOPE FLAT ☐ MODERATE ☐ STEEP ☐

DRAINAGE GOOD ☐ FAIR ☐ POOR ☐

DEPTH OF SOIL FOR PLANT ROOTS LESS THAN 50cm ☐ 50-100cm ☐ MORE THAN 100cm ☐

YIELD OF CROP GOOD ☐ AVERAGE ☐ POOR ☐

OR PREVIOUS CROP: _____

WEED INFESTATION LIGHT ☐ MODERATE ☐ HEAVY ☐

OR TYPE OF CROP COVER: _____

INSECTS/DISEASE PRESENT ☐ ABSENT ☐ NOT OBSERVED ☐

NAME: _____

ANALYSIS REQUESTED

MAJOR NUTRIENTS N ☐ P ☐ K ☐ Ca ☐ Mg ☐

MINOR NUTRIENTS Mn ☐ Fe ☐ Zn ☐ Cu ☐ B ☐ S ☐

collect soil samples. Soil analysis request forms are available from Chemistry Section. You should record information about your soil samples on this form.

SENDING YOUR SAMPLES

Place your dried samples in a paper bag, or wrap them in paper. Mark them clearly with your sample indentification then pack them securely in a box or other strong wrapping material. Send them, together with a completed plant analysis request form and your diagram of the area sampled, to:

Chemistry Section
Department of Primary Industry
P. O. Box 417
Konedobu

Your samples should reach Chemistry Section in good dry condition. Therefore be sure to send them by the fastest possible method, so that they do not have time to rot. Rotten leaves are not suitable for analysis.

RECOMMENDATIONS

When the soil cannot supply enough of all the essential plant nutrients, the crop will not produce its maximum yield. Leaf analysis will show when one, or more, nutrients are limiting growth. Suitable fertilizers can then be recommended.

Remember that a crop's demand for inorganic fertilizer may be reduced if you return crop wastes to the ground - for example, coffee pulp (see Siki, 1980), or sweet potato vines (see Leng, 1982). Compost made from grass, ash and animal manures are all good sources of plant nutrients and should be used when available.

FURTHER READING

Leng, A.S. (1982). Maintaining fertility by putting compost into sweet potato mounds. *Harvest* 8(2): 83-84.

Mengel, K. and Kirkby, E.A. (1982). *Principles of Plant Nutrition.* International Potash Institute, Bern Switzerland.

Siki, B.F. (1980). Coffee pulp as a manure on sweet potato. *Harvest* 6(1): 1-4.

Thiagalingam, K. (1985. Taking samples for soil tests. *Harvest* 11(1): 1-4.