FERTILIZER USE ON TEA
PART 1 — INTRODUCTION

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Sixteen nutrients are considered essential for the growth of most plants. A plant nutrient can be defined as a chemical element which is necessary for the growth of plants. The plant nutrients can be classified as macro-nutrients (major nutrients) or micro-nutrients (trace elements) depending on the quantity that is required by the plant. Although micro-nutrients are required in small quantities they are equally important as macro-nutrients for the normal growth of plants.

The essential elements are listed below with their chemical symbol in brackets:

Macro-nutrients

Carbon (C)	Nitrogen (N)
Hydrogen (H)	Phosphorus (P)
Oxygen (O)	Potassium (K)
	Calcium (Ca)
	Magnesium (Mg)
	Sulphur (S)

Micro-nutrients

Manganese (Mn)	Zinc (Zn)
Iron (Fe)	Boron (B)
Copper (Cu)	Molybdenum (Mo)
Chlorine (Cl)	

The first three macro-nutrients, carbon, hydrogen and oxygen are obtained from the carbon dioxide of the atmosphere and water by plants. Plants by their green colouring substance called chlorophyll and in the presence of sunlight convert carbon dioxide and water to glucose by a process called photosynthesis.

$$\text{Carbon dioxide} + \text{water} \xrightarrow[\text{sunlight (energy)}]{\text{chlorophyll}} \text{Glucose} + \text{oxygen}$$

The glucose (sugar) becomes the building block of all forms of carbohydrates in the plant tissue. The sugar molecules in the plant combine with nitrogen, phosphorus and sulphur compounds and get converted to amino-acids and finally to various forms of proteins. Thus, these nutrients, carbon, hydrogen and oxygen make up the bulk of the plant tissue.

All other nutrients are derived mainly from the soil. Soils are the end product of weathering (decomposition) of the earth's outer crust (rocks) caused by physical, chemical and biological processes. The minerals derived from the rocks contain varying proportions of nutrients and their availability to plants depends on the texture and structure of the soil and the degree of microbial activity. The roots extract nutrients mainly from the soil solution and in forms which can be readily absorbed by the plant roots. In addition roots exclude chemicals which in direct contact with the soil particles could, cause release of nutrients for the utilization by the plant. It should be noted that water is necessary for the plants to extract mineral nutrients from the soil and for the translocation within the plant.

The decay of organic matter caused by soil micro-organisms also releases mineral nutrients but this is a slow process and may not be sufficient for normal growth of plants. At the same time micro-organisms utilize some of the mineral nutrients in the soil and make them unavailable to the plant.

In places where there is heavy rainfall, nutrients could be washed down the soil profile by a process called leaching. In general, most of the feeder roots of tea are confined to the first eighteen inches and thus any nutrients leached below this depth will not be available to the plant. If the depth of soil is good, then plant roots can penetrate the soil profile deep and have a greater chance of extracting more nutrients as they are washed down the soil profile.

Different crops remove plant nutrients in definite and different proportions. The tea plant, for example, requires larger amounts of nitrogen compared to phosphorus and potassium. Although soils contain certain amount of plant nutrients the amounts and the proportions are not sufficient for normal plant growth. In addition if these nutrients are not replaced over a prolonged period, the natural resources of the soil get completely depleted leading to plant starvation.

The idea of fertilizer application is to supplement the soil with the nutrient requirements of the plant. Fertilizer application, should, therefore, be balanced in such a way that each different crop gets adequate quantity of all plant nutrients in required proportions. If balanced fertilizer applications are done, then it is possible to obtain maximum crop production with optimum levels of fertilizer over a very long period of time. Unbalanced fertilizer application could prove detrimental for plant growth and may become uneconomical with time. For example, if only nitrogenous fertilizers are applied to tea, then satisfactory returns may be obtained for a few years, provided the soil is rich in other nutrients such as phosphorus and potassium. During this short period, the plant will deplete the soil of other nutrients, and the plants will become gradually weak and highly susceptible to adverse climate, pests and diseases. Once this happens, addition of nitrogenous fertilizer will not have any beneficial effect, but instead will have adverse effect on crop production and thus its application becomes detrimental and uneconomical. Emphasis is, therefore, made here for the need for balanced fertilizer applications.