# Chapter 11
# Soil Sampling Procedures for Chemical Analysis

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## ABSTRACT

*This chapter describes procedures used in soil sampling and its analysis; as well as why there is need to sample soils and for what purpose. We also describe the different types of soils present in nature and compare the different sampling regimes used in soil studies as well equipment's used, and the associated reagents necessary for a specific analysis. The chapter provides background information to scientists engaged in soil studies.*

## INTRODUCTION

Soil is a component part of the environment. It is regarded as a non-renewable resource because it takes a long period of time to form. Soil is a complex mixture of inorganic and organic materials. The inorganic components of soil are derived from rock sediments that were formed by the weathering of bedrock. These inorganic particles are composed primarily of silicates, but may also contain phosphates and limestones, depending on the location of the soil. The organic components are derived from the decayed remains of plants and animals. Soil is generally composed of sand, silt and clay particles, organic matter, water, and air spaces. Relatively coarse particles (diameter of 0.10-2.0 mm) make up the sand. Slightly finer particles form the silt, while the finest particles (0.002 mm) form the clay (Girard, 2014). The proportions of sand, silt, clay particles, and organic matter determine the soil type. Loamy soil contains approximately equal proportions of sand, silt and organic matter. Loamy soil is a productive soil that crumbles easily. Below the soil, lie the subsoil and unweathered rocks. Soils commonly become stratified into layers at different depths. The layers of soil at different depths show different composition and natures.

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## NEED FOR SOIL SAMPLING

A soil sample tells us much about the edaphic characteristics of our environment including productivity, fire influences, changes due to global warming, differences in soil nutrient contents from one area to another etc. Comparisons of soil samples can indicate the effects of human activities on the landscape, the influence of weather patterns or soil compaction on water flow, or the level soil of pollution. However, unless a specific problem is suspected, the most common reason for sampling soils is to determine the levels of essential nutrients. Knowledge of nutrient status of the soil can help a farmer make better and more profitable decisions in the management of a crop. Soil testing for nitrogen (N), phosphorus (P), potassium (K), and sulphur (S) is done to help professionals determine crop nutrient needs and monitor previous management and intervention practices. Other macronutrients (calcium and magnesium) and micronutrients (boron, chlorine, copper, iron, manganese, molybdenum, nickel and zinc) are sometimes analyzed to diagnose nutrient deficiencies.

The first and most critical step in soil testing is collecting soil samples. It should be kept in mind that only a very small portion of a field sample is actually analysed in the laboratory. As a result, it is vital that the soil sample collected is representative of the entire field. The sample should not be collected from the best part of the field, nor should it come from the worst part. It should include soil from every part of the field. Fields that are managed separately should be sampled separately. As a rule, each part of the field used to grow a particular crop different from others should be analysed separately because each crop type will have different nutritional requirements and will leave the soil with different characteristics.

## TYPES OF SOIL SAMPLING

The type of sampling plan to employ depends on the size, topography, and soil structure of the field to be sampled. The approach to adopt in sampling a uniform site will be different from the one to use for a non-uniform site. In the same vein, the sampling method used for a field with little or no information, or record of previous sampling will be different from the one used to sample a field with a consistent record of sampling. For a uniform site, a random sampling will be adequate. For a non-uniform site, other sampling methods will have to be employed. When developing a soil sampling plan, the field to be sampled is broken into zones or grids. Within those zones or grids, soils can be taken randomly or taken at, or near the intersections. Soil test values from random and grid sampling are often used to provide a single estimate for an entire field. This value may then be used to calculate fertilizer application rates.

### Double Sampling

In double sampling, a field is sampled in phases; hence, it is also referred to as multi-phase sampling. Estimate of the mean and variance obtained in the first phase of sampling are used to develop the design to be used for the second phase. The phases of the study may occur within a day or two of each other, or there may be several months between the phases. The interval between the sampling phases is dependent upon the time available for analysis and review. Double sampling is often used when stratification is deemed necessary to control some sources of variation within the data (US EPA, 1992).