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Soil sampling

Soils, a foundation of life

Seventeen elements are considered essential to plant growth. Carbon (C), hydrogen (H), and oxygen (O) are the most abundant elements in plants.

The remaining 14 essential elements are classified as macronutrients and micronutrients, and the classification is based on their relative abundance in plants.

The macronutrients are nitrogen (N), phosphorus (P), potassium (K), sulfur (S), calcium (Ca), and magnesium (Mg). Compared with the macronutrients, the concentrations of the eight micronutrients: iron (Fe), zinc (Zn), manganese (Mn), copper (Cu), boron (B), chloride (Cl), molybdenum (Mo), and nickel (Ni) are very small.

Diagnosis tools and methods

Three basic tools are available for diagnosing soil fertility problems

1. Plant symptoms and field observations: A nutrient-deficient plant exhibits characteristic symptoms because normal plant processes are inhibited.

2. Plant tissue analysis: the concentration of essential elements in plant tissue is related to plant growth and yield. The methods include tests on fresh tissue in the field and analyses per-formed in a laboratory

3. Soil analysis: a soil test is a chemical extraction of a soil sample to estimate nutrient availability. Soil tests extract part of the total nutrient content that is related to (but not equal to) the quantity of plant available nutrient.

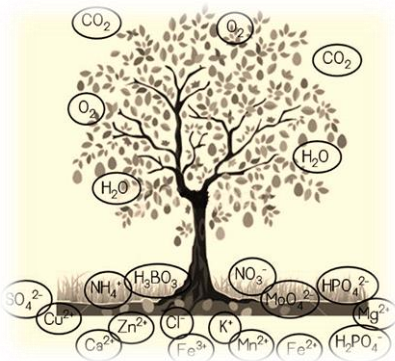


Table 1 Relative and average nutrient amount concentration

Classification	Nutrient		Concentration in Plants[1]	
	Name	*Symbol*	*Relative*	*Average*
Macronutrients	Hydrogen	H	60,000,000	6%
	Carbon	C	40,000,000	45%
	Oxygen	O	30,000,000	45%
	Nitrogen	N	1,000,000	1.5%
	Potassium	K	250,000	1.0%
	Calcium	Ca	125,000	0.5%
	Magnesium	Mg	80,000	0.2%
	Phosphorus	P	60,000	0.2%
	Sulfur	S	30,000	0.2%
Micronutrients	Chloride	Cl	3,000	100 ppm (0.01%)
	Iron	Fe	2,000	100 ppm
	Boron	B	2,000	20 ppm
	Manganese	Mn	1,000	50 ppm
	Zinc	Zn	300	20 ppm
	Copper	Cu	100	6 ppm
	Nickel	Ni	2	0.1 ppm
	Molybdenum	Mo	1	0.1 ppm

Source: Havlin *et al.* (2013)

Soil testing process consists of three critical phrases:

3.1 Sampling the soils

3.2 Chemically analyzing the samples

3.3 Interpreting the analytical result to make a recommendation on the kind and amounts of nutrients to apply.

How to sampling the soils

Soil sampling is widely acknowledged to be one of the weakest links in the soil testing process. Part of the problem is that about a teaspoonful of soil is eventually used to represent millions of kilograms of soils in the field. If the sample does not represent the whole field, it is impossible to provide a reliable nutrient recommendation. Field sampling errors are much greater than laboratory analysis errors, thus, the accuracy of any nutrient recommendation is entirely dependent on the quality of the sample collected from the field.

Field Average Sampling

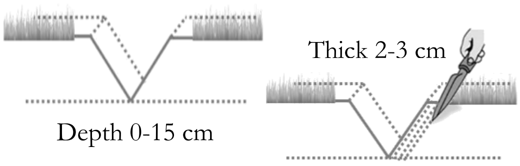
Each field should be subdivided into sampling units rep-resenting a relatively uniform area. Criteria used to delineate a sampling unit include soil types, slope, drainage, or past management *(Figure 1)*.

Sampling units vary in size, but usually are 17 ha. Small areas within a sampling unit that are not representative of the unit should be omitted from the sample.

Even in a relatively uniform area, variability in soil test levels exists. For example, recent lime or nutrient applications, or previous crop residues, may have been unevenly distributed. A sample taken entirely from areas high in these materials would not represent the field average. To minimize sampling errors, 15–40 sample cores should be collected within the sampling unit *(Figure 2 and 3)*.

Sampling Depth

For cultivated crops, samples are ordinarily taken to tillage/root zone depth that can vary from 0-15 cm.



Remove the tool with the slice intact, and take a 1-inch-wide core strip from the center down the entire length.

Figure 2 Collecting a surface soil sample and placing the 15–40 cores from each sampling unit in the bucket. Havlin *et al.* (2013)

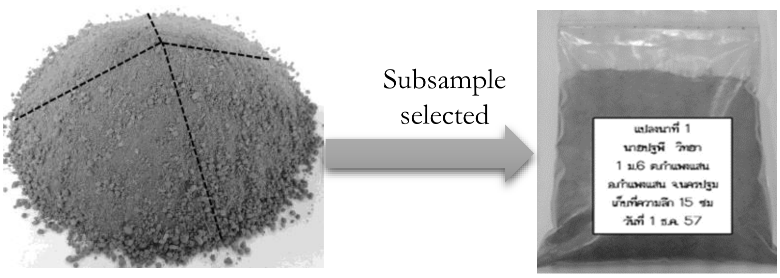


Figure 3 Soil samples within each sampling unit are composited by mixing in a non-galvanized container, and a subsample is sent to the laboratory for analysis (in a zip lock bag).

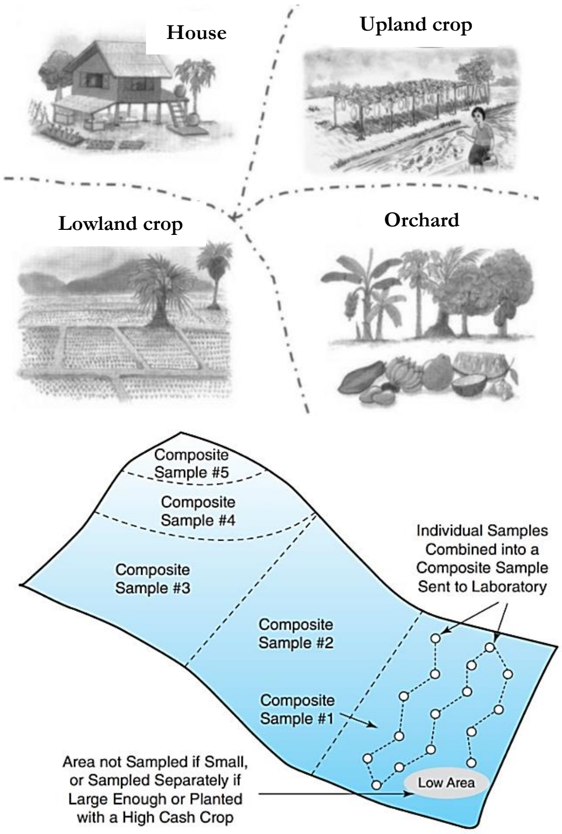
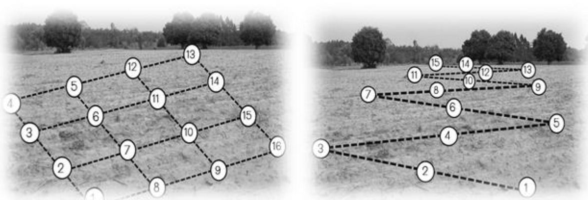


Figure 1 Composite samples sent to a laboratory for analysis represent relatively uniform areas within a field. Havlin *et al.* (2013).



Next, allow the samples to dry at room temperature (do not use artificial heat like an oven) After the soil is dry, mix all the soil core

Generally, a soil testing lab will measure the Available phosphorus, Exchangeable potassium, soil pH, ECe and organic matter in your soils.

Find Out More:
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