

# Principle of Soil Science

2<sup>nd</sup> Stage of Horticulture Department

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# COURSE INFORMATION

- Syllabus
- Class schedule
- Lectures
- Tests
- Labs
- Final exam



# Class Format

- Lecture:
- **Horticulture: Thursday**, 12:30-14:30 in Hall room 12; each week on a specific topic.
- Lecture and Lab attendance are **mandatory (compulsory)**.
- Lecture will cover broad topics and perhaps introduce their perspectives **(points of view)** about soil.

# Objectives of Principal of Soil Science

- Students will learn about
  - Soil : their origin and formation
  - The physical, chemical and biological properties of soil.
  - Surveying and Classifying of soil
  - Plant nutrition and Fertilizers



# The Topics

**1<sup>st</sup> week** Introduction of Soil Science.

**2<sup>nd</sup> week** Traditional and Modern Classification of Soil Science.

**3<sup>rd</sup> week** Soil Formations and Processes of Soil Formation.

**4<sup>th</sup> week** Physical Properties of Soil.

**5<sup>th</sup> Week** **FIRST TEST. (fixed at first class)**

**6<sup>th</sup> week** Factors that Effect of Physical Properties of Soil.

**7<sup>th</sup> week** Water Molecules With Clay Surface.

**8<sup>th</sup> week** Chemical Properties of Soil.

**9<sup>th</sup> week** Factors that Effect of Chemical Properties of Soil.

**10<sup>TH</sup> Week** **SECOND TEST. (fixed at class 6)**

**11<sup>th</sup> week** Soil Fertility and Fertilization.

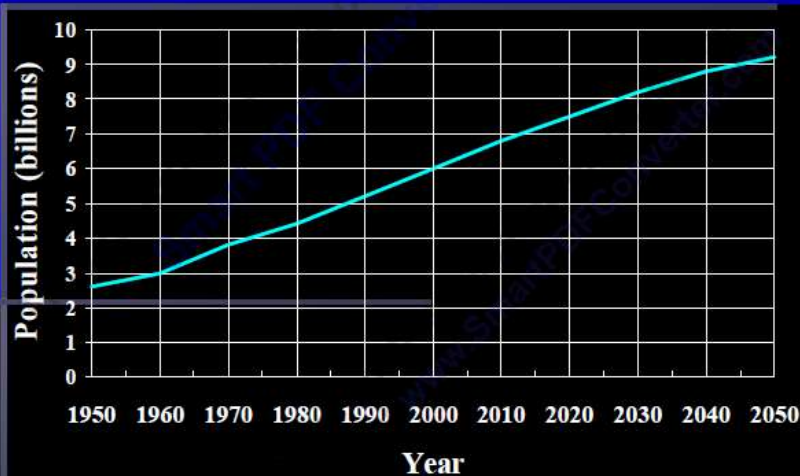
**12<sup>th</sup> week** Soil Microbiology.

**13<sup>th</sup>** course review.

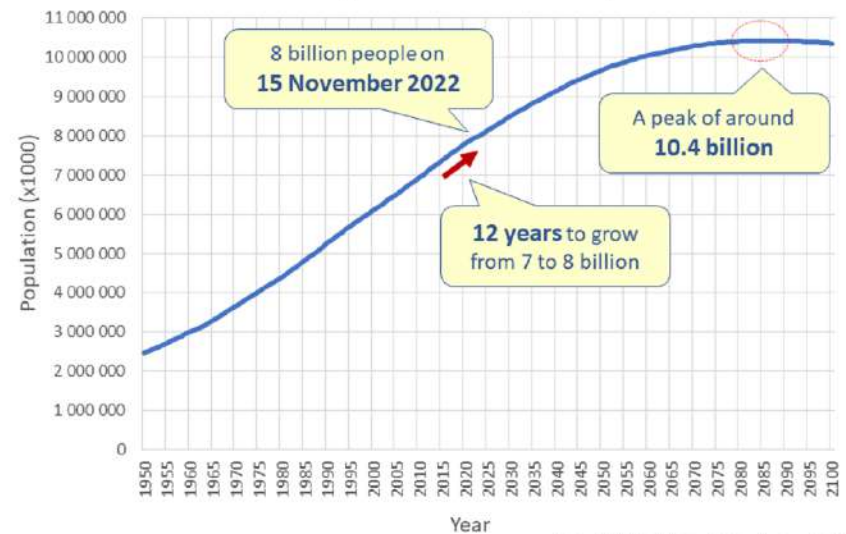
# What do you think about this diagram?

The World Population in 2023 is 8,045,311,447 (at mid-year, according to U.N. estimates),

## World Population: 1950 - 2050



## World Population & Prospects



Data: UN World Population Prospects 2022

# Introduction

Agriculture comes from the Latin words *Agre* = *Land* and *Cultura* = *Cultivation*. Agriculture means Cultivation of the Land.



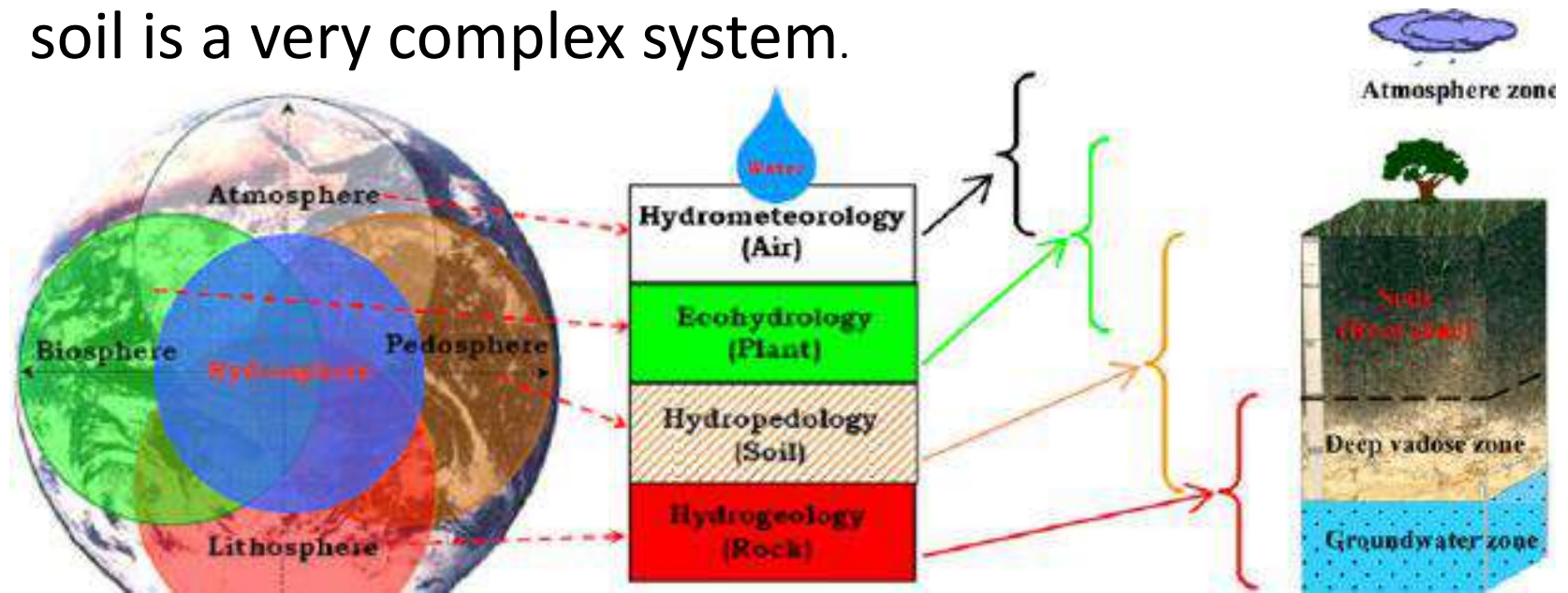
Agriculture supplies food for the population. Soil is the single most important resource in agriculture; Soil supports life.

# Concept of soil

The word 'Soil' has been derived from the Latin word 'solum' means 'Floor' or 'Ground'. It is thought that “without life, there is no soil and without soil, there is no life on the earth planet”. Basically, soil is a dynamic natural body, developed as a result of pedogenic processes during and after weathering of rocks, consisting of mineral and organic constituents, possessing definite physical, chemical, mineralogical and biological properties.



It is very much interesting to note that the soil (pedosphere) lies at the interface of the earth's lithosphere, hydrosphere, atmosphere and biosphere. Thus, soil or pedosphere is the environment, where all these four spheres interact. Therefore, we can say that soil is a very complex system.



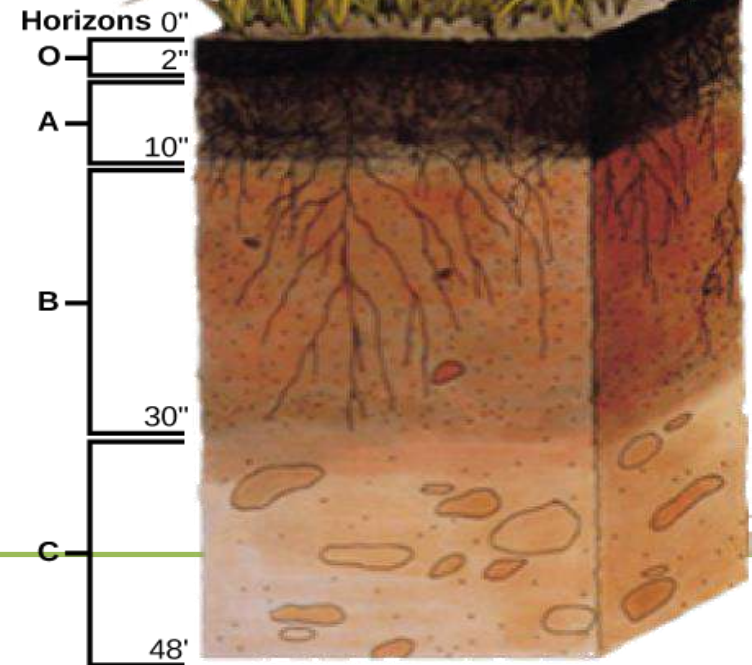
# What is Soil Science?

- It is the science dealing with soils as a natural resource on the surface of the Earth including soil formation, classification and mapping; physical, chemical, biological, and fertility properties of soils; and these properties in relation to the use and management of soils.
- *Soil science is the branch of agriculture* that deals with soil considered as a natural body and as an important medium for plant growth.



# What is soil?

- Generally soil refers to a natural body consisting of layers (horizons) of mineral and organic components of variable thickness, which differ from the parent material in their morphological, physical, chemical, mineralogical properties and their biological characteristics

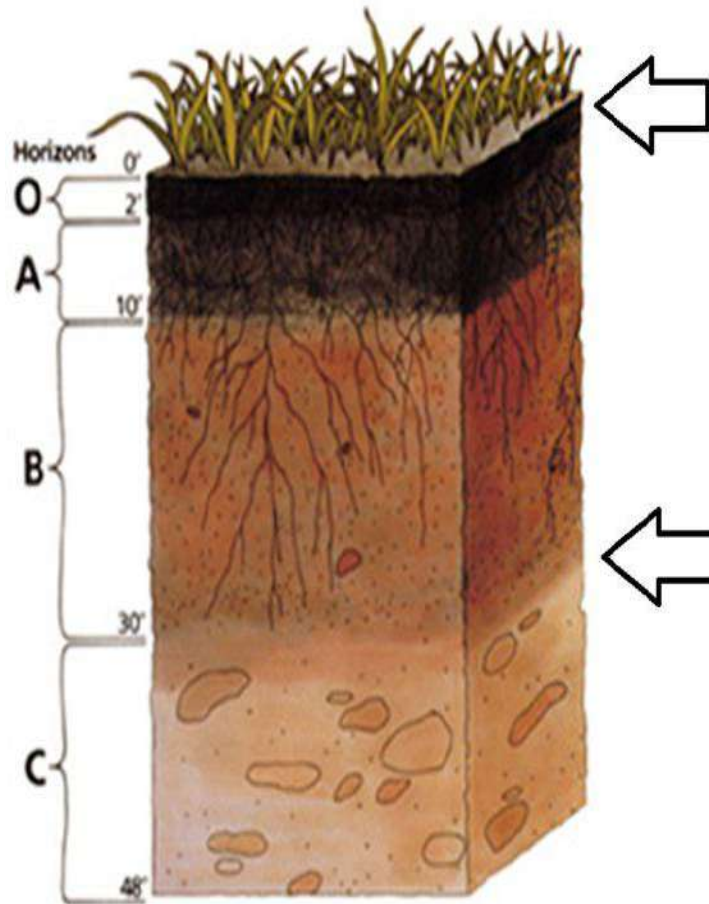




# The term SOIL was derived from the Latin Word “**SOLUM**” Means **Floor’** or ‘**Ground**.”

The solum in soil science consists of the surface and subsoil layers that have undergone the same soil forming conditions.

**For a Layman soil is dirt or debris. • For an Agriculturist soil is a habitat for plant growth (to grow crops)**



## Soil Thickness

The upper part of the soil is called the Solum (A+B horizons). In undisturbed soils these upper horizons are highly permeable due to well developed soil structure.

- An **agricultural** definition of soil is a dynamic natural body on the surface of the earth in which plants grow, composed of mineral, organic materials and living organisms form.
- Or it is a mixture of mineral and organic material that is capable of supporting plant life
- An **engineering** definition of soil is : A mixture of mineral material (sands, gravels and fines) used as a base for construction

# History of soil science development

- History of soil science development in the world and Iraq.
- The soil science developed for more than 120 years ago.
- The Russian scientist Dockuchaev put the principle of the soil as a science, and he wrote many report about it.
- The Germaine scientist Glinka had translate Dockuchaev reports to Germany language and from there they distributed to all other European countries.
- At 1918 the American scientist Marbut translated it to English.
- At 1927 took place in in Washington, DC the first conference of soil and considered as a individual science.

In Iraq for the first time the department of soil and Agriculture chemistry has established at 1954 in Agriculture college of Abughreb by the American scientist Russel.

At the same time the other scientist Buringh (1954-1958) have made the classification of soil of Iraq from the north to the south.

After that the department of soil in Ministry of agriculture have been opened.

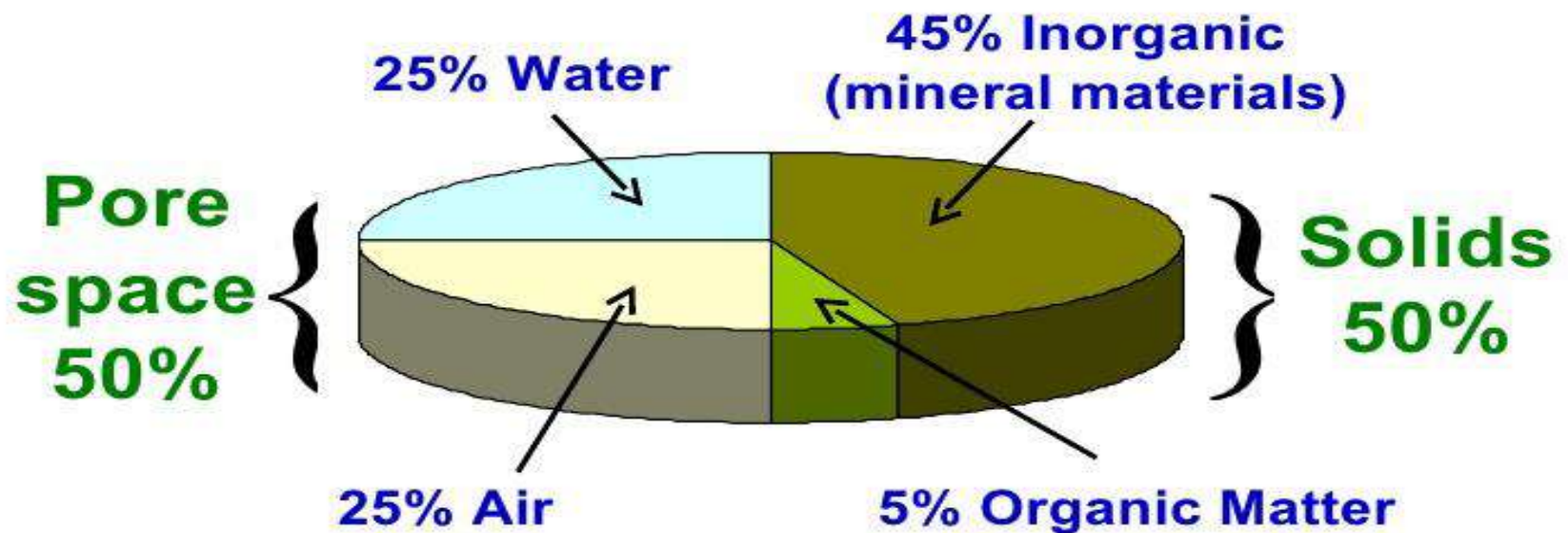
Dockuchaev is consider as the ***father of the soil***.





# Composition of soil on volume basis (Soil components)

## Average Soil Composition



# Views on Soil

- For a House wife; soil is dirt that has to be cleaned.
- For an Agriculturist soil is a medium for plant growth vital for food production and human survival.
- For a Mining Engineer soil is a debris covering the Rocks
- For a Civil Engineer soil is a foundation for buildings and highway.
- City hall (municipal) ; soil is a site for dumping of waste.



# Functions of the soil

## The Five Functions of Soil

- 1
- 2
- 3
- 4
- 5



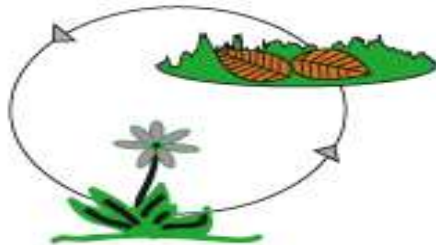
Habitat for Soil Organisms



Water Supply and Purification



Recycling nutrients and organic wastes

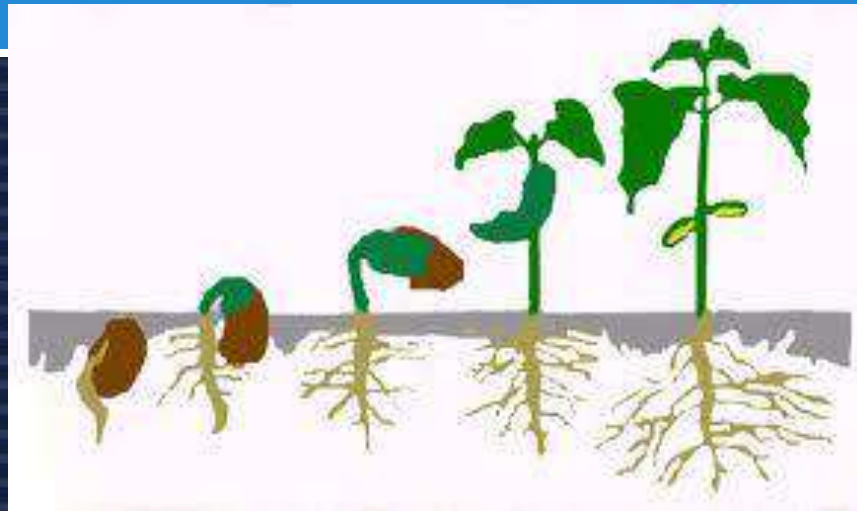


Engineering Medium



# Soils and Plant Growth

- Physical **support** of plants
- Provides **water** and **air**
- Provides essential elements
  - Macro-**nutrients** = N,P,K,Ca,Mg,S
  - Micro-nutrients = B,Fe,Mn,Cu,Zn,Mo,Co,Cl









# Supplying Plant Nutrients

## Nutrients that plants obtain from the soil




### Macronutrients:

(needed in large amounts)

-  Nitrogen (N)
-  Phosphorus (P)
-  Potassium (K)
-  Calcium (Ca)
-  Magnesium (Mg)
-  Sulfur (S)

### Micronutrients:

(needed in small amounts)

-  Chlorine (Cl)
-  Cobalt (Co)
-  Copper (Cu)
-  Iron (Fe)
-  Manganese (Mn)
-  Molybdenum (Mo)
-  Nickel (Ni)
-  Zinc (Zn)



# Macronutrients & Micronutrients in Plants



K increases resistance against Pests & Low Temperatures

P plays a major role in capturing Sun's Energy

Ca & Mg aid Cell Division & strengthen Cell Walls

N & Mg are base elements in Chlorophyll

B helps in rapid Cell Wall formation & growth

N & P lead to Rapid Vegetative Growth

Cu & Zn are components in Enzymes

ATP

N & P are vital components of ATP

Ca regulates Growth Enzymes

Fe & Mn help in Photosynthesis

Mg is a P Carrier

K improves Quality

P aids flower & seed formation

P promotes Ripening/Maturity

Mg & Cu aid Respiration

P & K strengthen Stem

K & Cl controls opening & closing of Stomata

K aids transportation

K promotes Root Health

Ni helps N-Fixing Plants

N, P & S aid Root Growth

P promotes Early Root Growth

S stimulates seed & Nodule Formation

Ca aids Absorption & New Roots

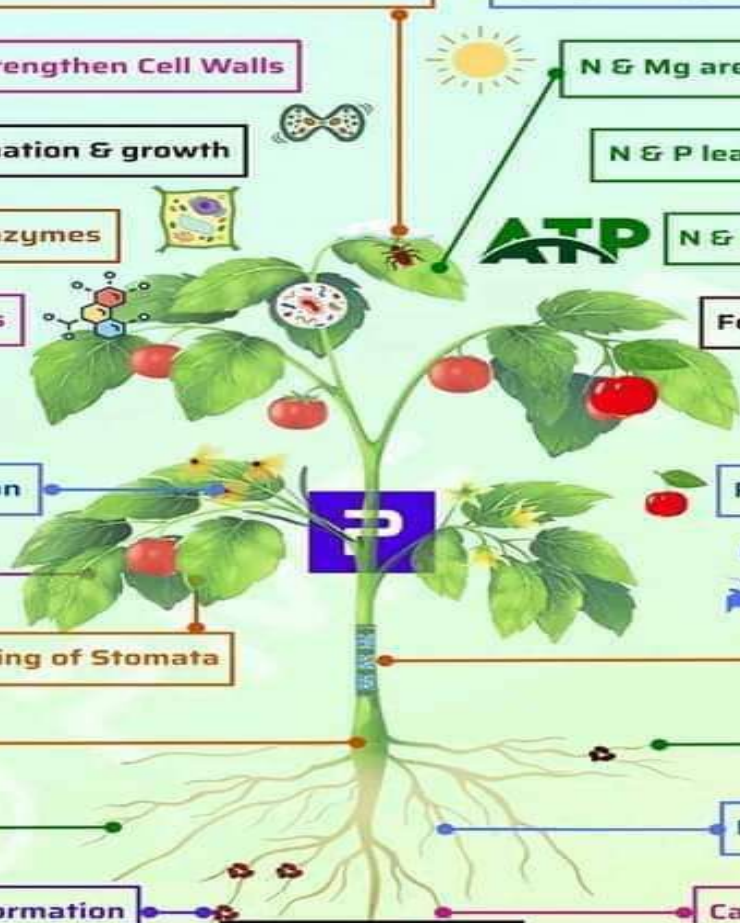
Mo helps in synthesis of Nitrate Reductase

Smart Biology

Micronutrients: Iron (Fe), Copper (Cu), Zinc (Zn), Manganese (Mn), Nickel (Ni), Boron (B), Molybdenum (Mo) & Chlorine (Cl)

Macronutrients: Carbon (C), Hydrogen (H), Oxygen (O), Nitrogen (N), Phosphorous (P), Potassium (K), Calcium (Ca), Sulfur (S) & Magnesium (Mg)

NPK — Nitrogen (N), Phosphorous (P), Potassium (K)



# Cycling plant nutrients

