

Ministry of Higher Education  
Salahaddin University  
College of Agricultural Engineering Sciences  
Field Crops Department



**Principles of Field Crops**  
**Second Grade**  
**Fall Semester (2022-2023)**  
**Instructor: Saber Wasman (PhD)**  
**Lecture 4**

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## **Soil requirements**



- Although soil is less important than climate, soil texture and soil reaction (acidity) play a major roll in determining which crops are grown.
- It shows crop distribution is determined largely by climatic and soil-moisture factors.
- Soil provides certain favorable conditions for plant growth.

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## Texture



- Soil texture has an important influence upon crop adaptation, **medium and heavy soils** are best for fine-rooted grasses, wheat, and oats, **whereas**, the coarser rye, corn and sorghum plants can not thrive, and more common grown on the **light sandy soil**.
- Rice demands heavy soil that prevents excessive water losses from leaching.
- Water percolates more quickly and more deeply into light soil, but heavy soils have the greater water storage capacity.

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**Texture of the soil refers to the size of its particles, grouped on the basis of diameter as:**

2-0.05 mm (sand)

0.05-0.002 mm (silt)

0.002- and less (clay)

- Soil class is recognized on the basis of the percentage of these separates.
- The principle classes as to texture are **sand, loamy sand, sandy loam, silt loam, clay loam, silty clay loam and clay**.
- Clay soils calls a heavy soils and sand soils calls a light soil or sometimes called hard and soft land.

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## Soil Constituents



### Water

The most important constituent in the soil occurs in **three forms** besides occurring in the form of **vapor**.

**Capillary** water is the water used mostly by plants.

When plants **wilt**, the soil may contain **2-17%** moisture depending upon its texture and humus content.

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Water below this permanent wilting point is largely unavailable to plants.

**Gravitational** water is moved downward by gravity and may percolate beyond reach of the roots of crop plants.

**Hydroscopic** water is adsorbed on soil particles and that is not available to plants.

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**Air:** which constitutes from 20-25% by volume of an ordinary moisture soil, supplies the O<sub>2</sub> necessary for root growth and for oxidation of O.M. (organic matter) and other soil constituents.

**Aeration** maybe too poor for plant growth in a soil having much water



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- An adequate supply of plant nutrients is essential for the growth of crop plants.
- About 25-30 chemical elements are found in plants. C, O<sub>2</sub>, H<sub>2</sub>, are most abundant.
- The essential mineral elements are N, P, K, but Ca, Mg, S, also essential elements are absorbed by crops in considerable quantities.
- The minor elements are Mn, Fe, Bo, Cu, Zn, Mo, Co, which plants need in small quantities.

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**Zinc** is essential for plant growth and development including cell division, starch synthesis and seed formation.

**Manganese** and **iron** serve as catalysts in chlorophyll synthesis, while **chlorine** is involved in electron transport during photosynthesis. **Molybdenum** is for nitrogen fixation and as component of enzymes.

**Cobalt** is for nitrogen fixation.

**Copper** is for oxidizing enzymes and **boron** in cell division and growth processes

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## Crops for Special Conditions

### 1- Crops tolerant to salinity:

- A- Barley, sugar beet, rapeseed, and cotton maybe grown in soil contains 0.8-1.67% salts (8-16 millimhos per centimeter)
- B- White and red clover, field bean have low tolerance (0.3-0.4%)
- C- Most of the other field crops have a medium tolerance which salt content should not exceed 0.8%

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### 2- Crops tolerant to acid soils:

- A soil with pH 7 is neutral, one higher than 7 is alkaline, while a soil with a pH below 7 is acid.
- These pH values are for hydrogen-ion activity.
- High acidity may increase absorption of aluminum and manganese by plants and retard absorption of calcium or phosphorus as a result of iron exchange

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## Tillage Practices

### Purposes of tillage:

1. To prepare a suitable seedbed
2. To eliminate competition from weed growth
3. To improve physical conditions of the soil



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### Implement Use in Preparation of seedbed



The implement use in preparation of seedbed differs in the depth, their effectiveness in destroying weed and they stir the soil.

#### 1- Plowers:

- There are several types of plowers, but the most common one is the ordinary **mold board plow**.
- The stubble plow is good to use in old cultivated lands.
- The disk plow is good for plowing hard dry land.
- The subsoil plow is employed to loosen the soil in the bottom of the furrow made by the ordinary plow.

#### 2- Harrows:

The harrows used in preparation of the seedbed may be mentioned the

- (1). Spike-tooth (2). Spring –tooth

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**Mold board plow**

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**Stubble plow**

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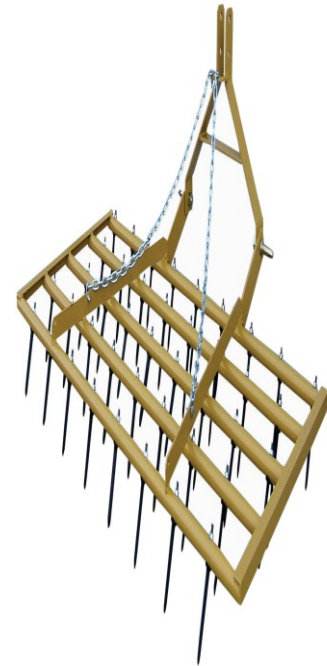


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Subsoil plow

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## Depth of Plowing



- It seems that extremely deep plowing is not necessary for ordinary field crops.
- Deep plowing does not necessarily decrease the yield, but it increases it. Under ordinary conditions with the common field crops a desirable and practical depth to plow, seems to be about **5-8 inches ( 1 inch=2.54 cm)**.
- The depth to which land should be plowed will vary with:
  - 1- time of plowing
  - 2- type of soil.

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- Plowing in the late fall and winter, when the land is to be planted in the spring, may frequently be deeper than when the land is to be planted soon after plowing especially in the heavy soils.
- Sometimes plowing more than 7 inches does not generally result in increased crop yields.

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**Deep plowing increases crop yield in two ways:**

plants can obtain more nutrients from clay soil than from sand particles and the soil with higher clay content can hold more moisture for longer periods than soil with lower clay content.

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## Time of plowing



- The time to plow will vary with the **climate, crop and soil conditions**.
- In the humid seasons, the time of plowing will depend on the crop and soil conditions.
- When such crops as wheat or barley are fall sown, plowing should be done in the summer.



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- The plowing of land for corn, cotton, soybean and other spring sown crops, maybe done in the fall or spring.
- Fall plowing may start any time after the weather become cold but it is not always desirable to plow land in the fall especially when the soil is poor with organic matter.



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The rate and time of herbicide application are more important to give a good result for weed control without harming the crops. Small weeds are easier to kill than large ones.