



# Advanced Fertilizers Technologies

## Lecture 2

# Methods of Fertilizers Application

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# INTRODUCTION

The application of fertilizers (**organic and mineral**) is an important agricultural practice. And the amount of fertilizer added to the soil depends on several factors, including the **concentration of the element** in the soil, the type of crop, **soil characteristics**, **climatic conditions**, the **period of crop growth** and other factors that determine the crop's need for nutrients.

For the purpose of obtaining **high production** and of **good quality**, the **amount of fertilizer added and the least environmental pollution must be taken into account**, especially with **nitrogen** fertilizers, which are lost from **coarse-textured soils** usually due to the leaching process and groundwater pollution. Adding manure correctly increases the efficiency in absorbing nutrients and obtaining a high yield for the crop, surface and depth of the soil and as it maintains the quality of the groundwater .

**The best addition of fertilizers, using the right methods quantities, leads to:**

- 1. Increasing Fertilizer Use Efficiency (FUE), which increases productivity and reduces environmental pollution**
- 2. Reduce fertilizer losses**
- 3. Ease of adding and handling fertilizers**
- 4. Increasing the availability of nutrients in the soil and their absorption by plants**



**the aspects that should be taken into consideration when adding fertilizers are**

- 1. The availability of the nutritional element in the mineral and organic fertilizer**
- 2. The needs of the crop for the nutritional element during the different stages of its growth**
- 3. Time to add fertilizer**
- 4. Methods of addition and where to add fertilizer**
- 5. Addition by spraying**
- 6. The response of the crop to the method of adding fertilizer and the interaction between nutrients such as nitrogen, phosphorous and potassium**
- 7. Residual effect of organic and mineral fertilizers**
- 8. Unit costs of nutrients and the economic feasibility of mineral and organic fertilizers**

# Methods of Solid Fertilizers Application

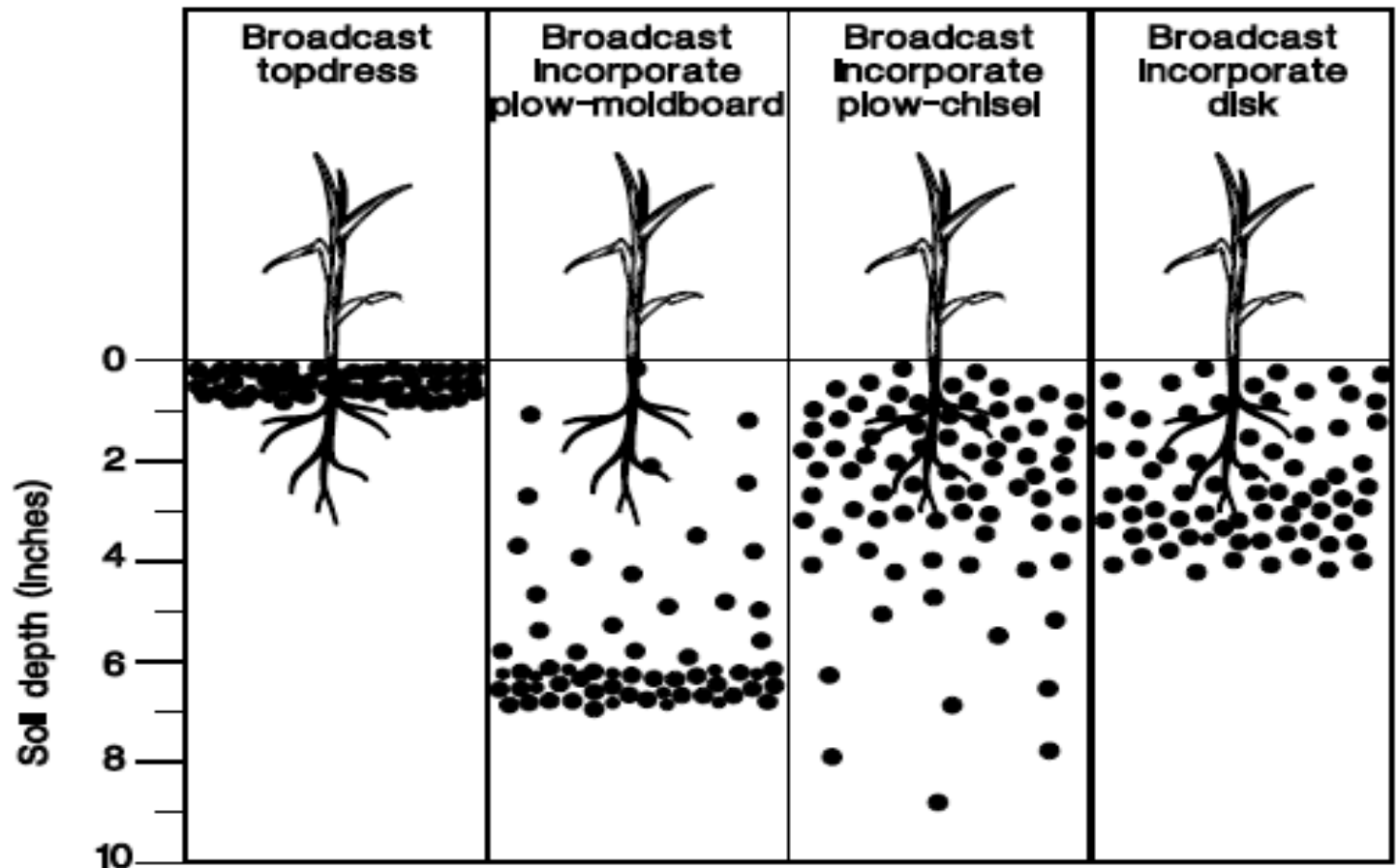
## First: The Broadcasting Method •

It is intended to add solid fertilizers to the surface of the soil, usually before sowing. The fertilizer can be mixed with soil components mechanically or remain on the soil surface, and it may be reached by rain or irrigation water or loss at high temperatures (especially with -dissolving fertilizers)



# Top dressing

## BROADCAST FERTILIZER



# Top dressing

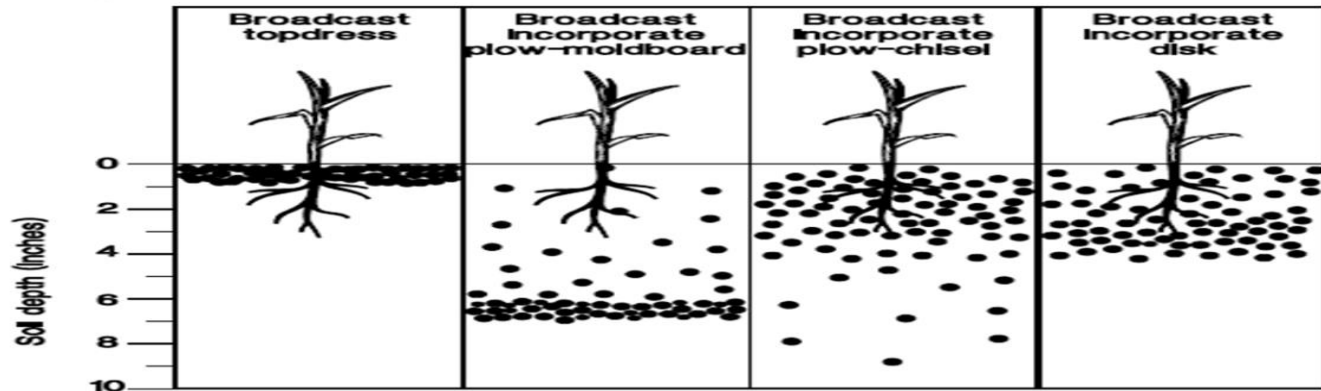
**Broadcast Top-dress.** ١

Broadcast incorporated plow-moldboard .٢

Broadcast incorporated Plow-Chisel .٣

Broadcast incorporated .٤  
disk

## BROADCAST FERTILIZER



# Second: Banding Method

It is the process of applying fertilizer in a band under, over, near or on both sides of the seeds and plants during the planting or planting phase

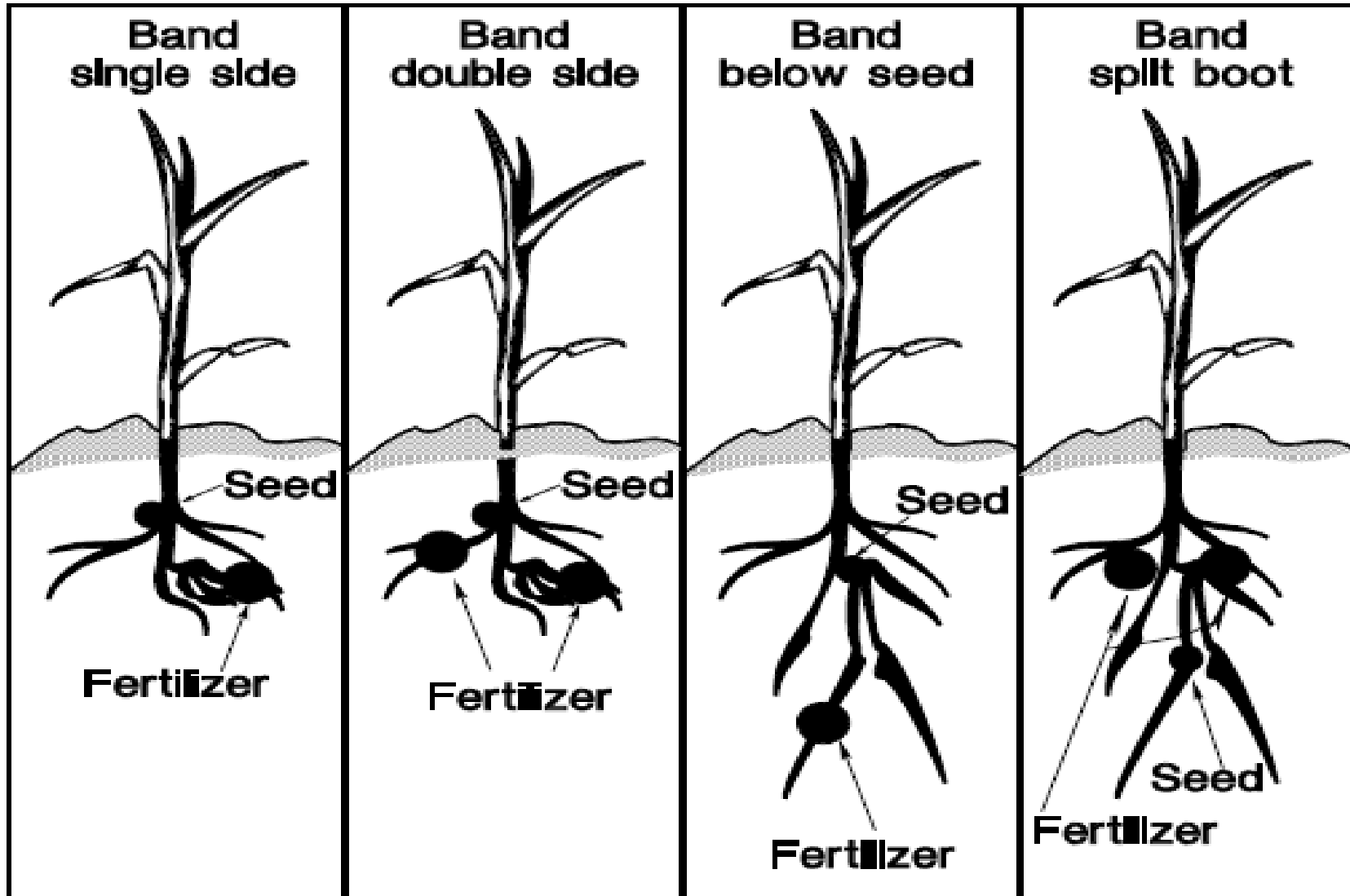
All nutrients can be added in solid form except for boron. The fertilizer is added in the hollows at a distance of 5 cm from the roots of the crops to avoid the problem of the danger of salinity and ammonia toxicity.

There are four methods to add fertilizers in the form of band :-

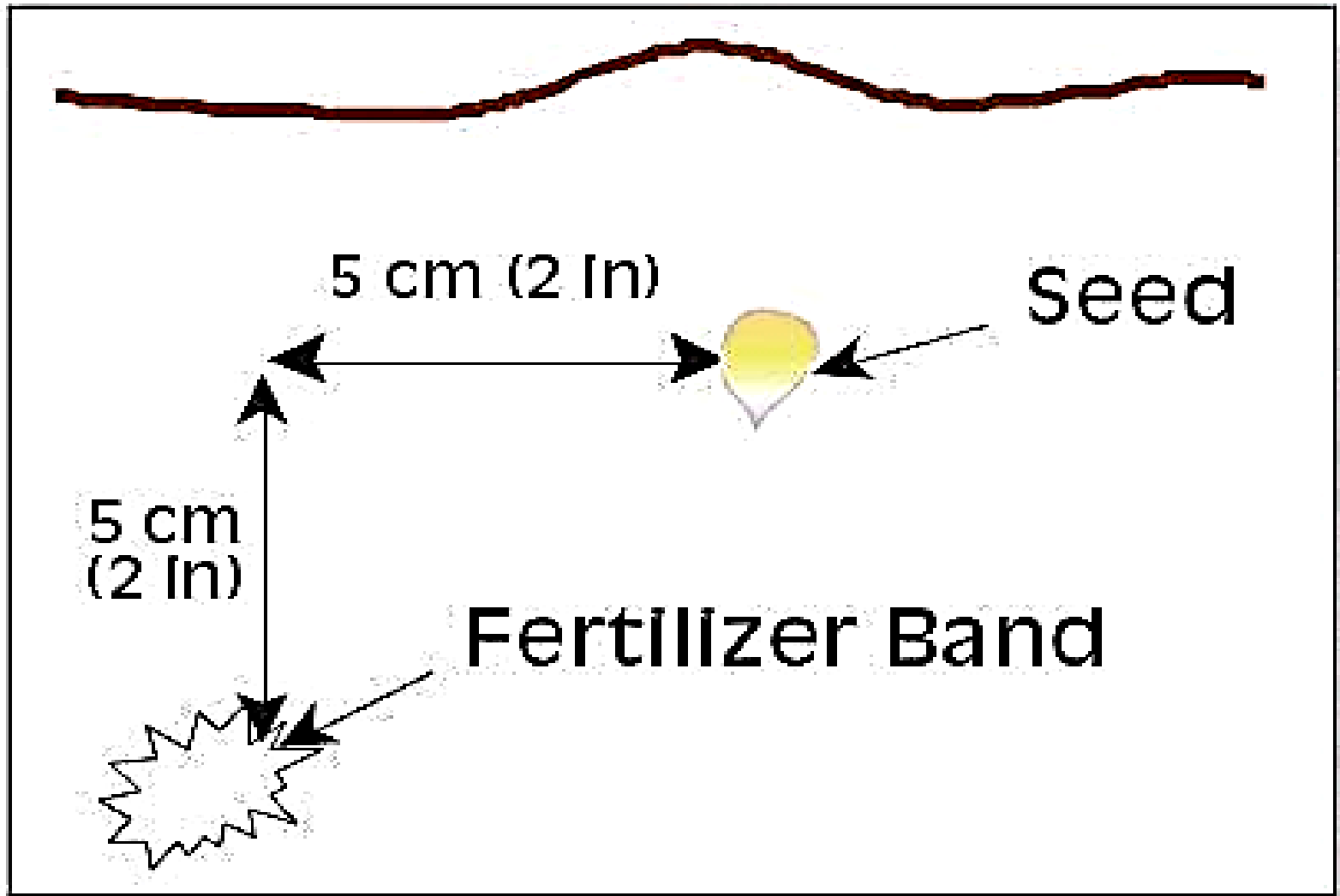
- 1. Band Single side**
- 2. Band double side**
- 3. Band below seed'**
- 4. Band split boot**



# Methods of Fertilizers application by bands



# Banding method



# Third: Row Application

In this method, fertilizers are added to the soil in the form of belts or lines on both sides of the line of planting seeds or plants on one side or both sides of roots this is called **side dressing**.

Machines can be used for adding fertilizer or it can be added with seeds.

The fertilizer is placed at a distance of **5-8 cm from the seed site** and at a **depth of 3-5 cm from the soil surface**. Great care must be taken when adding fertilizer in this method in terms of its proximity to the seeds and its exposure to salt stress or the heterogeneity and distribution of fertilizer, which causes its loss and the plant's lack of response to the added fertilizer and a decrease in the quantity and quality of crop production.

# Row Application





# Forth: Foliar Fertilization

**Foliar fertilizers are not a substitute for fertilizers added to the soil, but they do to increase the rate of nutrient absorption.**

**In general, when the fertilizer is sprayed on the vegetative parts of the plant, it provides the plant cells with nutrients, which leads to an increase in the activity of the plant cells**

**Choice of foliar fertilization of a particular element depends on the degree of concentration of this element within the tissues of the plant.**

**Leaves are characterized by their ability to absorb nutrients through the stomata, and then these elements penetrate into the leaves.**

**The other path is to absorb nutrients through the cuticle through cracks, as the cuticle is partially permeable to the substance and solutions.**

# Foliar Fertilization

It must be taken into account when adding fertilizers by foliar on the leaves, a small amount of nutrients is taken in this way compared to what the plant needs of nutrients and in large quantities such as **nitrogen, phosphorous and potassium**, so spraying the plant with these three elements is not practical (except for urea, which absorbs quickly and represented inside the leaf cell).

This method is **suitable** for spraying fertilizers of **micro-elements** (**iron, copper, zinc, manganese...etc**) due to the problems of precipitation

# Foliar fertilization



## The importance of foliar fertilization

1. A complementary or complete method of fertilizing with macro-nutrients
2. Reducing the quantities of nutrients added to the soil directly and reducing the risks of pollution in certain cases
3. It is considered a preventive measure to counteract the apparent and hidden element deficiency, especially for micro-nutrients
4. Improving the availability of plant nutrients, especially micro-nutrients and phosphorous nutrient , in high soil pH
5. Improving the quality of vegetables and fruits,
6. Increasing the concentration of nutrients in plants and its yield .



## Factors affecting the absorption of nutrients added by Foliar method

Temperature, Humidity ,Leaf age, other factors such as wind speed, composition of liquid fertilizer ...etc

# Fertigation

**Fertigation** is the method of fertilization by irrigation, which is a combination of the words **Fertilization + Irrigation**, and it is the process of adding nutrients in certain and constant concentrations with the irrigation water according to the crop requirements from irrigation water and nutrients during different stages of growth.

This is done by injecting the fertilizer by different fertilizer injectors directly into the irrigation lines to reach a constant level of moisture and a suitable concentration of nutrients in the root zone.

# Fertigation

This method is considered the most widespread in irrigated agriculture in the world because of its many advantages such as keeping chemical fertilizers and increasing the efficiency of fertilizer use and the quantity of irrigation water and then increasing production. Also, this method is characterized by reducing the loss of chemical fertilizers as a result of leaching and controlling the concentration of nutrients in the soil solution

in addition to flexibility in the timing of fertilizer application according to the need of the crop and reducing environmental pollution, especially for groundwater, especially with nitrates

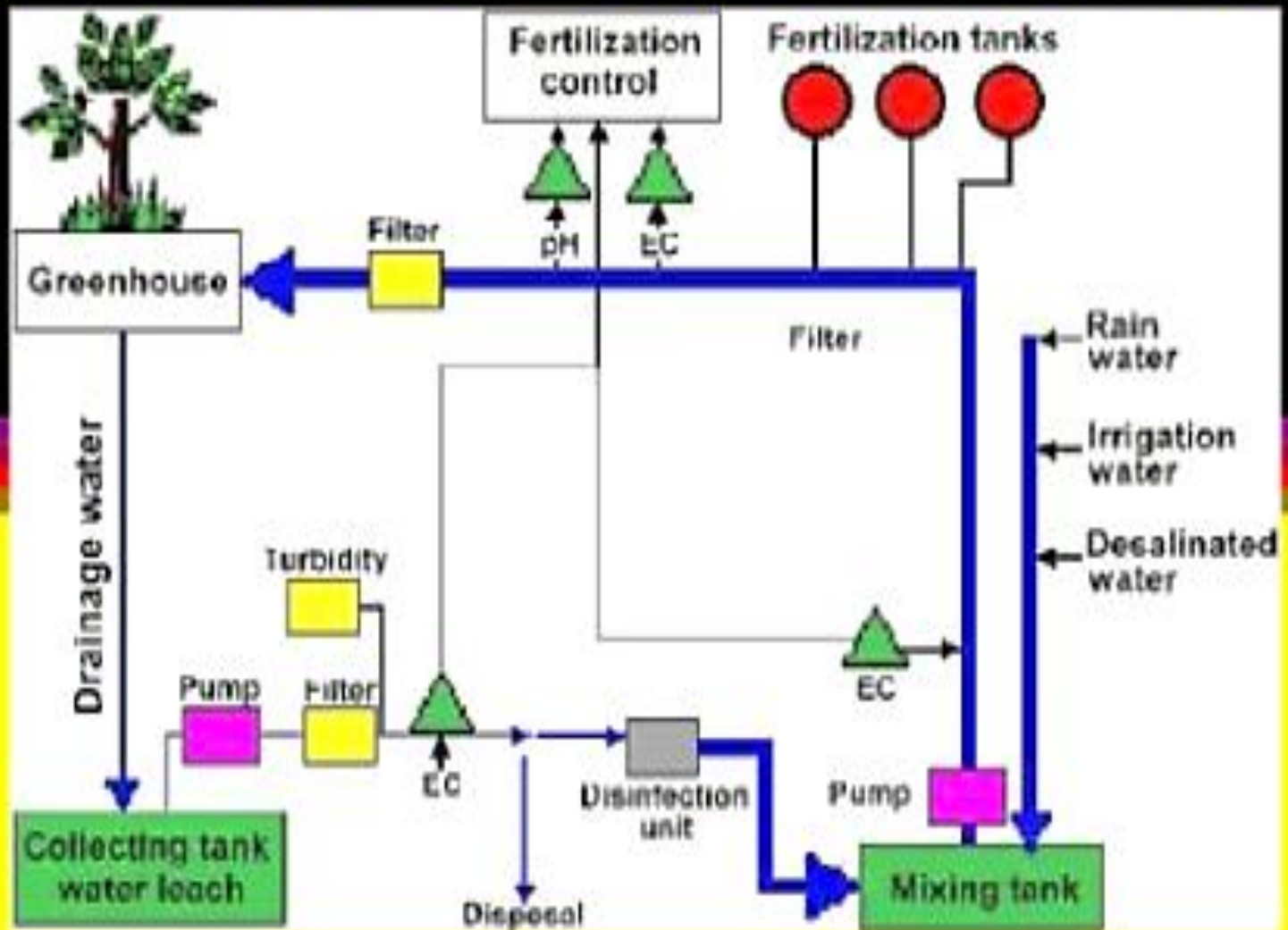
# Fifth: Fertigation

The process of fertilizing with irrigation water(**FERTIGATION**) is one of the modern methods of composting, as it is possible to obtain with this technology a high production and little pollution to the environment by increasing the fertilizer efficiency, reducing the amount of fertilizer added and controlling the amount of fertilizer and the time of its addition

# Fertigation



# FERTIGATION



# FERTIGATION






To develop a successful fertilizer program through irrigation water, the following factors must be taken into account: -


- 1. The chemical composition of irrigation water (especially its calcium, sodium and sulfate concentration and chlorides)**
- 2. Soil properties (soil texture, soil structure, soil permeability, nutrient concentration , soil pH, organic matter content , carbonate minerals, etc.)**
- 3. Climatic factors (temperature, relative humidity, wind speed, light intensity)**
- 4. Plant (type, cultivar, age, root distribution, plant salt tolerance, length of growing season, growth stage, the rate of water consumption during the different stages of growth)**
- 5. Economic factors (costs of all fertilization program inputs, labor and expected return)**





There are four main factors when choosing the appropriate fertilizer for the fertigation method:

1. **Plant type and growth stage**
2. **Soil conditions**
3. **Water quality**
4. **Fertilizer availability and price**



The most important characteristics that must be available in the fertilizers used in the irrigation system with fertilization

1. Not to allow precipitation to occur inside the irrigation pipes
2. Safe to use in the field.
3. It has no harmful side effects on soil and plants.
4. Complete 100% water solubility.
5. Do not react with compounds or other fertilizers that are added with it during irrigation water.
6. It has a low salt index and a low pH value (acidic) to be used

# FERTIGATION VS FERTILIZATION



the Conventional, The Plant get a larger dosage of Fertilizers than required hence more **losses**



The Fertilizers is applied according as Plant need for nutrients. It is the balane diet for Plants, More benifits

**ask me**

**any**

**question i**

**have to**

**answer**