

# Fertilization and irrigation of fruit crops

Attila Ombódi

## Definition of fertilization

- The process of providing materials (fertilizers) to the soil, to the leaves (or to the air) for supplying plant nutrients or amending soil fertility.

## Basic elements of a fertilization technology

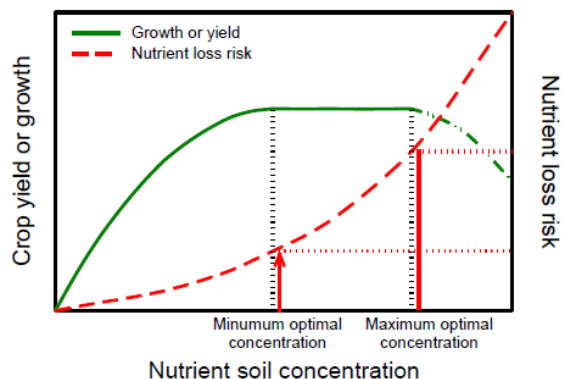
1. type of the fertilizers
2. amount of the fertilizers
3. method of fertilizer application
4. time of fertilizer application

## 1. Fertilizers used for fruit production

- **Organic fertilizers:** farm yard manure, compost, green manure, etc. – for improving organic matter content, soil structure and water holding capacity
- **Inorganic fertilizers**
  - **Mined inorganic fertilizers:**– limestone, gypsum, etc. – for soil amendment, like changing pH, CEC
  - **Chemical fertilizers** – for maintaining optimal nutrient level in the soil; to avoid/cure nutrient deficiency symptoms; straight, compound or complex?  
CI containing fertilizers →← berry fruits
  - **Controlled release fertilizers**

## 2. Amount of fertilizers

- The used amount of fertilizers depends on the
  - species
  - projected yield
  - nutrient use efficiency of the crop
  - cultivation method, level of cultivation
  - soil type
  - organic matter and nutrient content of the soil
  - weather conditions (leaching, mineralisation)
  - type of fertilizer used
  - application method



/Incrocci & Massa, 2017/

## Inputs for fertilizer calculation and fertilization

- Soil type
- Results of soil test and foliar analysis + visual diagnosis (observation)
- Cropping history of the field → target yield (t)
- Relative nutrient need (kg/t) of the crop
- Fertilizer composition

## Advantages of fertigation

- Nutrient concentration can be maintained around the optimum level
- The following parameters can be constantly adjusted to the actual needs of the plants, to the growth phases:
  - amount of nutrients
  - concentration of nutrients
  - ratio of nutrients

## 4. Time of fertilizer application

- At orchard establishment
  - **Goal:** soil amendment, making a reserve of nutrients at the depth of the future main root zone
  - farm yard manure; P, K, Mg, Ca
- Outside of the vegetation period – **basal fertilization**
  - **Goal:** keeping good nutrient level in the soil
  - farm yard manure (once in 3-4 years) – late autumn, N – early spring; P and K - autumn (once in 2-3 years), Ca, Mg
- During the vegetation period – (**sidedressing**), **fertigation**, **foliar application**
  - **Goal:** permanent supply of nutrients based on the needs of the crop

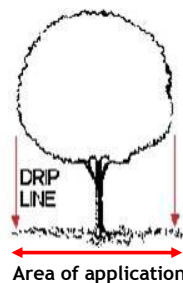
## 3. Methods of fertilizer application

- **Directly to the soil:**
  - broadcast application - depth of incorporation, banding, sidedressing; injection
- **Distributed by irrigation onto the soil:**
  - fertigation (chemigation) (**fertilization + irrigation = fertigation**)
  - irrigation methods – drip, sprinkler
- **Onto the leaves (foliar application):**
  - mainly for supplementary application to avoid/cure deficiency problems (Ca!, microelements!; N, Mg), at the time of grand period of shoot growth

## 3. Methods of fertilizer application

- **Directly to the soil:**
  - broadcast application - depth of incorporation, banding, sidedressing, drill hole; injection
- **Distributed by irrigation onto the soil:**
  - fertigation (or chemigation) (**fertilization + irrigation = fertigation**)
  - irrigation methods – drip, sprinkler
- **Onto the leaves (foliar application):**
  - mainly for supplementary application to avoid/cure deficiency problems (Ca!, microelements!; N, Mg), at the time of grand period of shoot growth

## Fertilizer application



- **When**
  - Late fall
  - Early spring
- **How**
  - Broadcast in a circle extending to drip line

## Basic elements of an irrigation technology

1. method of irrigation
2. aim of the irrigation
3. time and frequency of irrigation
4. amount of irrigation

## Aim of the irrigation

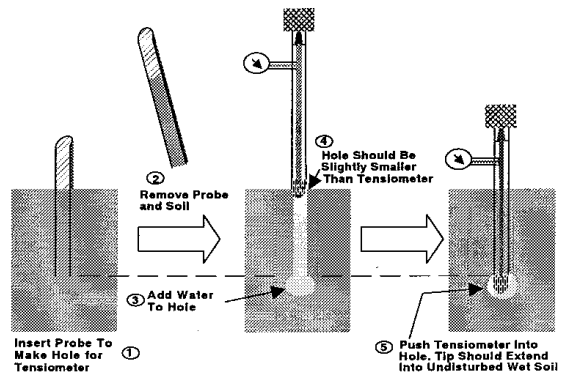
- **Water supply** – complementing natural precipitation; (regulating water supply)
- **Nutrient supply** together with water, fertigation
- **Conditioning** – increasing relative humidity, decreasing air and plant temperature by evaporation of misted water
- **Enhancing coloration** of fruits – water is sprayed on the surface of ripening fruits
- **Delaying bud break** – evaporative cooling of buds by misting, (can decrease fruit quality)
- **Reducing frost damage** – water is sprayed onto the trees at subzero temperatures

## Time, frequency and amount of irrigation

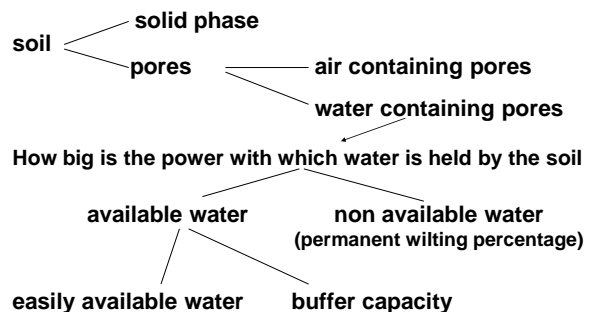
- Soil water content (and state of the plant) should be monitored for good timing of irrigation
- Duty of water (for the season) = crop water requirement – effective natural precipitation
- Evapotranspiration = pan evaporation \* crop coefficient
- The amount of water supplied during one irrigation and frequency of irrigation depends on the
  - soil physical composition
  - aim of the irrigation
  - irrigation method

## Irrigation systems

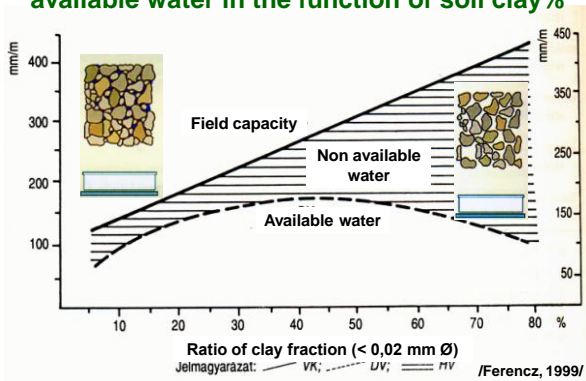
- Gravity flow – Flood, Furrow; needs leveled ground, low investment and not so low operational costs
- Sprinkler – movable or fixed system, fixed system needs less manual labor, but has higher installation cost; over-the-tree or under-the-tree system; suitable for every irrigation aim
- Drip (trickle) – supplies small amounts at frequent intervals, suitable just for water and nutrient supply; danger of clogging
- Combination of sprinkler and drip



## Soil water content



### Field capacity, non-available water and available water in the function of soil clay%



### Excesses in additional irrigation leads to

- excessive growth
- lower fruit quality
- nutrient leaching
- contamination of ground water
- cause a lack of woodiness
- result in winter frost damage in sensitive varieties
- in summer can also promote increased disease infestation