

# **Managing a Drip Irrigation System to Maximize Potato Crop Productivity Using Nano-Phosphate in Sandy Soil**

## **Supplemental Material**

### **Method of soil and water analysis**

The methods mentioned in the book Soil Sampling and Methods of Analysis (Carter and Gregorich, 2007) were used to conduct soil (physical and chemical) and water (chemical) analysis. This is a brief explanation of these methods:

#### **1. Physical analysis of soil**

##### **- Soil mechanical analysis**

The international method of soil mechanical analysis was used to determine soil texture. In this method, the soil particle size distribution was determined by using  $\text{NH}_4\text{OH}$  as a dispersing agent.

##### **- Bulk density**

Soil bulk density was measured by drawing 5 cm x 7.2 cm core from (0-15, 15-30, 30-45, and 45-75cm) soil depths.

##### **- Field capacity (FC) and Wilting point (WP)**

Soil moisture characteristics (FC and WP) were determined in the laboratory of the Reclamation & Development Center Desert Soils - Faculty of Agriculture - Cairo University using a pressure plate apparatus device.

#### **2. Chemical analysis of soil**

Some chemical analysis of soil, such as pH values, were determined in soil suspension (1: 2.5);  $\text{EC}_e$  ( $\text{dS m}^{-1}$ ) values were determined in the extract of soil paste, soluble anions ( $\text{meq l}^{-1}$ ) (i.e., carbonates, bicarbonate, and chloride), and soluble cations ( $\text{meq l}^{-1}$ ) (i.e., calcium, magnesium, sodium, and potassium) were determined in this extract as follows:

- ❖ Total soluble salts were determined in the extract of saturated soil paste for the latter.

- ❖ Chloride ( $\text{Cl}^-$ ) was determined in the extract of saturated soil paste using potassium chromate with standard silver nitrate ( $\text{AgNO}_3$ ) as an indicator according to Mohr's method.
- ❖ Soluble carbonate ( $\text{CO}_3^{2-}$ ) and bicarbonate ( $\text{HCO}_3^-$ ) were determined volumetrically by titration with a standard solution of sulfuric acid using phenolphthalein as indicator for the former and methyl-orange.
- ❖ Soluble sulfate was detected by the difference between total soluble cations and anions.
- ❖ Soluble calcium ( $\text{Ca}^{++}$ ) and magnesium ( $\text{Mg}^{++}$ ) were determined in the extract of saturated soil paste with EDTA, with versenate solution and sodium hydroxide as an indicator for calcium. While Eriochrome Black T and ammonium purpurate with EDTA were used as an indicator for calcium plus magnesium.
- ❖ Soluble sodium ( $\text{Na}^+$ ) and potassium ( $\text{K}^+$ ) were determined photometrically in the extract of saturated soil paste by flame photometer (JENWAY PFP7).

### **3. Chemical analysis of irrigation water**

pH values were determined in soil suspension (1: 2.5), electrical conductivity ( $\text{EC}_i$ ), and soluble cations and anions were done in the irrigation water were determined as shown in the above section.

### **Reference**

Carter MR, Gregorich EG (2007) Soil Sampling and Methods of Analysis, 2nd ed. CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, pp. 1-1262. <https://doi.org/10.1201/9781420005271>.