



EVALUATION OF SOIL FERTILITY IN SOME SOILS OF TOSKA AREA, EGYPT.

BY

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SUMMARY AND CONCLUSION

Optimal use of nutrients based on soil analysis can improve crop productivity, minimize wastage of these nutrients and mitigate hazardous impact on environment leading to bias through optimal production. The information on the availability of nutrients status in soils of Toshka area is meager. Therefore, soil and plant samples were collected in January 2017 from twenty nine pivots (the pivot equal 120 to 150 feddan) of the study areas. The first area (A) is called El-Rajhy Company and the second area (B) is called South Valley Company. Soil samples from two depths (0-25 and 25-50 cm) at each location were collected using an auger and plant samples of wheat and alfalfa were collected from the same locations. The samples sites were recorder using the global positioning system (GPS) for localizing each site. This study aimed to assess the nutrients status in soil and the relationship between these nutrients and some soil properties. Therefore, soil and plant samples were analyzed according the standard methods and the obtained results are shown as follows:-

A. Physical soil properties

- 1- The results indicated that sand content varied from 38.0 to 93.0% with an average value of 74.26 %. Silt content varied between 1.0 and 45.0% with an average value of 8.21 %. The clay content varied from 6.0 to 35.0% with an average value of 19.53 %. The results also showed that 55.6% of soil samples were sandy loam.
- 2- The results indicated that the saturation percentage (SP) ranged between 23.44 and 90.50 % with an average of 41.69 %. The highest value (90.50%) was found in the subsurface sample number (7 B) while the lowest values were found in the surface sample number 11 A and in the subsurface sample number 14 B.

B. Chemical soil properties

- 1- Results indicated that 48.3 % of the tested soils were non-calcareous (CaCO_3 content <5%) and 43.1 % were slightly calcareous (CaCO_3 content between 5 to 15%) while the remaining 8.6 % were calcareous (CaCO_3 content > 15%).
- 2- There was low organic matter content in the studied soils. It varied from 0.03 to 0.94% with an average value of 0.27 %.
- 3- The pH of the investigated soils varied from 6.91 to 8.75 with an average value of 7.62. About 86.2% of the soil samples had slightly alkaline pH values (7.5 -8.0), while 5.2% were moderately alkaline (8.00-8.50), whereas only 8.6% had strong alkaline (>8.50).
- 4- Soil salinity (ECe) ranged between 0.79 to 17.6 dS/m with an average value of 4.53 dS/m. The obtained results showed that 29.3% of the soil samples were found in category of no deleterious effect on crop, 19% were critical for germination and 25.9% were critical for salt sensitive crop, 22.4% were injurious to most crops and 3.4% were very high degree of salinity.
- 5- Sodium adsorption ratio (SAR) values in all soil samples analyzed from study area ranged from 0.84 to 51.24 with an average value of 7.89. The high values of SAR were compatible with high soil salinity.
- 6- Cation exchange capacity (CEC) values in all the studied soil samples ranged from 0.06 to 8.49 $\text{cmol}(+) \text{kg}^{-1}$ soil with an average value of 4.27 cmolckg^{-1} soil.
- 7- The obtained results exposed that the carbonate and bicarbonate ions ranged from 96 to 700 mg/kg with an average value of 230 mg /kg. Soluble chloride ion (Cl^-) ranged from almost 24 to 965 mg/kg an average value 101 mg/kg. The soluble sulfate (SO_4^{2-}) of the investigated soils ranged from 10 to 6185 mg/kg with an average value of 956 mg /kg.
- 8- The obtained results revealed that the soluble calcium (Ca) ions ranged from 18 to 727 mg /kg an average value of 195 mg/kg. Soluble magnesium (Mg) varied from 3 to 179 mg/kg with an average value of 33 mg/kg. Soluble sodium (Na) in the

investigated soils ranged from 25 to 2550 mg/kg with an average value of 294 mg/kg. Soluble potassium (K) in the investigated soils ranged from 13 to 113 mg/kg with an average value of 50 mg/kg.

C- Nutrients availability in soil

- 1- The available nitrogen in the soil ranged from 36.4 to 142.8 mg / kg with on average value of 58.51 mg/kg. About 86% of the studied soils had enough nitrogen (>40 mg/kg) and 31% contained excess N.
- 2- The available phosphorus content ranged between 0.81 and 55.18 mg/kg with an average value of 4.88 mg/kg. About 81 % of the studied soil samples showed low quantity of available phosphorus (<5 mg/kg).
- 3- The available K content ranged from 51 to 529 mg/kg with an average value 280 mg/kg. Most of the studied soil samples (91%) had enough of available K (>135 mg/kg).
- 4- The level of available Fe in the studied soils ranged between 0.74 and 10.02 mg/kg soil with an average value of 3 mg/kg soil and most of the soil samples (79.3%) were not enough (<4 mg/kg) of available Fe
- 5- The levels of available Cu in soils ranged from 0.24 to 8.20 mg/kg soil with an average value of 1.47 mg/kg soil. The data showed that the extractable-Cu was considered enough (>0.5 mg/kg) in most soil samples (75.9%).
- 6- The available Zn ranged between 1.20 and 12.2 mg/kg soil with an average value of 5.82 mg/kg soil. All soil samples had enough of available Zn (>1 mg/kg).
- 7- Available Mn in the studied soils of Toshka area ranged between 1.38 and 12.2 mg/kg soil with an average value of 6.35 mg/kg soil. Most of soil samples (89.7%) were enough in available Mn (>2 mg/kg)
- 8- The available B ranged from 0.04 to 18.42 mg/kg with an average value of 1.47mg/kg. The data showed that the available B was considered low (<0.45 mg/kg) in 44.8% and enough (>0.45 mg/kg) in 56.2% of the studied soil samples.

D- Plant tissue analysis

- 1) The total N in the plant samples ranged from 1.1% to 5.2 % with an average value of 3.41%. About 69% of the investigated plant samples in the study areas had enough N content.
- 2) The content of P in the studied plant samples ranged between 0.14% and 0.34% with an average value of 0.29%. Most of the plant samples (82.8%) contained enough P.
- 3) The K content in the plant samples ranged from 1.77 to 5.52% with an average value 3.22%. The obtained results showed that 97.6% of the plant samples had enough in K content.
- 4) The levels of Fe in the plant tissue ranged from 149 to 820 mg/kg with an average value of 296 mg/kg. All the plant samples had enough in Fe.
- 5) The Cu content in the plant samples ranged from 9 to 210 mg/kg with an average value 57.6 mg/kg and all the plant samples had enough content of Cu.
- 6) The content of Zn in the plant samples ranged between 21 and 79 mg/kg with an average value 43 mg/kg and all plant samples had enough in Zn.
- 7) The Mn in the plant tissues ranged from 25 to 88 mg/kg with an average value of 48.6 mg/kg and all the studied plant samples had a sufficient amount of Mn.
- 8) The B content ranged between 0.9 and 113.8 mg/kg with an average value of 11.7 mg/kg in plant samples. The results showed that 93.1% of the studied plant samples had deficient of B.

The following considerations are recommended

It might be recommended that

- Soil properties such as pH, EC, CaCO₃ and OM play major roles in controlling the availability of plant nutrients. These factors could be manipulated in order to combat any present or future deficiencies of nutrients in some soils Toshka.

- Some plant sample (30%) had excess N, so it is recommended to decrease N fertilization rates to save the environmental ecosystem. The excess N may push plants to remain in a vegetative growth stage and delay initiation of flowering, resulting in lowered yields.
- The available P was low in most soils and had deficiencies in some plants. It is expected that the studied area may respond to the P fertilizers.
- The available K was enough in most soils and the tested plants had enough K in most cases.
- The available Cu, Zn and Mn were enough in most soils and plants.
- On the basis of these results, farmers are advised to use integrated nutrient management practice to maintain optimum concentration of all the essential nutrients for plants. Farmers are also advised to add organic and bio-fertilizers.
- The soils of Toshka require attention regarding nutrient management practices and regular monitoring of soil health for better crop production.