AMELIORATION OF DEGRADED SOILS IRRIGATED WITH LOW QUALITY WATER

By

HESHAM MANSOUR EID

B.Sc. Agric. Sci. (Soils and Water), Fac. Agric., Fayoum Univ., 2011

THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Sciences

(Soil Science)

Department of Soil
Faculty of Agriculture
Cairo University
EGYPT

2018

APPROVAL SHEET

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ABSTRACT

The current research work studied the impact of low quality waters varied in their sources of contamination on soil characteristics and vegetables grown in these soils as well as possible biochemical remediation of such soils. Results implied that application of low quality water led to increase Zn equivalent parameter as an index of increasing heavy metals in the studied soils. The concentration of contaminants in Kafr-Elsheikh soil was the highest, followed by Kombora and Abo Rawash which revealed that, total and available forms of varied contaminants were higher existed in the heavy texture soils than in the light ones. In the greenhouse remediation study on Kafr-Elsheikh contaminated soil, five treatments were applied including chemical remediative ammendments *i.e.,* elemental sulfur, rock phosphate, probentonite, prokaolinite and compost extract, and biological remediatve ammendments (*Thiobacillus thiooxidans, Thiobacillus ferrooxidans,* phosphate dissolving bacteria, *Pseudomonas fluorescens* and arbuscular mycorrhizae) and growing hyper accumulator plants *i.e.,* Radish and Turnip in both individual and mixture applications and irrigated with the same contaminated water used in the field. Results implied that application of integrated management with radish plant as hyper accumulator plant was the best for minimizing the hazards of contaminated irrigation water. The three treatments which gave the most significant improvement *i.e.,* elemental sulfur, rock phosphate and inoculated with a mixture of *Thiobacillus thiooxidans, Thiobacillus ferrooxidans,* phosphate dissolving bacteria, arbuscular mycorrhizae (AM) and enriched with compost extract (T_3), combined mixture of probentonite and prokaolinite and inoculated with *Pseudomonas fluorescens,* arbuscular mycorrhizae (AM) and enriched with extracted compost (T_4), and combined mixture of all the remediative amendments (T_5) were selected to be evaluated under field conditions with radish hyper accumulator plant. Results showed that the same trend obtained in greenhouse with significant improvement in soil characteristics. In addition, these treatments especially the integrated management significantly decreased the concentration of heavy metals in radish plant. In conclusion, minimizing the hazards of heavy metals by natural modified local products could be the best management practices in having healthy food.

Key words: Management practices, heavy metals, soil contamination, low quality water.

DEDICATION

This thesis would never have been completed without the compassion and support of my beloved father, mother, sisters and wife. My words would not be enough to thank all of you. I dedicate this work to all of you.

ACKNOWLEDGMENT

First and foremost, all the praises and limitless thanks are to ***ALLAH*** *who gave me the capability to do this work.*

I wish to express my gratitude and appreciation to my supervisors ***Dr. M. El-kherbawy*** *and* ***Dr. E. Elmorsy,*** *Professors of Soil, Faculty of Agriculture, Cairo University, and* ***Dr. A. Zaghloul*** *Professor of Soil, NRC, Egypt, who gave me an opportunity to work under their supervision and helpful guidance.*

Special thanks to ***Dr. E. Elsyad,*** *Professor of soil Science, Soil and Water Department, Fayoum University, who gave me an opportunity to study basics of soil chemistry under his supervision, also for revision and judging this work.*

Special thanks to ***Dr. M. Abdel Mohsen,*** *Professor of soil, Faculty of Agriculture, Cairo University, for constructive criticism, revision and judging this work.*

I would like to show my whole hearted and best thanks to ***Prof. Dr. F. Awad*** *and* ***Prof. Dr. M. Saber,*** *NRC, Egypt, for supervision, valuable suggestion to better my work and finally the technical advice. I am proud and honored to be your student.*

The author is indebted to ***Prof. Dr. S. El Ashry,*** *NRC, Egypt, for her faithful support and helping to achieve numerous tasks in this work. I acknowledge the kindness of the research group of soil chemistry Lab, Soils and Water Use Dept, NRC, Egypt, for their encouragement and for a friendly face. I am very thankful to all members of the Department.*

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INTRODUCTION

No doubt water is a vital resource for farming and human existence as well. The current shortage in fresh water resources coupled with the escalating demands provoked many countries in arid and semi-arid regions to use low quality water in farming. Certainly, low quality water drastically deteriorates soil ecosystem. In association with the recently observed increases in population and rises in economic and social activities in Egypt, the anxiety on water scarce is elevating. In other words, Egyptian farmers would receive in the very near future less irrigation water both in quantity and quality. For that, decision-makers have adapted numerous plans to trustworthy water resources. It is imperious to save and conserve water while providing necessary plans to satisfy the social and economic needs in a sustainable policy.

It is worthy to state that the water sources in Egypt are apt to countless types of contaminants, both chemical and biological, arising from varied sources. Such situations adversely impacted the quality of irrigation water, as well as the appropriateness of crop harvest for human and animal consumption.

One of the core of the current Egyptian water policy is the reuse of low quality water, mainly agriculture drainage water and treated sewage effluent, including a periodically monitoring of their adverse agro-environmental consequences. The low quality water is always polluted with enteric pathogens, organic toxins as well as certain heavy metals posing environmental hazard to both human and biodiversity, besides restricting water reuse. Certainly monitoring these hazards