EFFECT OF USING SOILCONDITIONERS ON WATER USE EFFICIENCY AND PRODUCTIVITY OF TOMATO PLANT

By

MOHAMED RASHAD MOSTAFA ELDOLIFY

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 1999

M. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2005

A thesis submitted in partial fulfillment

Of

The requirements for the degree of

DOCTOR OF PHILOSOPHY

In
Agricultural Science
(Vegetable Crops)

Department of Horticulture
Faculty of Agriculture
Ain Shams University

2016

Approval Sheet

EFFECT OF USING SOILCONDITIONERS ON WATER USE EFFICIENCY AND PRODUCTIVITY OF TOMATO PLANT

By

MOHAMED RASHAD MOSTAFA ELDOLIFY

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 1999

M. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2005

This thesis for Ph. D. degree has been approved by:

Dr. Sayed Mahmoud Singer **…...…….**

Research Prof. Emeritus of Vegetable Crops, National Research Center

Dr. Ayman Farid Abou-Hadid **…...…….**

Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Dr. Ahmed Abou- El-Yazied Abd El- Hafize **…...…….**

Prof. of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Dr. Mohamed Hashim Mohamed El-Deeb **……...……**

Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Ain Shams University

Date of Examination: 22 / 3 / 2016

EFFECT OF USING SOILCONDITIONERS ON WATER USE EFFICIENCY AND PRODUCTIVITY OF TOMATO PLANT

By

MOHAMED RASHAD MOSTAFA ELDOLIFY

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 1999

M. Sc. Agric. Sc. (Horticulture), Ain Shams University, 2005

Under the supervision of:

Dr. Mohamed Hashim Mohamed El-Deeb

Prof. Emeritus of Vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University (Principal supervisor)

Dr. Ahmed Abou- El-Yazied Abd El- Hafize

Prof. of Vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University

Dr. Mohamed Abdrabbo Ahmed

Head Research of Agriculture Climate, Central Laboratory for Agriculture Climate, Agricultural Research Center.

ABSTRACT

Mohamed Rashad Mostafa El Dolify: Effect of Using Soil Conditioners on Water Use Efficiency and Productivity of Tomato Plant. Unpublished Ph.D. Thesis, Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2016.

The current study was performed to investigate the effect of three water regimes as well as, three different soil conditioners on the yield and the quality of tomato fruit. The studied water regimes were namely; 60, 80 and 100% of class A pan. The tested soil conditioners were "Hundz soil", "Oligo plus" and "Bioconditioner". Impact of the two investigated factors was studied separately, as well as, the interaction. The experiment was carried out at El-Dolify Farm, Khatatba, Monofia Governorate during two seasons (2012/2013 and 2013/2014). Tomato hybrid Yara F1 was used in this investigation. The obtained results confirmed that, using the "Hundz soil" or "Oligo plus" lead to the significant increments in all tested parameters related to the yield and the fruit quality. It also enhanced all vegetative growth measurements (plant height, leaves number per plant, fresh and dry weight of leaves). The treatments increased all assayed a chemical constituent of plant leaves i.e. chlorophyll, total nitrogen, phosphorus and potassium as well as total acidity and L.Ascorbic acid content. Moreover; interaction between "Hundz soil" or "Oligo plus" and any tested water regimes were significantly better than Bioconditioer and control in number of fruits per plant, average fruit weight, early, marketable and total yield. In addition, the results show that the chemical properties of tomato fruits were improved by applying the "Hundz soil" or "Oligo plus". Concerning the water use efficiency, the tested soil conditioners had a significant effect compared to control treatment (untreated). Whereas, irrigating the tomato plants under this experimental condition confirmed the validation of using the 80% irrigation regime without significant losses in the crop yield.

Key words:

Tomat, Water regimes, Soil conditioners, Hundz soil, Oligo plus , Bioconditioner , Yield, Water use efficiency

ACKNOWLEDGMENT

First of all, I would like to express my deepest thanks to **Allah** who gave me the power, knowledge and patience to finish this work.

My supreme gratitude and appreciation to my family, especially the soul of my father **Mostafa Eldolify** for their help, encourage, support, understand and repeated continues prayers through working of this thesis.

I would like to express great thanks and deep gratitude to **Prof. Dr. Mohamed Hashim Mohamed El-Deeb,** Professor Emeritus of Vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University, for suggesting of current study, supervision and help during the course of this study and during preparing and reviewing the manuscript.

Deep gratitude and thanks is also due to **Prof. Dr. Ahmed Abou- El-Yazied Abd El-Hafize,** Professor of Vegetable Crops, Department of Horticulture, Faculty of Agriculture, Ain Shams University, for his kind supervision, advice, valuable assistance, during the preparation of this thesis.

I am also indebted and expressing my full thanks to **Prof. Dr. Mohamed Abdrabbo Ahmed**, Head of Research, Central Laboratory for Agriculture Climate, Agricultural Research Center, for his supervision, great support and continued help during the preparation of this work.

I would like thank **Mr. Mofdy Morgan** Chairman of Board of Directors Hundz Soil Company for his support.

Thanks are also extended to **the staff members** of Climate modification Department research, Central Laboratory for Agricultural Climate for their encouragement and help during the course of this work.

CONTENTS

LIST OF TABLES

INTRODUCTION

Tomato (*Solanum lycopersicum* L.) is an important vegetable crop grown worldwide and Egypt for both fresh and processing markets**.** Egypt produces 3853341 ton during summer cultivation from the area of 238376 feddan, and the average of production is 16.165 ton/feddan **(MALR 2013)**. Researchers acknowledge that tomato has a higher acreage of any vegetable crop in the world **(Ho *et al.*, 1999)**, and it also requires a high water requirement for both, optimal vegetative and reproductive development **(Arturo *et al.*, 1995; Jones, 1999).** Water plays a crucial role in determining the yield of tomato. However, it is most likely that a water scarcity period will have to be faced in the not too distant future. The unpredictable rainfall and increasing competition for water resources will compel the adoption of irrigation strategies in Africa. Deficit irrigation could allow saving water and in the same time it maintains satisfactory yields or production levels **(Topcu *et al.*, 2007).** Under this strategy, crops are deliberately allowed to sustain some degree of water deficit and yield reduction. Deficit irrigation is irrigating the root-zone with less water than required for evapotranspiration **(Zegbe-Dominguez *et al.*, 2003).** However, deficit irrigation for most vegetables such as tomato has been extensively studied, but with contrasting results **(Dorji *et al.*, 2005).** For example**, Zegbe-Dominguez *et al* (2003)** revealed that tomato dry mass yield did not decrease under deficit irrigation compared to full irrigation, besides making a 50% saving in water and approximately 200% increase in irrigation water use efficiency and relevant fruit quality attributes improved. In this respect, many investigations were carried out to study the effect of irrigation regime on vegetative growth and productivity of tomato plants. In this connection, **El-Beltagy *et al.* (1984), Fattahallah (1992), Merghaney (1997), Navarrete and Jeannequin (2000),** all reported negative effects of water stress on tomato growth, chemical constituents and fruit yield and quality

of plant foliage. Under Egyptian conditions, irrigation water is a limited agricultural resource. This study addresses the rationalized of using water in the intensive tomato growing technology. The principal resource of water in Egypt is the Nile River which provides us yearly with about 55.5 billion cubic meters. The second source is the underground water. Agriculture share of the water budget was about 81% and increased to 85% in 2006 **El-Beltagy and Abou-Hadid (2008**). Irrigation water is gradually becoming scare especially in arid and semi-arid regions. Therefore, water saving and conservation now in Egypt is essential to support agricultural development needed. Also, the efficient use of water by irrigation is becoming increasingly important. Crop water consumption is thermal dependent, therefore, it is expected that crop water requirement may be improved by using soil conditioners during growth season. Such treatment contributes to save water and improve water use efficiencies and the quality of fruits **(Lorenzo *et al.*, 2003).**

The aim of this investigation is to perform a study on the effect of adding three soil conditioners and three irrigation levels as well as their interaction on vegetative growth, chemical constituents of plant foliage, yield quantity and quality, and water use efficiency of tomato plants to reveal the best combination between irrigation level and soil conditioner that can be recommended to increase yield and save water consumption of tomato plants grown during summer season under sandy soil conditions.