STUDIES ON THE EFFECT OF PGPB ON CITRUS ROOTSTOCK UNDER TWO TYPES OF SOIL CONDITION

By

WALAA HASSAN ESMAIL IBRAHEM

B. Sc. Agric. Sci. (Biotechnology), Fac. Agric., Cairo Univ., 2004
M. Sc. Agric. Sci. (Microbiology), Fac. Agric., Cairo Univ., 2013

THESIS

Submitted in Partial Fulfillment of the Requirements for the Degree of

DOCTOR OF PHILOSOPHY

In

Agricultural Sciences
(Agricultural Microbiology)

Department of Agricultural Microbiology
Faculty of Agriculture
Cairo University
EGYPT

2019

Former Reviewer **Vice Dean**

APPROVAL SHEET

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Department: Agricultural Microbiology **Approval: 14 /4 /2019**

ABSTRACT

Citrus one of the most economically important crops in Egypt, efforts are always put to increase the citrus cultivated lands, especially reclaimed lands.

In the presented study, 19 isolates were isolated from the rhizosphere area of sandy soil cultivated with citrus and 15 isolates were isolated from the rhizosphere area of calcareous soil. These isolates possess the ability of producing ACC-deaminase, IAA, GA and sidrophore. They also possess the ability of dissolving phosphate and fixing atmospheric nitrogen. The most potent isolate from each soil were identified and their toxicity was evaluated using MTT assay. The sandy soil isolate was *Stenotrophomonas maltophilia,* which was the less toxic and safer isolate to use in agricultural applications. The calcareous soil isolate was *Enterobacter cowanii,* which, due to its higher toxicity level, is preferred to use in nonedible crops like decorative and wood forest plantations only. *In vivo*, the effects of *Stenotrophomonas maltophilia* were tested on two types of seed rootstock (Volcamariana and sour orange) in both the sandy soil and calcareous soil. The results revealed that this isolate was successful in improving the cultivate parameters in both types of treated soil. As for the treated soils, the shoot length of both types of soil was improved relatively equally, while the leaves number and the root length were better in the sandy soil compared to the calcareous soil. On the other hand, the stem thickness and the proline content were better in the calcareous soil compared with the sandy soil for both the rootstocks. Moreover, the chlorophyll content in the volkamariana cultivated in the sandy soil were higher compared to the sour orange in the sandy soil, on the other hand the sour orange had higher chlorophylls contents in the calcareous soil compared to the volkamariana in the calcareous soil. The NPK, Ca and Mg contents increased in the leaf in both rootstocks cultivated in the sandy soil compared to the calcareous soil, while the Na contents decreased. The GA contents in the roots for both rootstocks increased in the sandy soil compared to the calcareous soil. Applying the isolate also allowed decreasing the ethylene content in the root for both the rootstocks in both soil types. It also helped in increasing the activity of the hydrogenase and nitrogenase enzymes in the sandy soill. In conclusion, the *Stenotrophomonas maltophilia* is useful to use with citrus plants, especially in reclaimed lands, hence improving its growth under rough conditions.

Keywords: Volkamariana, sour orange, citrus, *Stenotrophomonas maltophilia, Enterobacter cowanii*, sandy soil, calcareous soil.

ACKNOWLEDGEMENT

Firstly my unlimited thanks to "Allah"

I wish to express my gratitude and appreciation to ***Dr. Mohamed Zakaria Sedik*** *Professor of Agriculture Microbiology, Faculty of Agriculture, Cairo University, for suggesting the problems, supervision continued assistance, and guidance through the course of my study and for his revision of the manuscript.*

All the good greetings to ***Dr. Nadia Fahmy Amin*** *Professor of Agriculture Microbiology, Faculty of Agriculture, Cairo University, for suggesting the problems, supervision, continued assistance, and guidance through the course of my study and i am sorry for your loss. She was such a great person; she will live on in our memories forever.*

My thanks are directed to ***Dr. LOBNA ABD-ELAZIZ AHMED MOUSSA,*** *Head Research of Agricultural Microbiology, Soils, Water and Environ. Res. Inst. (SWERI), Agric. Res. Center (ARC), Giza for her guidance, cooperation and supervision, as well as encouragement during the practical work.*

I wish to express my graduate and appreciation to ***Dr. Hayam Mohamed Fathy*** *Lecturer of Agricultural Microbiology, Faculty of Agriculture, Cairo University For supervision and her guidance through the courses of study.*

Great and special thanks are also extended for my dearest friends and staff members of Citrus Research Department, ARC, Giza.

Lastly, I would like to sincerely thank my family especially my mother for unlimited help and my partner Mohammed Ezzat for giving me their whole hearted support and my sweet children Zaina and Ahmed.

LIST OF ABBREVIATIONS

ABA:	Absisic acid
ACC:	Aminocyclopropane carboxylice acid
ACCD:	Aminocyclopropane carboxylate deaminase enzyme
ARFs:	Auxin response factor
BNF:	Biological nitrogen fixation
C6:	*Enterobacter cowanii*
C-P:	Carbon phosphate bond
CAS:	Chrome azurol S
CCM:	Combined carbon medium
CaM:	Calmodulin
Chl:	Chlorophyll
CDPKs:	Ca^{2+} dependent protein kinases
dS m^{-1}:	DeciSiemens per metre
DHA:	Dehydrogenase activity
DMSO:	Dimethyl sulfoxide
DMF:	Dimethyl formamide
EPC:	Electron pressure control system
EC:	Electrical conductivity
ESP%:	Exchangeable sodium percentage
EPC:	Electron pressure control system
GA:	Gebrillic acid
HDTMA:	Hexa decyl tri methy-l- Ammonium bromide
IAA:	Indol acetic acid
LDH:	lactate dehydrogenase enzymes
$Meq.L^{-1}$:	Miliequivalents / liter
MTT:	Methylthiazolyldiphenyl tetrazolium bromide
OM:	Organic matter
PGPB:	Plant growth promoting bacteria
ROS:	Reactive oxygen species
SP%:	Saturation present
PSB:	Phosphate solubilizing bacteria
SA:	Salicylic acid
SAM:	S-Adenosyle-L-Methonine
SAR:	Sodium adsorption ratio
SCC:	Sour orange under calcareous soil control
SCS13:	Sour orange under calcareous soil treated by S13
SDM:	Shoot dray matter

S13:	*Stenotrophomonase maltophilia*
SSC:	Sour orange under sandy soil control
SSS13:	Sour orange under Sandy soil treated by S13
SUP:	Supernatant
T. Cell:	Toluenized cells
TSA:	Tryptone soya agar
TSB:	Tryprone soya broth
VCC:	Volkamer lemon under calcareous soil control
VCS13:	Volkamer lemon under calcareous soil treated by S13
VSC:	Volkamer lemon under sandy soil Control
VSS13:	Volkamer lemon under sandy soil treated by S13
USDA:	United state department of agriculture

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