

Deanship of Graduate Studies

Al-Quds University

**The Response of Chickpea (*Cicer arietinum* L.)
To Irrigation with Reclaimed Wastewater**

By

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M. Sc. Thesis



2002

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B.Sc.: Al-Quds university, Palestine

A thesis Submitted in Partial Fulfillment of Requirements for the

Degree of Master of Science in Applied and industrial

Technology / Graduate Studies

Al-Quds University

Sept, 2002

Program of Postgraduate Studies in Applied & Industrial Technology

Deanship of Graduate Studies

"The response of chickpea (Cicer arietinum L.) to irrigation with reclaimed wastewater"

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DECLARATION

I certify that this thesis submitted for the degree of Master in the result of my own research, except where otherwise acknowledged, and that this thesis (or any part of the same) has not been submitted for a higher degree to any other university or institution.

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ACKNOWLEDGMENTS

Before and above all I would like to express my endless thanks to GOD for conciliation and providing patience.

I would like to thank Al-Quds University for giving me the opportunity to pursue my M. Sc degree. My deepest appreciation is expanded to the Palestinian Consultancy Group (PCG) and EU for their generous funding to this work.

I owe a great deal of thanks to my supervisors Dr. Mustafa Khamis, Dr. Magdy el-Dakiky and Dr. Adnan Manassra for their guidance, advice and invaluable assistance. I would like to extend my special thanks and appreciation to Dr. Marwan Haddad for his fruitful discussion and assistant.

I would like to thank the staff of the Center for Chemicals and Biological Analysis for their help in the laboratory work especially Jawad Shquair also especial thanks to my lovely friend Omer Ayyad (Abu-Daud).

Last I would like to thank every one that contributed towards the progress of this work, provided help, moral support, love or encouragement.

Table of contents

Acknowledgment.	i
Table of contents.	ii
List of abbreviations.	v
List of Tables.	vi
List of Figures.	vii
Abstract.	x
I. INTROUCTION.	1
I.1 Chickpea.	2
I.1.1 Common and scientific names.	2
I.1.2 Description.	2
I.1.3 Origin.	2
I.1.4 Types.	3
I.1.5 Chemistry.	3
I.1.6 Planting and irrigation.	3
I.1.7 Diseases.	4
I.1.8 Harvesting.	5
I.1.9 Yield and economics.	5
I.1.10 Breeding.	5
I.2 Reuse of wastewater.	7
I.2.1 Historical reuse of wastewater.	8
I.2.2 Parameters used in evaluation of agriculture water quality.	8
I.2.3 Irrigation technique.	9
I.2.4 Wastewater treatment.	10
I.2.4.1 Methods of Wastewater treatment.	13
I.2.4.2 Palestine experience in wastewater treatment and reuse.	16
I.2.4.1.1 Wastewater characteristic in Palestine.	17
I.2.4.1.2 Wastewater treatment plants.	20
I.3 Objectives.	22
II. EXPERIMENTAL.	23
II.1 Wastewater treatment.	24

II.1.1 Treatment system description.	24
II.2 The reuse of treated wastewater.	28
II.3 Analytical and sampling techniques.	29
II.3.1 Chemicals.	29
II.3.2 Instrumentation.	30
II.3.3 Sampling and analyses.	30
II.3.3.1 Wastewater.	30
II.3.3.2 Soil.	31
II.3.3.3 Plant.	32
II.3.4 Uniformity parameters.	32
III. RESULTS AND DISCUSSION.	34
III.1 Wastewater treatment plant.	35
III.1.1 Influent and effluent characteristic of wastewater.	35
III.1.2 Wastewater treatment plant performance.	37
III.2 The effluent reuse in agriculture.	39
III.2.1 Effect of the effluent on soil properties.	40
III.2.1.1 Soil pH.	40
III.2.1.2 Soil electrical conductivity.	40
III.2.1.3 Soil chloride.	43
III.2.1.4 Soil bicarbonate.	43
III.2.1.5 Soil potassium.	44
III.2.1.6 Soil sodium.	45
III.2.1.7 Soil organic nitrogen and phosphorus.	45
III.2.1.8 Microbiology test.	46
III.2.2 Effect of effluent in the plant growth parameters and chemical Composition of chickpea.	47
III.2.2.1 Effect on growth parameters.	47
III.2.2.1.1 Efficiency.	47
III.2.2.1.2 Biomass.	48
III.2.2.1.3 Grain yield.	50
III.2.2.1.4 Harvest index.	50
III.2.2.1.5 Days to 50% flowering.	52

III.2.2.2 Effect of effluent on chemical composition and Microbiology of chickpea.	52
III.2.2.2.1 Sodium.	52
III.2.2.2.2 Potassium.	53
III.2.2.2.3 Phosphorus.	55
III.2.2.2.4 Organic nitrogen.	56
III.2.2.2.5 Microbiology.	58
IV. CONCLUSION AND SUGGESTION FOR FURTHER WORK.	59
V. APPENDIX.	62
VI. REFERENCES.	65
VII. ARABIC SUMMARY.	72

List of abbreviations

BOD: Biological oxygen demand.
COD: Chemical oxygen demand.
DO: Dissolved oxygen.
EC: Electrical conductivity.
FC: Fecal coliform.
F.S: Fresh water and surface drip irrigation.
F.SUB: Fresh water and subsurface drip irrigation.
FW: Fresh water
HI: Harvest index.
ICP: Inductively coupled plasma.
MBR: Membrane bio-reactor.
MCM: Million cubic meter.
NFT: Nutrient film technique.
MS: Millisemenes.
KHP: Potassium hydrogen phthalate.
RO: Reverse osmosis.
SAR: Sodium absorption ratio.
SBR: Sequential batch reactor.
S: Semen's.
TC: Total coliform.
TDS: Total dissolved solids.
TPC: Total plat count.
TS: Total solids.
TSS: Total suspended solids.
UCC: Christiansen uniformity coefficient.
UCW: Wilcox and wails uniformity coefficient.
W.S: Wastewater treatment (effluent) and surface drip
irrigation.
W.SUB: Wastewater treatment (effluent) and subsurface
drip irrigation.

List of Tables

Table [1]:	The acceptable parameters of soil to be suitable for agriculture	9
Table [2]:	Physical properties of water.	10
Table [3]:	Typical chemical quality of raw domestic wastewater.	12
Table [4]:	Comparison between the performance of chlorine, ozone and ultraviolet radiation in wastewater effluent disinfection.	15
Table [5]:	The water demand in Palestine for the year 1990, 2000 and its estimated projection for the years 2010 and 2020.	18
Table [6]:	Characteristics of raw wastewater in West Bank.	19
Table [7]:	Efficiency of wastewater Treatment Plants in Palestine	20
Table [8]:	The description of wastewater treatment plant at Al-Quds University.	25
Table [9]:	The chemical and biological analysis of influent and effluent of wastewater generated from Al-Quds University compared to international acceptable values for irrigation.	38
Table[10]:	Frequency of breaking down of the different parts of the treatment plant at Al-Quds University during 36 months of operation.	39
Table[11]:	Cost estimation of treatment of 1m ³ of wastewater at Al-Quds University	39
Table[12]:	Soil parameters at different depth before plantation and after harvesting of chickpea irrigated with effluent and FW using surface drip irrigation	41
Table[13]:	Soil parameters at different depth before plantation and after harvesting of chickpea irrigated with effluent and FW using subsurface drip irrigation	42
Table[14]:	The variation of TPC in soil after harvesting the chickpea.	46
Table[15]:	The FC and TC in soil before plantation and after harvesting of chickpea.	47
Table[16]:	The Biological growth parameter for the chickpea cultivar ICC 11293 irrigated with effluent and FW using surface	48

and subsurface drip irrigation.

Table[17]:	The chemical analysis of leaves and seeds of ICC 11293 cultivar irrigated with effluent and F.W using surface and subsurface drip irrigation.	54
Table[18]:	The FC and TC of plant irrigated with effluent and FW using surface and subsurface irrigation.	58

List of Figures

Figure[1]:	A schematic diagram of wastewater treatment plant.	26
Figure[2]:	The connection of wastewater treatment plant to the sewage system and storage pool	27
Figure[3]:	Sketch of the field experiment.	29
Figure[4]:	EC(mS/cm) in soil before plantation and after harvesting of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation	43
Figure[5]:	Chloride (mg/g) in soil before plantation and after harvesting of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation	44
Figure[6]:	Bicarbonate (mg/g) in soil before plantation and after harvesting of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation	44
Figure[7]:	Potassium (mg/g) in soil before plantation and after harvesting of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation	45
Figure[8]:	Efficiency of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation	48
Figure[9]:	Biomass (kg per square meter) of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.	50
Figure[10]:	Grain yield (kg per square meter) of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.	51
Figure[11]:	Harvest index (HI) of different cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.	51

- Figure[12]: Sodium (mg/g) content in seeds of different cultivars of 53 chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.
- Figure[13]: Sodium (mg/g) content in leaves of different cultivars of 53 chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.
- Figure[14]: Potassium (mg/g) content in seeds of different cultivars of 55 chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.
- Figure[15]: Potassium (mg/g) content in leaves of different cultivars of 55 chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.
- Figure[16]: Phosphorus (mg/g) content in seeds of different cultivars of 56 chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.
- Figure[17]: Phosphorus (mg/g) content in leaves of different cultivars 56 of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation
- Figure[18]: The organic nitrogen (mg/g) content in seeds of different 57 cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.
- Figure [19]: The organic nitrogen (mg/g) content in leaves of different 57 cultivars of chickpea irrigated with effluent and FW using surface and subsurface drip irrigation.

ABSTRACT

A pilot plant for the treatment of wastewater was installed at Al-Quds University site. It is based on the activated sludge treatment process with a capacity of 50m³/day. The sewer system in the university contained gray, black and storm wastewater. The influent and effluent characteristics were monitored over 36 months from October 98 to July 2001. The pH, EC, TS, TDS, TSS, BOD and COD are the tests done to control the efficiency of the treatment. BOD and TSS reached about 30ppm and 20 ppm in the effluent, respectively. Also major ions, heavy metals and microbiology test were monitored. The results of these tests are acceptable for irrigation according to international standards. The treated wastewater produced from this plant was collected and used in the irrigation of different cultivars of chickpea, namely Bulgarit, WIR-32, Jordan and ICC11293 during three years with two different irrigation technologies surface and subsurface.

The response of the chickpea to irrigation using treated wastewater (effluent) is compared to the irrigation with fresh water (FW) and is followed by employing different biological growth parameters efficiency. The chemical and biological analysis of leaves and seeds show no significant difference between the effluent and FW using both irrigation technologies. The results indicate that two out of four cultivars tested namely Bulgarit and ICC 11293 can be irrigated with effluent without any loss in yield. In biomass even an improvement were observed. WIR-32 and Jordan showed significance reduction in their biological growth parameters when irrigated with effluent as compared with fresh water. Surface and subsurface drip irrigation gave similar results in most cases. The soil analysis shows no significant difference between irrigation with effluent and FW during this period.

CHAPTER I

INTRODUCTION

I.1 Chickpea

Chickpea is the second most important pulse crop in the world, grown in at least 33 countries in South Asia, West Asia, North Africa, East Africa, Southern Europe,