FERTIGATION MANAGEMENT OF CUCUMBER PLANTS UNDER PLASTIC HOUSES

BY

MOHAMED ABDRABBO AHMED ABDRABBO

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 1993
M. Sc. Agric. Sc. (Vegetable Crops), Ain Shams University, 2001

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

2005

Approval Sheet

FERTIGATION MANAGEMENT OF CUCUMBER PLANTS UNDER PLASTIC HOUSES

BY

MOHAMED ABDRABBO AHMED ABDRABBO

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 1993

M. Sc. Agric. Sc. (Vegetable Crops), Ain Shams University, 2001

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

Dr. Shamel Ahmed Shanan …….....……

Prof. Emeritus of Vegetable Crops, Faculty of Agriculture, Al-Azhar University

Dr. Ibrahim Ibrahim El-Oksh .....……..

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

Dr. Ayman Farid Abou Hadid .....……..

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

Date examination: / / 2005

FERTIGATION MANAGEMENT OF CUCUMBER PLANTS UNDER PLASTIC HOUSES

BY

MOHAMED ABDRABBO AHMED ABDRABBO

B. Sc. Agric. Sc. (Horticulture), Ain Shams University, 1993
M. Sc. Agric. Sc. (Vegetable Crops), Ain Shams University, 2001

Under the supervision of

Dr. Ayman Farid Abou Hadid.

Professor of Vegetable Crops, Hort. Dept., Fac. of Agric., Ain Shams University (principal supervisor)

Dr. Essam Mohamed Abd El Moniem.

Associated professor of Soil Science, Soil Dept., Fac. of Agric., Ain Shams University

Dr. Mahmoud Abdalla Medany.

Senior researcher, Central Laboratory for Agricultural Climate, Agriculture Research Center

ABSTRACT

Mohamed Abdrabbo Ahmed Abdrabbo. Fertigation Management of Cucumber Plants under Plastic Houses. Unpublished Doctor of Philosophy Thesis. (Vegetable crops). Department of Horticulture, Faculty of Agriculture, Ain Shams University, 2005.

Cucumber (*Cucumis sativus* L. cv. Delta Star F1) plants were grown in white plastic containers filled with sand at different levels of nitrogen, phosphorus and potassium under a typical plastic-covered greenhouse. The experiment was carried out in the Protected Cultivation Experimental Site at Dokki, Giza during the two successive seasons of 2002/2003 and 2003/2004. The main objective of this study was to determine cucumber response and nutrient uptake under different treatments. Twenty seven combinations of nitrogen [90 (N1), 180 (N2) and 270 (N3) mg/l]; phosphorus [15 (P1), 35 (P2) and 70 (P3) mg/l] and potassium [120 (K1), 240 (K2) and 360 (K3) mg/l] were applied in a randomized complete block design with three replicates. Plant leaf samples (4^{th} mature leaf from top) were removed in order to analyze nutrient concentration in cucumber leaves. Harvesting started after four weeks from transplanting and the total yield was accumulated every two weeks in order to find out the relationship between yield from one hand and N, P and K status from the other hand. The results showed that plant height, leaves area, stem diameter and chlorophyll content were increased with increasing nitrogen concentration in the nutrient solution accompanied with (P2K2), (P2K3), (P3K2) or (P3K3). The lowest early and total yields were obtained in N1 accompanied with different combinations of P and K. Meanwhile, N2 gave the highest early yield under different combinations with P and K but without significant differences with N3 treatments up till the 2^{nd} week after beginning of harvest; N3 gave significantly the highest total yield followed

by N2 accompanied with (P2K2), (P2K3), (P3K2) and (P3K3) in comparison with both N2 and N3 treatments with P1, K1 or both of them. Plant analysis revealed that low concentrations of N, P or K in the 4th leaf were proportional to low vegetative growth parameters and total yields.

Keywords:
Cucumis sativus; nitrogen, potassium; phosphorus nutrient dose; nutrient interaction; plant analysis; soilless culture.

ACKNOWLEDGEMENT

My heartfull thanks and gratefulness are extended to **Prof. Dr.Ayman Farid Abou-Hadid.,** Professor of Vegetable Crops, Faculty of Agriculture, Ain Shams University for his supervision, kind help, follow up and valuable constructive ideas.

Great thanks are expressed to **Dr**. **Essam Mohamed Abd El Moneim** Associated Professor of Soil Department, Faculty of Agriculture, and Ain Shams University for his constructive supervision and valuable helping throughout this study.

Deepest and sincere gratitude and appreciation to **Dr. Mohamoud Abdalla Medany,** Senior Researcher, Central Laboratory for Agricultural Climate, for his kind help, constructive supervision and encouragement.

My deep thanks are also extended to the Central Laboratory for Agriculture Climate (CLAC), Agriculture Research Center beside the staff of the Agriculture Laboratory for Arid Land Research Unit (ALARU) for the facilities granted during this work.

My heartfull thanks and sincere appreciation to **my parents** for their helpful support and encouragement allover my life.

CONTENTS

LIST OF FIGURES

LIST OF TABLES

1- INTRODUCTION

Addition of required nutrients with the irrigation water (fertigation) not only insured adequate and even distribution of plant nutrients within the active root growth zone, but also was the easiest way to manage in controlled environment greenhouse. Type and rates of fertilizers to be used for vegetable crops grown under greenhouse conditions is still a controversy **(Schwarz and Klaring, 2002)**.

Cucumber is one of the major vegetable crops grown in Egypt under plastic house conditions. The total number of plastic houses in Egypt was estimated to be 22 thousands units of 540 m^2 each, according to 2003 statistics; 13, thousands of them were devoted to cucumber in the autumn season, representing about 60% **(Egyptian Ministry of Agriculture, 2004).**

Inappropriate nutrient formulations and management may lead to nutrient imbalances, physiological disorders, and low growth rates in soilless culture. Many nutrient formula have been recommended for cucumber to improve yield and product quality, but no information is available on the optimal composition and concentration of nutrients for cucumber plants under plastic culture based on plant analysis **(Resh, 1997)**.

Through decades of research, sufficiency guidelines have been developed for most important vegetable crops. Evaluations of this standard with drip irrigation and fertigation still have not been conducted. With the increase in use of fertigation with drip irrigation vegetable production under greenhouse, there is a need to develop sufficiency range for leaf testing for fertigated plant **(Studstill *et al.*, 2003)**. Tissue mineral analyses frequently are used as basis for determining crop fertilization requirements and often correlated with yield. Tissue mineral concentration is not always related directly to mineral uptake; factors such as ion antagonism and dilution due to greater growth and yield must be considered **(Fageria, 2001)**.