THE EFFECT OF IRRIGATION FREQUENCY AND RATES ON GREEN BEAN UNDER TRICKLE IRRIGATION IN CLAY LOAM SOIL

By

SALMA MOHAMED HAFEZ

B.Sc. Agric. Sci. (Agricultural Engineering), Fac. Agric., Cairo Univ., 2011

THESIS

Submitted in Partial Fulfilment of the Requirements for the Degree of

MASTER OF SCIENCE

In

Agricultural Sciences

(Agricultural Engineering)

Department of Agricultural Engineering
Faculty of Agriculture
Cairo University
EGYPT

2016

APPROVAL SHEET

THE EFFECT OF IRRIGATION FREQUENCY AND RATES ON GREEN BEAN UNDER TRICKLE IRRIGATION IN CLAY LOAM SOIL

M.Sc. Thesis
In
Agric. Sci. (Agricultural Engineering)

By

SALMA MOHAMED HAFEZ
B.Sc. Agric. Sci. (Agricultural Engineering), Fac. Agric., Cairo Univ., 2011

APPROVAL COMMITTEE

Dr. MAHMOUD MOHAMED HEGAZI ……
Professor of Agric. Eng., Fac. of Agric., Ain Shams University.

Dr. MOHAMED ABD ELWAHAB KASSEM……
Professor of Agric. Eng., Fac. of Agric., Cairo University.

Dr. MOHAMED MOHAMED SHAHIEN……
Professor of Vegetable - Faculty of Agric. Cairo University.

Dr. MOHAMED EL-SAYED ABUARAB ……
Associate Professor of Agric. Eng., Fac. of Agric. Cairo University.

Date: / /

SUPERVISION SHEET

THE EFFECT OF IRRIGATION FREQUENCY AND RATES ON GREEN BEAN UNDER TRICKLE IRRIGATION IN CLAY LOAM SOIL

M.Sc. Thesis
In
Agricultural Sci. (Agricultural Engineering)

By

SALMA MOHAMED HAFEZ
B.Sc. Agric. Sci. (Agricultural Engineering), Fac. Agric., Cairo Univ., 2011

SUPERVISION COMMITTEE

Dr. ABDALLAH El-AMIN BADR (Late)
Professor of Agricultural Engineering, Fac. Agric., Cairo University

Dr. MOHAMED EL-SAYED ABUARAB
Associate Professor of Agricultural Engineering, Fac. Agric., Cairo University

Dr. MOHAMED MOHAMED SHAHEEN
Professor of Vegetable, Fac. Agric., Cairo University

DEDICATION

First of all, I would like to express my deepest thanks to ALLAH (God) for helping me to carry out and complete this work.

I dedicate this work to whom my heartfelt thanks, my husband for their patience and help, as well as to my parents and sisters for all the support they lovely offered along the period of my post graduation.

AKNOWLEDGEMENT

First of all thanks, from my deep heart I would like to express my thanks to ***ALLAH*** *who made me able to accomplish this work and helped me, all persons who helped me in any way making their ways always successful and fruitful.*

I wish to express my gratitude and appreciation to ***Dr. Abdallah El-Amin Badr,*** *Professor of Agricultural Engineering, Faculty of Agriculture, Cairo University, for his great help, continuous encouragement, guidance and enormous contribution in preparing this thesis*

Also, I wish to express my deep thanks for ***Dr. Mohamed El-Sayed Abuarab,*** *Associate Professor of Agricultural Engineering, Faculty of Agriculture, Cairo University for his sincere guidance, valuable advice and stimulating supervision during the course of development of the thesis.*

I wish to express my appreciation, and grateful to ***Dr. Mohamed Mohamed Shahien,*** *Professor of Vegetable Faculty of Agriculture, Cairo University, for his effort, advice and numerous discussion, guidance, sincere deep help and encouragement during of this work, who supported and sustained me in build this work. Thanks for him, for considering me as his younger sister.*

I am sincerely thankful to the friendly professional help of all the stuff of Agricultural Engineering Department, Faculty of Agriculture, Cairo University.

Name of Candidate: Salma Mohamed Hafez **Degree:** M.Sc.
Title of Thesis: The Effect of Irrigation Frequency and Rates on Green Bean Under Trickle Irrigation in Clay Loam Soil
Supervisors: Dr. Abdallah El-Amin Badr (late)
Dr. Mohamed El-Sayed Abuarab,
Dr. Mohamed Mohamed Shahein
Department: Agricultural Engineering
Branch: Soil and Water Engineering
Approval: 21 / 6 / 2016

ABSTRACT

This study was conducted over 2 years (2013 and 2014) to establish the optimal combinations between irrigation frequency and rate for trickle irrigated green bean using water production functions and water use-yield relationships. A field experiment was conducted using a randomized complete block design with three irrigation frequencies (F_1, F_2 and F_3, irrigation events once every 1, 2 and 3 days, respectively) and three trickle irrigation rates (I_1: 1.00, I_2: 0.80, and I_3: 0.60 of the estimated crop evapotranspiration, ET_C). Our results showed that yield and WUE increased with increasing irrigation frequency. Seasonal crop ETc of green bean varied from 163 mm in F_1I_3 to 327 mm in F_3I_1 treatments on 2013 and from 164 mm in F_1I_3 to 328.72 mm in F_3I_1 treatments on 2014. The maximum and minimum yield of 12030 and 4879 kg ha^{-1} were obtained in F_1I_2 and F_3I_3, respectively, in 2013, while in 2014, similar to the previous year, maximum and minimum yield were obtained from F_1I_2 and F_3I_3 as 12364 and 4678 kg ha^{-1}, respectively. WUE ranged from 5.65 kg m^{-3} in F_1I_2 to 2.38 kg m^{-3} in F_3I_3. Seasonal yield response factors (ky) were 0.845 and 0.856 in 2013 and 2014, respectively. Production functions of yield versus seasonal crop ETc were power for all combinations of irrigation frequency and rate for both growing seasons. The relationship between WUE and yield was best represented by a power equation. In conclusion, F_1I_2 irrigation treatment is recommended for field grown green bean in order to achieve higher yield and WUE.

Key Words: Irrigation frequency, Irrigation rate, Trickle irrigation, Green bean yield, Water use efficiency.

CONTENTS