THE EFFECT OF SOME ENGINEERING FACTORS ON FLEXIBLE SPRINKLER IRRIGATION SYSTEMS PERFORMANCE

By

ENGY MOSLAME MOHAMED KHAIR

B.Sc. Agric. Eng. (Agricultural Engineering), Ain Shams University, 2011

A thesis submitted in partial fulfillment
of
the requirements for the degree of

MASTER OF SCIENCE

In

AGRICULTURAL SCIENCE
(On Farm Irrigation and Drainage Engineering)

Department of Agricultural Engineering
Faculty of Agriculture
Ain Shams University

2015

Approval Sheet

THE EFFECT OF SOME ENGINEERING FACTORS ON FLEXIBLE SPRINKLER IRRIGATION SYSTEMS PERFORMANCE

By

ENGY MOSLAME MOHAMED KHAIR

B.Sc. Agric. Eng. (Agricultural Engineering), Ain Shams University, 2011

This thesis for the M. Sc. Degree has been approved by:

Dr. El-Saied Mohamed khalifa ...……

Professor of Agricultural Engineering, Faculty of Agriculture, Kafr El- Sheikh University.

Dr. Mahmoud Mohamed Hegazi ...……

Emeritus Professor of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Khaled Faran Taher El-Bagoury ……..

Associate Professor of Agriculture Engineering, Faculty of Agriculture, Ain Shams University (supervisor).

Dr. Abdel -Ghany Mohamed El-Gindy ……

Emeritus Professor of Agricultural Engineering, Faculty of Agriculture, Ain Shams University (Principal Supervisor).

Date of Examination: 23 / 5 / 2015

THE EFFECT OF SOME ENGINEERING FACTORS ON FLEXIBLE SPRINKLER IRRIGATION SYSTEMS PERFORMANCE

By

ENGY MOSLAME MOHAMED KHAIR

B.Sc. Agric. Eng. (Agricultural Engineering), Ain Shams University, 2011

Under the supervising of:

Dr. Abdel-Ghany Mohamed El-Gindy
Emeritus Professor of Agricultural Engineering, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University. (Principle Supervisor)

Dr. Khalid Faran Taher El-Bagoury
Associate Professor of Agricultural Engineering, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University.

Dr. Wael Mahmoud Sultan
Senior Researcher at Agricultural Engineering Research Institute **AEnRI**.

ABSTRACT

Engy Moslame Mohamed Khair: The Effect of Some Engineering Factors on Flexible Sprinkler Irrigation Systems Performance. Unpublished M. Sc. Thesis, Department of Agricultural Engineering, Faculty of Agriculture, Ain Shams University, 2015.

The engineering factors are necessary to improve sprinkler system efficiency. So, with studying the effect of operating pressure, nozzle diameter and riser height on sprinkler performance such as precipitation rates, distribution uniformity, and coefficient uniformity. This study will be focused in Floppy sprinkler irrigation system comparing with Rotating (pop-up) and Impact sprinklers performance. It has been carried out at the National Irrigation Lab. for on-farm Irrigation Equipment Test in Agricultural Engineering Research Institute. The result indicated to: the floppy sprinkler is the highest precipitation rate. Where under operating pressure 2 bar Precipitation Rates were (9.3, 9.14 and 7.65mm/h), The flow rates were (748.8, 660 and 666 lph), wetted radius (7, 7.2 and 9 m), Coefficient Uniformity "% " were (53.45, 68.7 and 54.9%) and when using overlap simulationby Excel, the sprinklers achieve at operating pressure (2bar) and 100% overlap 78.05, 81.04 and 57.6% for Floppy, Rotating (pop-up) and Impact sprinklers respectively. From **Private Farm** result, if we applied the Floppy sprinkler system, the operating structure would be as follow: with 72% overlap the system achieved DU% 70.6% (from ASAE it's good design). **At the AEnRI** , The result indicated to the less soil compaction caused from Floppy sprinkler 0.27g/cm^3 under 2 m height, unlike Impact sprinkler caused soil compaction under 1 m height (0.55 g/cm^3). This study can be useful to identify the operational condition like operating Pressure and sprinkler

irrigation system design so using floppy sprinkler is the more efficient flexible sprinkler irrigation system under telescopic riser 2 m height and under operating Pressure 2 bar.

Key words: Sprinkler Irrigation system, Floppy sprinkler, Impact sprinkler, Rotating sprinkler (pop-up).

ACKNOWLEDGMENT

Thanks to **Allah** for his gracious kindness in all the endeavors that the author has taken in her life.

The author wishes to express gratitude and most appreciation to her advisor **Prof. Dr. Abdel -Ghany El-Gindy**, Emeritus Prof. of Agric. Eng., Ain shams Univ. for valuable advice and encouragement.

The author also wishes to thank **Dr. Khalid Faran** Associate Professor of Agric. Eng., Ain shams Univ. for supervising my work.

With sincere appreciation due to **Dr. Wael Sultan**, Senior Researcher for Agricultural Engineering Research Institute for his constant help and advice.

Thanks a lot to **Dr. Mustafa Mahmoud**, Senior Researcher for Agricultural Engineering Research Institute for his great effort throughout this work.

Thanks a lot to **Proff. Dr. Hegazi**, Emeritus Prof. of Agric. Eng., for valuable advice at this work

Thanks a lot to **Proff. Dr. Khalifa** Emeritus Prof. of Agric. Eng., for valuable advice at this work

Thanks are expressed to the owners of **Abo-salah farm**, for their co-operation during carried out this work.

The author wishes to express her deepest appreciation to **her family** for their understanding, patient, loving encouragement and co-operation during carried out this work.

Finally, special thanks to all staff of the National Irrigation Lab for on-farm Irrigation Equipment Test in Agricultural Engineering Research Institute, for their valuable help in this work.

CONTENTS

LIST OF TABLE

LIST OF FIGURES

LIST OF APPENDICES

1-INTRODUCTION

The sprinkler irrigation system simulates the natural falling rain. The major problem in Egypt is low water management, which effect on sprinklers performance beside water use efficiency. The sprinkler irrigation system is less efficient so we should improve its performance to integrated water management. This indicated to take high crop yield and not to waste water at Evapo-transportation rate or deep percolation and increasing the reclaimed lands.

El-Gindy (2007) reported that, water considered the iterance to agriculture development. Egypt is in arid region due to decrease the rainfall under 400 mm/year. The new irrigation methods have more management in irrigation water with using sprinkler systems and localized systems which used to decrease drainage, improve soil water contents, decrease ground water level and increase crop production. **Hegazi and El-Gindy (2007),** mentioned that**,** the pressure and orifice diameter effect at flow rate and wetted diameter and wetted efficiency**. Hunter (2012),** Water pressure in an irrigation system will affect the performance of the sprinklers. If the system is designed correctly, there will be enough pressure throughout the system for all sprinklers to operate properly. **Rain bird (2004),** stated that, we have found that conditions which most often interfere with the proper operation of impact sprinklers are low water pressure, foreign materials in the irrigation water, and excessive damage or wear to sprinkler parts. Any one or a combination of these actors can cause the sprinkler to stop rotating completely or rotate to one side and fail to return. **BREYTENBACH A. (2012),** mention that, the flow of water secured by the flow controller warrants a constant flow of water moving through the silicone tube to cut the stream of water into even medium-sized droplets similar to rain, ensuring a very high efficiency with minimum evaporation loss, due to little or no mist formation**.**

The main objectives of this study were:

- Recommended by appropriate operating conditions for Floppy Sprinkler.
- Violation of Floppy software.
- Comparison between the performance of Impact Sprinkler, Rotating (pop-up) Sprinkle and flexible Sprinkler.
- Studying the effect of difference riser height at soil Profile under many kinds of sprinkler.
- Evaluating sprinklers performance at different riser height under different sprinkler.