UNIVERSITI PUTRA MALAYSIA

WATER MANAGEMENT OPTIMIZATION MODEL FOR THE RAZMGAN AGRICULTURAL DISTRICT IN KHORASAN PROVINCE, IRAN

SEYED MAHDI FATEMI

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By

SEYED MAHDI FATEMI

Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia, in Fulfilment of the Requirements for the Degree of Master of Science

April 2011

Dedicated to

My kindly wife

For her supports and her encouragements

My lovely son, Morteza

My kind-hearted mother and my patient father

And

My family

Abstract of thesis presented to the Senate of University Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Chairman: **Associate Professor Thamer Ahmad Mohammad Ali, PhD**

Faculty: **Engineering**

Water deficit in the dry season of semi-arid regions, (especially in low scale farms and established orchards) results in a significant decrease in agricultural productivity. This problem can be overcome by optimal operation of reservoir based on prioritization of water allocation for crops considering the sensitive growth periods. In this study, a non-linear optimization model is employed to reduce the impact of water deficit in order to increase crop productivity and net income for farmers. The LINGO 8.0 software was used to determine the optimal amounts of both water and land for the existing cropping pattern. The LINGO model was applied to the Razmgan semi-arid area which is located 10 km south of the Shirvan city, northern Khorasan province, Iran, where irrigation needs are supplied from the river and the existing auxiliary reservoir stores the surplus water in the wet season in order to reduce the impact of water deficit in the dry season. Inefficient current water management, especially, in operation of the existing auxiliary

reservoir and non optimal water allocation for crops growth periods result in a low actual yield for crops in the study area. To determine the optimal operation of the reservoir, various scenarios of the water release from the reservoir, to reduce the imposed water-stress during the crop growth stages were explored. Results of the LINGO model showed application of scenario 4 results in the maximum annual net income for the farmers (USD 1,778,298), which shows 26.21% increase than the current status (USD 1,409,030). Also application of the scenario 4 overcomes the existing water deficits in the months of July, August, September, October and November, only 13% and 42.16% water deficits remain for the months of May and June, respectively, and water consumption decreases from 3,359,000 m^3 in the current status to 2,999,369 m^3 in the optimal status. Monthly irrigation scheduling to achieve the maximum net income was derived from the output of the model for use by the farmers. Application of the LINGO model for irrigated area subjected to the water deficit and low agricultural productivity helps to increase the current net income of the farmers.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

MODEL PENGURUSAN AIR UNTUK KAWASAN PERTANIAN RAZMGAN DI PENGOPTIMUMAN WILAYAH TIMUR LAUT KHORASAN IRAN

Oleh

SEYED MAHDI FATEMI

April 2011

Pengerusi: **Profesor Madya Thamer Ahmad Mohammad Ali, PhD**

Fakulti: **Kejuruteraan**

Defisit air pada musim kemarau daerah separa lembab (terutama bagi pekebun kecil dan kawasan penyemaian benih), signifikan dengan berkurangan produktiviti pertanian. Masalah ini dapat diatasi dengan pengurusan agihan air daripada kawasan tadahan simpanan air yang optimum mengikut keutamaan penanaman dan mengambil kira masa pertumbuhan sensitif bagi tanaman. Dalam kajian ini, model pengoptimuman non-linier digunakan untuk mengurangkan kesan defisit air untuk meningkatkan produktiviti tanaman dan pendapatan bersih petani. Model LINGO 8.0 diaplikasikan pada daerah separa lembab Razmgan yang terletak 10 km sebelah selatan kota Shirvan, utara Khorasan, Iran, kawasan ini memerlukan pengairan yang boleh didapati daripada sungai dan kawasan simpanan tadahan air pada musim hujan, ini dapat mengurangkan defisit air di musim kemarau. Pengurusan air yang kurang cekap, terutama, dalam pengoperasian air simpanan tadahan dan peruntukan air yang tidak mencukupi semasa

tempoh pertumbuhan tanaman akan menjadikan hasil yang lebih rendah daripada sepatutya bagi daerah kajian. Untuk menentukan operasi yang opitimal dari kawasan simpanan tadahan air, pelbagai senario pengaliran air dari tadahan itu boleh dilakukan , sebagai cara membekalkan air yang hanya mencukupi untuk tahap-tahap pertumbuhan tanaman. Hasil kajian menunjukan model LINGO menunjukkan aplikasi dari senario itu 4 perkara yang menjadikan maksimun pendapatan tahunan peladang (USD 1,778,298) ini menunjukkan pertambahan 26.21% bagi pendapatan semasa (USD 1,409,030) selain itu aplikasi daripada senario itu juga 4 perkara menyebabkan defisit air yang ada dalam bulan Julai, Ogos, September, Oktober dan November dapat diatasi, hanya 13% dan 42.16 % kekal untuk bulan Mei dan Jun, dan penurunan konsumsi air dari 3.359.000 m^3 dalam status semasa kepada 2,999,369 m^3 dalam status optimal. penjadualan pengairan bulanan untuk mencapai keuntungan bersih yang maksimum diperolehi daripada model yang digunakan oleh petani. Penggunaan model LINGO bagi bagi pengairan sehubung dengan defisit air dan kurangnya produktiviti pertanian dapat membantu pertambahan pendapatan semasa bagi petani.

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This study can not be completed without the blessing and strength that the God give to me, so my thanks to God for this achievement.

Seyed Mahdi Fatemi

April. 2011

I certify that a Thesis Examination Committee has met on April 2011 to conduct the final examination of Seyed Mahdi Fatemi on his Master of Science thesis entitled "Water Management Optimization Model For The Razmgan Agricultural District In Khorasan Province, Iran" in accordance with the Universities and University Colleges Act 1971 and the Constitution of the Universiti Putra Malaysia [P.U.(A) 106] 15 March 1998. The Committee recommends that the student be awarded the relevant degree.

Members of the Thesis Examination Committee were as follows:

Chairman:

Assoc. Prof. Dr. Ahmad Rodzi b. Mahmud

External Examiner:

Profesor Dr. Salim Said

1nd Internal Examiner:

Profesor Ir. Dr. Lee Teang Shui

2rd Internal Examiner:

Assoc. Prof. Dr. Abdul Halim Ghazali

_____

SHAMSUDDIN SULAIMAN, PhD
Professor and Deputy Dean
School of Graduate Studies
Universiti Putra Malaysia

Date:

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

Thamer Ahmad Mohammad, PhD

Associate Professor

Faculty of Engineering

Universiti Putra Malaysia

(Chairman)

Mohd Amin Mohd Soom, PhD

Professor

Faculty of Engineering

Universiti Putra Malaysia

(Member)

_____

HASANAH MOHD. GHAZALI, PhD

Professor and Dean

School of Graduate Studies

Universiti Putra Malaysia

Date: ---- 2011

DECLARATION

I declare that the thesis is my original work except for quotations and citations which have been duly acknowledged. I also declare that it has not been previously, or is not concurrently, submitted for any other degree at University Putra Malaysia or at any other institution.

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SEYED MAHDI FATEMI

Date : 7 April 2011

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