Saltmed Model in Sustainable Irrigation Management in Saudi Arabia

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Introduction

To save water in Saudi Arabia, both farmers and governmental agencies started changing irrigation strategies by using surface and subsurface drip irrigation. This could save irrigation water while maintaining a satisfactory production level (Al-Omran et al., 2010, 2012; Costa et al., 2007). Important methods to save irrigation water and increase crop water productivity (CWP) are regulated deficit irrigation (RDI).

Regulated Deficit Irrigation System, RDI

RDI is a method of water conservation where the crops are deliberately exposed to some degree of deficit irrigation through all or certain growth stages and defined as an optimization strategy in which irrigation is applied during non-drought-sensitive growth stages of a crop.

SALTMED model

Investigations of the salinity and moisture distribution under RDI and PRD for a wide range of water salinities, irrigation strategies, few models adopt irrigation management as an integrated approach that accounts for water, crop, soil, and field management, e.g.: 1. infiltration models; 2. root water uptake models; 3. water and solute transport models and 4. specific application models.

SALTMED Model Application

Because the Saltmed model was successful under different climatic conditions, irrigation water qualities and types in different places throughout the world, there is substantial benefit in testing the latest version of the model in Saudi Arabia's arid conditions. This model can help not only in irrigation scheduling, estimating crop water requirements and irrigation water conservation but can also be used to predict yields and soil salinization.

Purpose

1.Evaluate moisture and salt distribution at different depths under surface drip irrigation with deficit irrigation treatment.

2.Predict soil water content and salt distribution and its impact on yield at different irrigation water quality using SALTMED Model.

Methods

Field experiment was carried out during the two season (2012- 2013) at green house complex of Almohous Farm, Thadiq Governorate, 120 km northwest of Riyadh Saudi Arabia

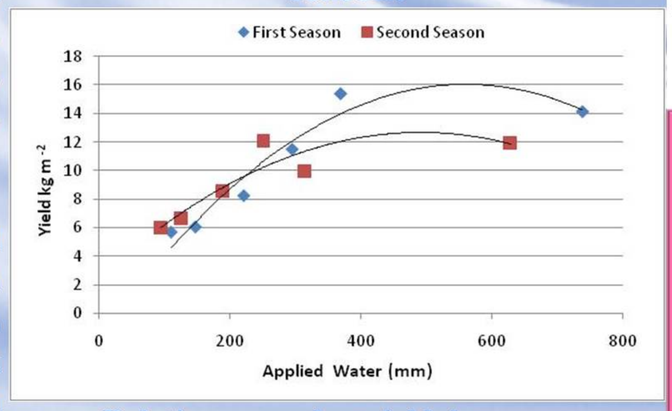
Table (1) Treatment of the Experiment

Treatment	Initial St.	Develop. St	Mid St.	Late. St.	Description
T_1-100	1	1	1	1	Full irrigation During the season (100% of ETc).
T_2-80-0	1	1	1	1	80% of ETc irrigation during the season has given.
T_3-60-0	1	1	1	1	60% of ETc irrigation during the season.
T_4-40	1	1	1	1	40% of ETc irrigation during the season has given.
T_5-30	1	1	1	1	30% of ETc irrigation during the season has given.
T_6-Trad	Traditional Irrigation				just counting irrigation water from a local traditional irrigation system by a

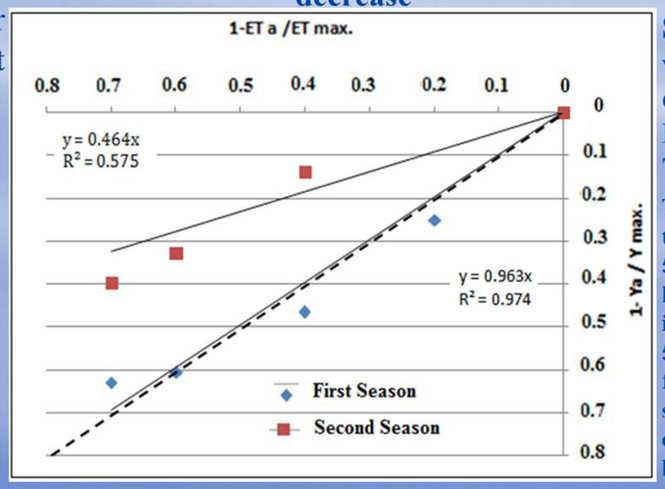
Table 2. Chemical properties of irrigation water.

EC (dS/m)	pH	Cation and anion concentration (meq/L)								SAR	Trace elements (mg/L)		
		Ca	Mg	Na	K	CO_3	HCO_3	Cl	SO_4		Fe	B	NO_3
1.43	7.1	4.2	2.4	7.3	0.13	0.0	2.0	7.2	5.0	4.1	0.20	0.81	7.0

The Relationship between marketable total cucumber yield and applied water at different seasons

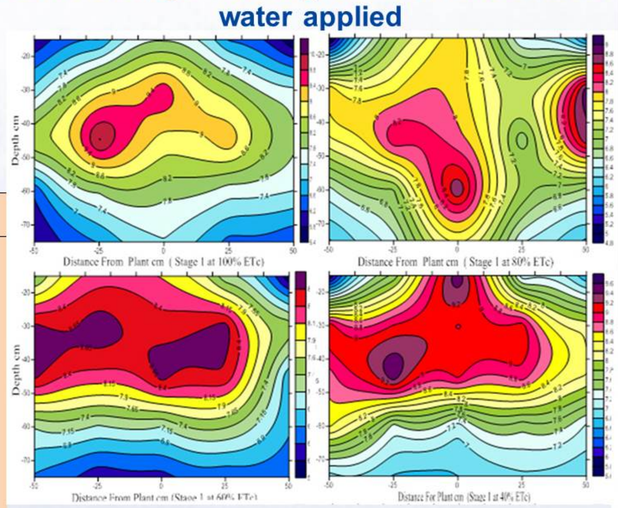


Relative cucumber yield decrease as function of relative evapotranspiration decrease



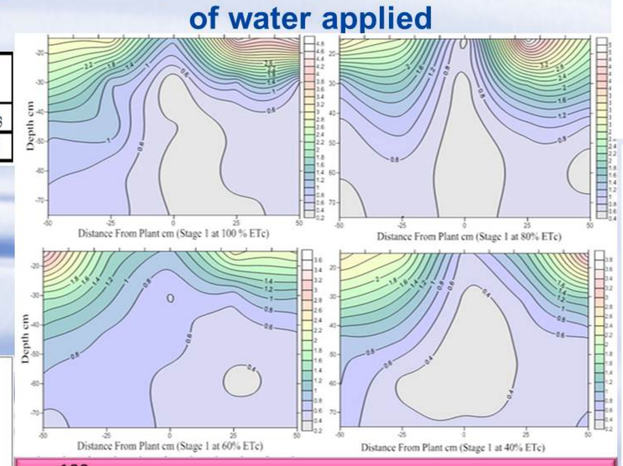
Soil Moisture Distribution Pattern in Soil Profile

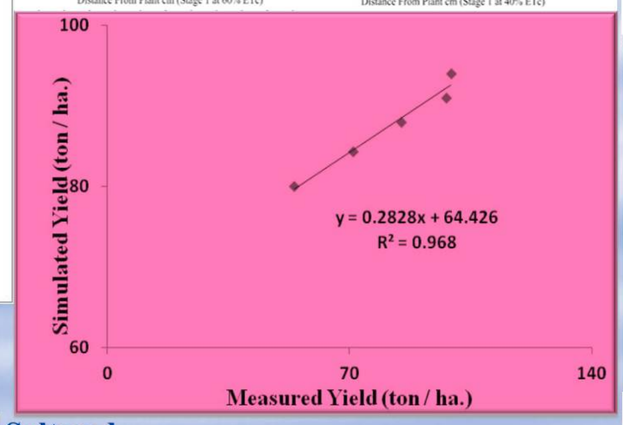
SMC at stage 1 during different amounts of water applied



Pattern of Salt Distribution:

SD at stage 1 during different amounts of water applied





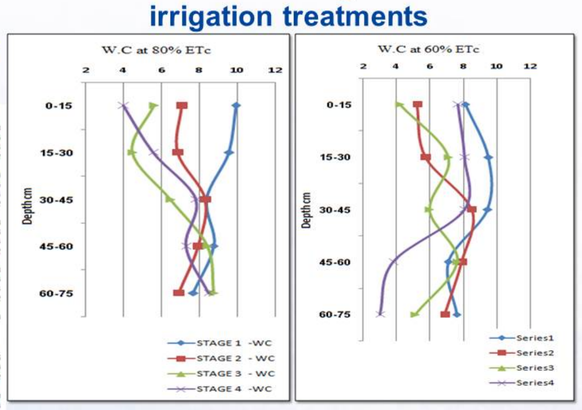
Saltmed

validation was carried out using the irrigation deficit treatments (80%, 60%, 40%, and 30% Etc)

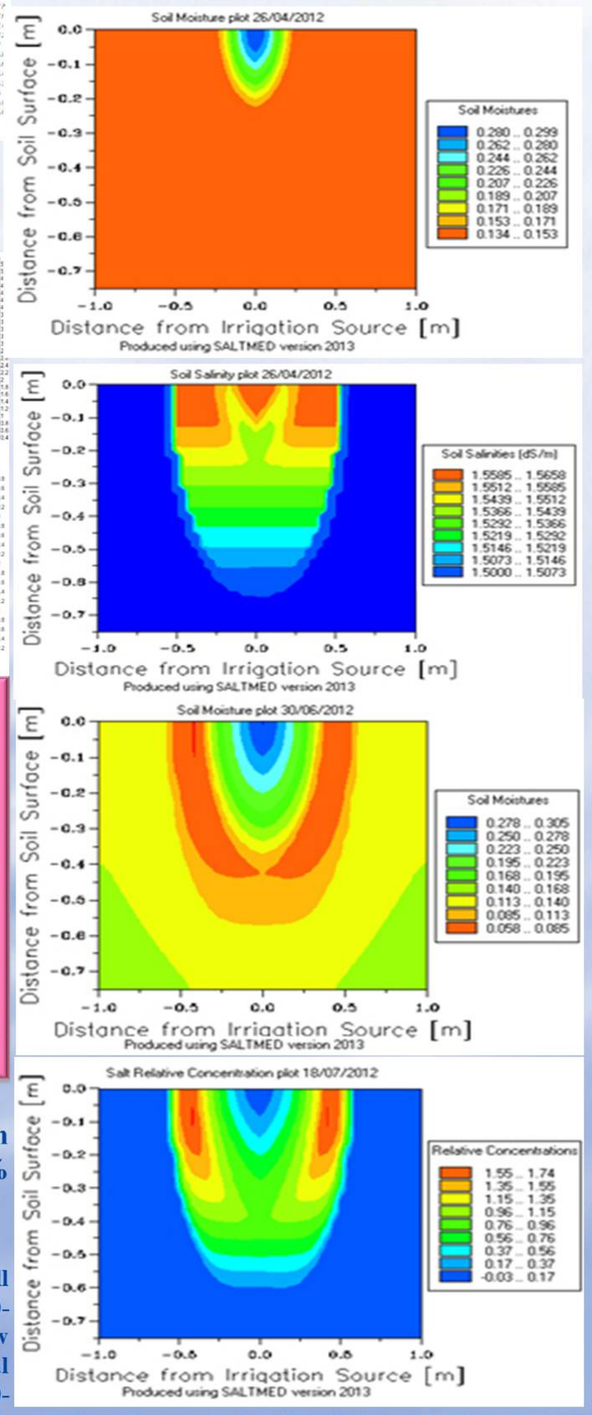
The data indicate

That water distribution show specific pattern in all treatment during first stage. SMC was high at depth 30-50cm.The treatment of traditional irrigation practice show high value of SMC at all depth, the SMC of traditional irrigation practice treatment was 10-12% at depth 30-50cm, with a minimum of 8.5% at soil surface. Generally for all other treatment SMC were low about 6-7% on the surface and increased gradually with a depth without clear distribution trend 9-10%,then was not clear different between of 100, 80, 60 ETc.

water content throughout deficit irrigation treatments



Model Calibration and Validation



soil moisture and soil salinity and salt relative concentration plots and soil, salt distribution vertical and horizontal and crop yield during stage one predicated by SALTMMED program.