Economic and Environmental Evaluation of Different Irrigation Systems for Date Palm Production in the GCC Countries: The case of Oman and Saudi Arabia

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Plan

- Introduction
- Date Palm Irrigation Systems
- Subsurface Drip Irrigation
- Research Problems
- Research Objectives
- Experimental Research Design Framework
- Methodology
- Empirical Research Findings
- Concluding Remarks and Policy Recommendations

Introduction

- Date palm production is a strategic sector in the GCC countries,
- Development of sustainable date palm production systems,
- Improve date palm productivity per unit of water,
- Rationalize the available resources.

Date Palm Irrigation Systems

Oman

Traditional irrigation system

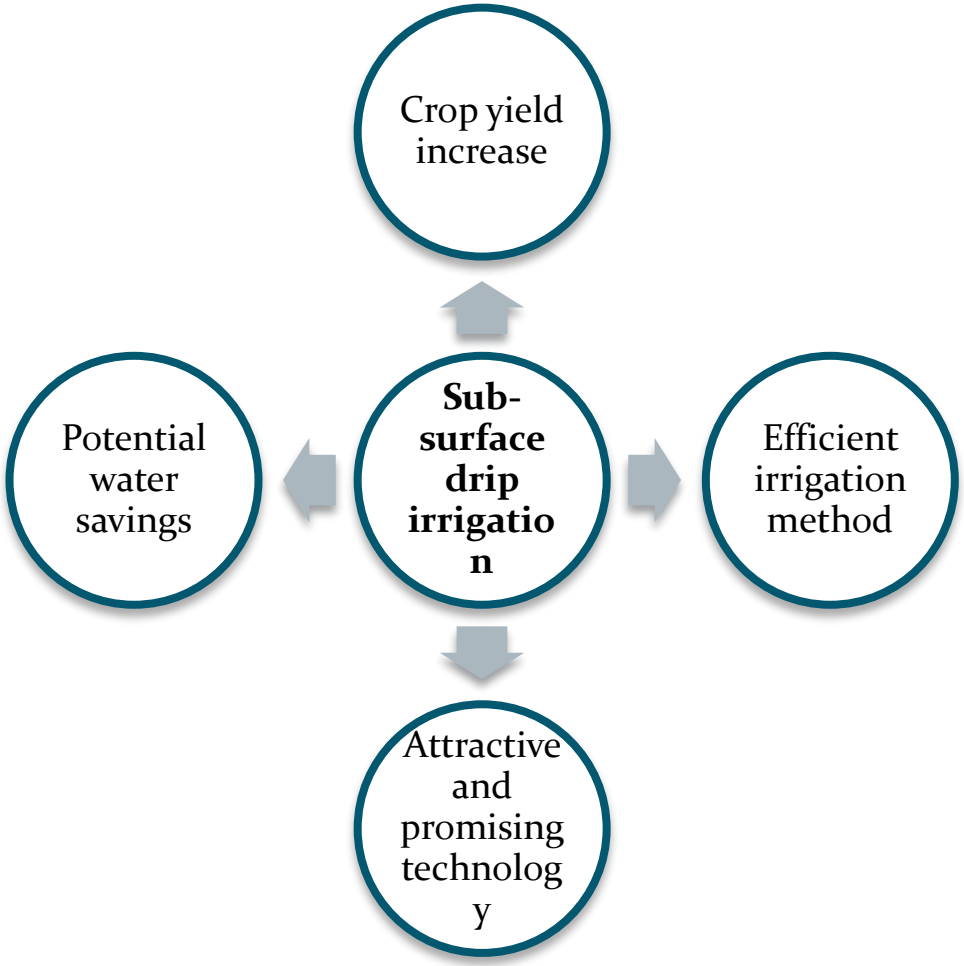
Underground aquifers: wells / Falaj

KSA

Scarcity of surface water resources

Groundwater resources overexploited

Subsurface Drip Irrigation - Facts



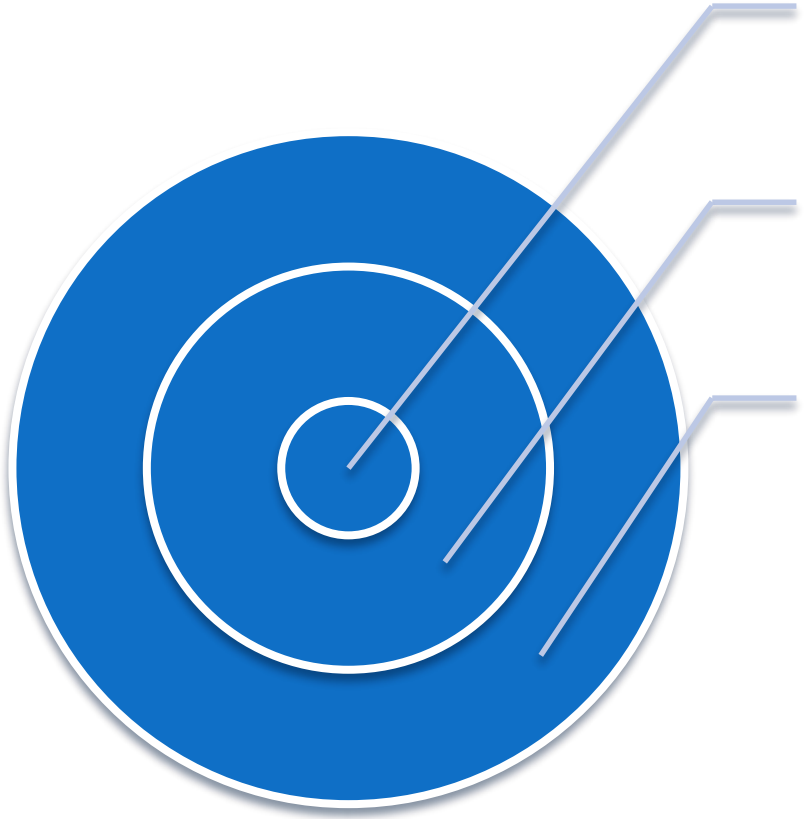
Research Problems

Water scarcity in the GCC

Water application strategies

Maximized yield and reduced water loss

Research Objectives



To evaluate the irrigation water volumes' effect on the date palm productivity and water use efficiency under several conventional and improved irrigation systems

To investigate economically and environmentally the effectiveness of this introduced irrigation system

To compare this irrigation system (SDI) to several conventional irrigation systems used in the GCC countries

Experimental Research Design Framework: Oman

Intervention I	• Irrigation with bubbler irrigation system at the rate of 100% of water requirements
Intervention II	• Irrigation with subsurface drip irrigation at the rate of 60% of water requirements
Intervention III	• Irrigation with subsurface drip irrigation at the rate of 40% of water requirements
Intervention IV	• Irrigation with subsurface drip irrigation at the rate of 20% of water requirements

Experimental Research Design Framework: KSA

Intervention I

- Irrigation with surface drip irrigation (DI)

Intervention II

- Irrigation with sub surface drip irrigation (SDI)

Methodology

- Estimation of Water use efficiency (WUE):

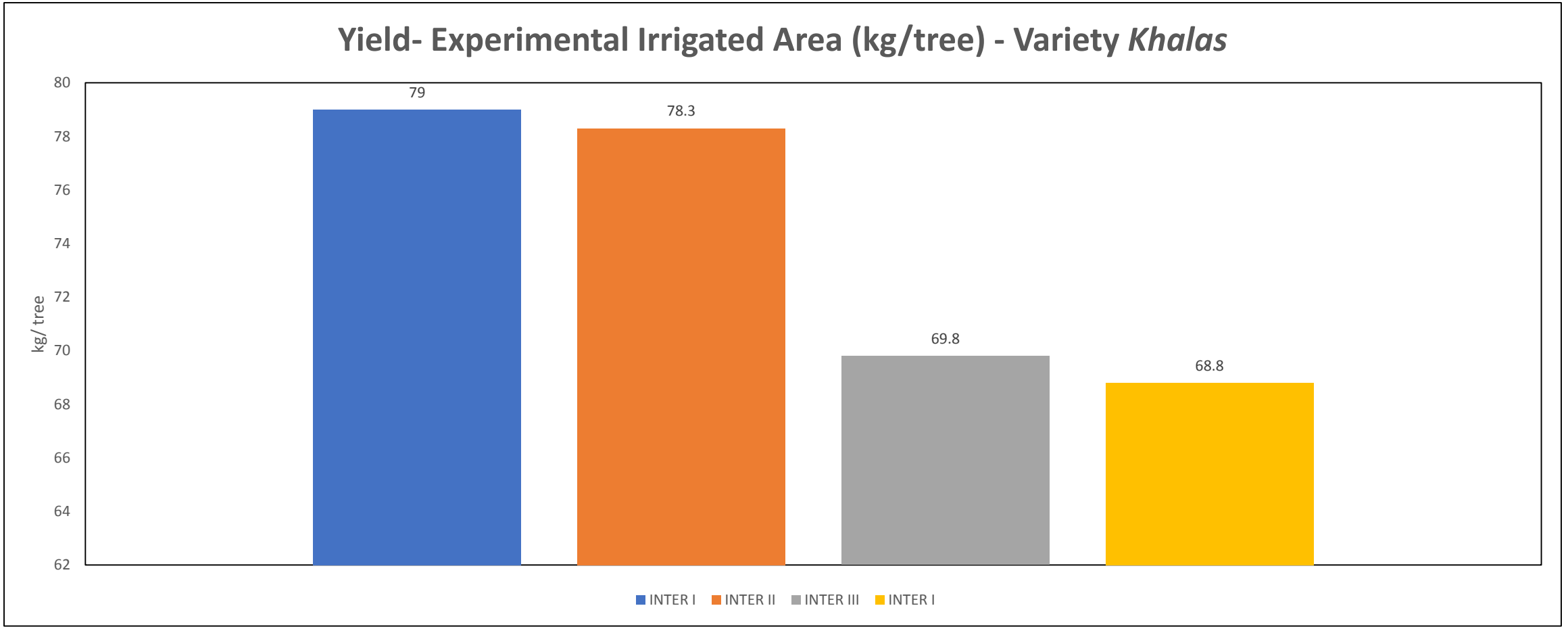
$$WUE = Y/W$$

  - WUE is water use efficiency (kg/m3),
  - Y is the total marketable date palm yield (kg), and
  - W is seasonal irrigation applied water (m3).

- Economic comparison between both irrigation systems using a partial budgeting method (PBA)
- ANOVA procedure from the statistical analysis software (SPSS) is used
- To compare treatment means, Fisher's protected least significant difference (LSD) was used for ($p \leq 0.05$) significant level.

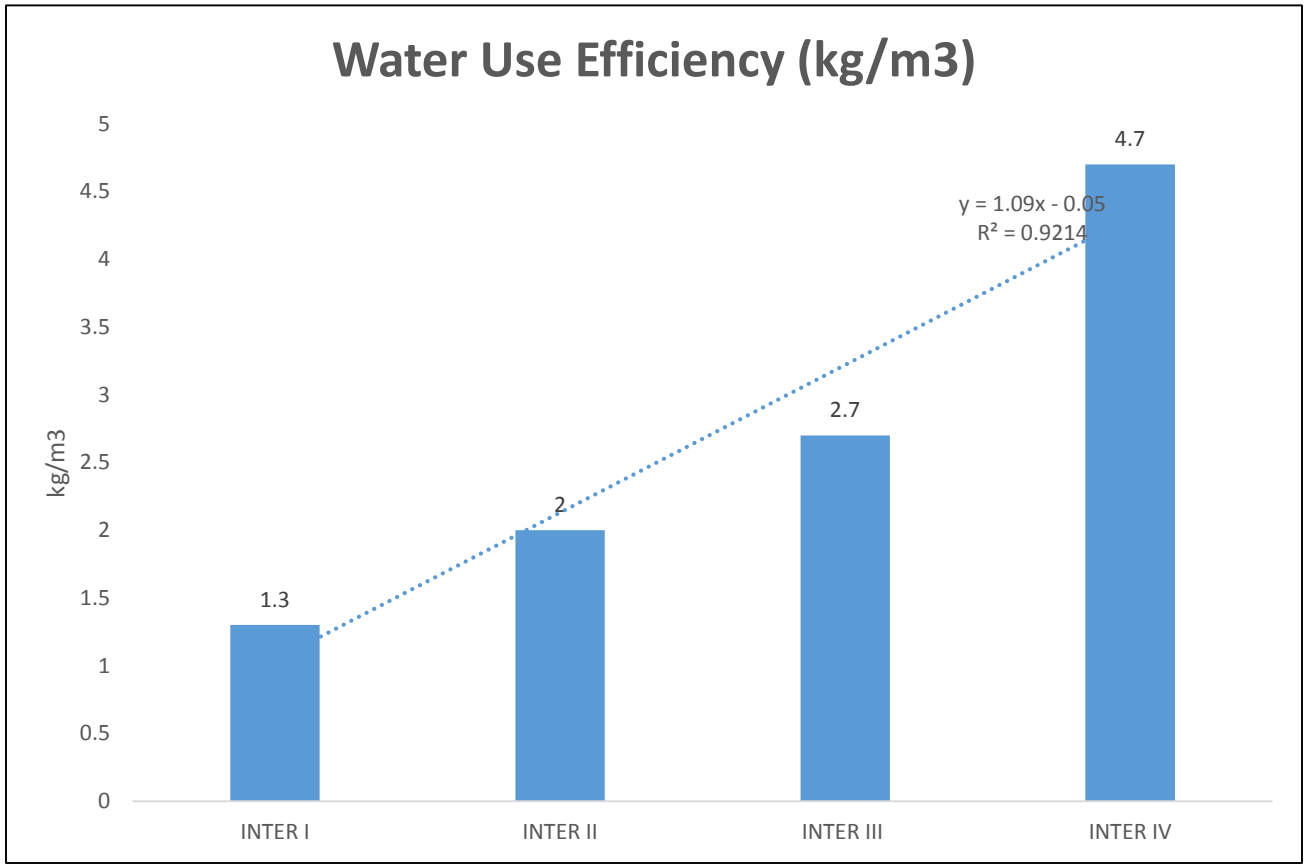
Empirical Research Findings
“Case of Oman”

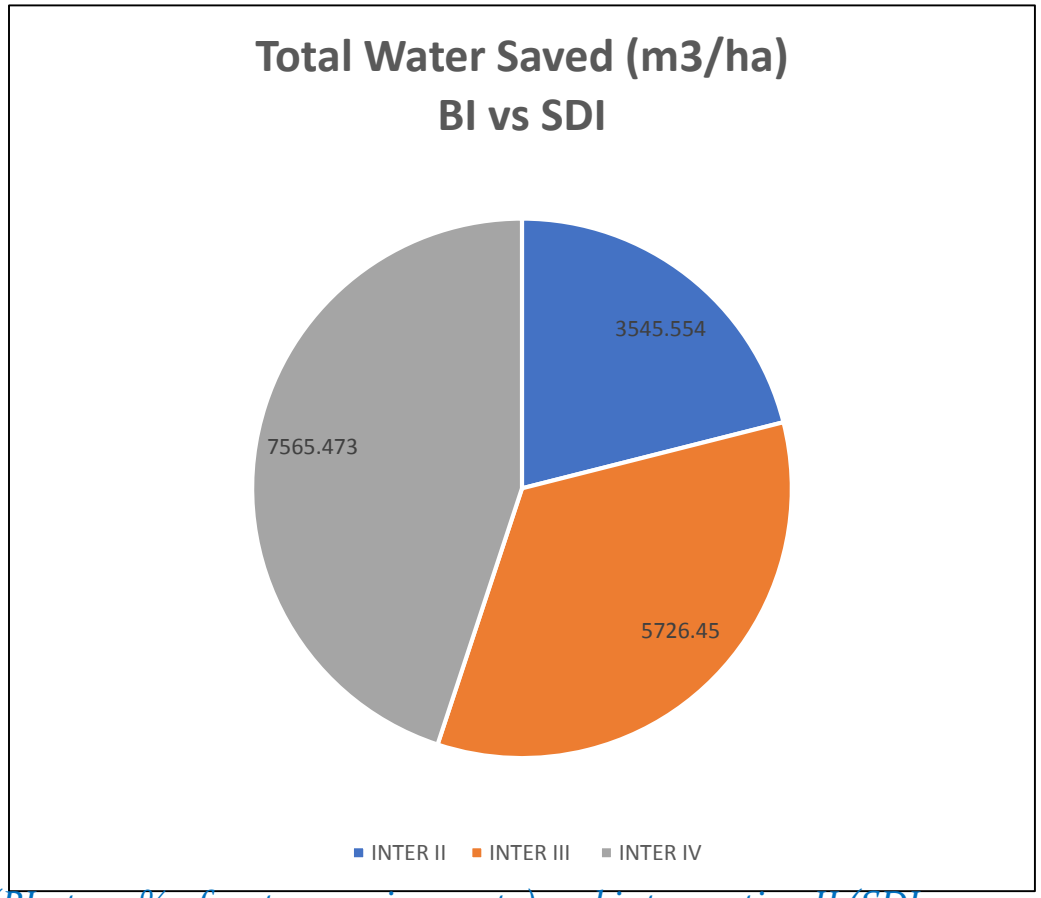
Economic Evaluation: Date Palm Yield



Note: No significant difference in the date palm productivity under intervention I (BI at 100% of water requirements) and intervention II (SDI at 60 % of water requirements), intervention III (SDI at 40 % of water requirements), intervention IV (SDI at 20 % of water requirements),

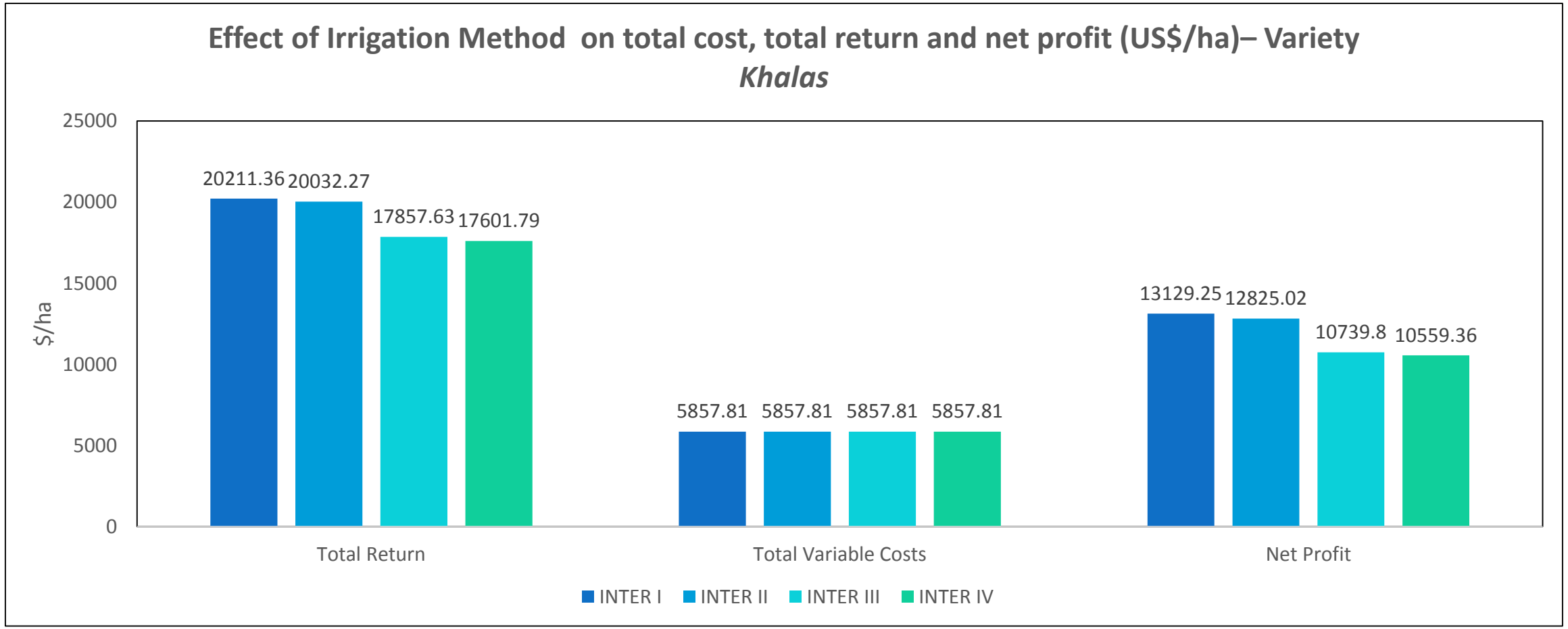
Environmental Evaluation: Water Use Efficiency (WUE)





Note: No significant difference in the date palm productivity under intervention I (BI at 100% of water requirements) and intervention II (SDI at 60 % of water requirements), intervention III (SDI at 40 % of water requirements), intervention IV (SDI at 20 % of water requirements),

Economic and Financial Analysis



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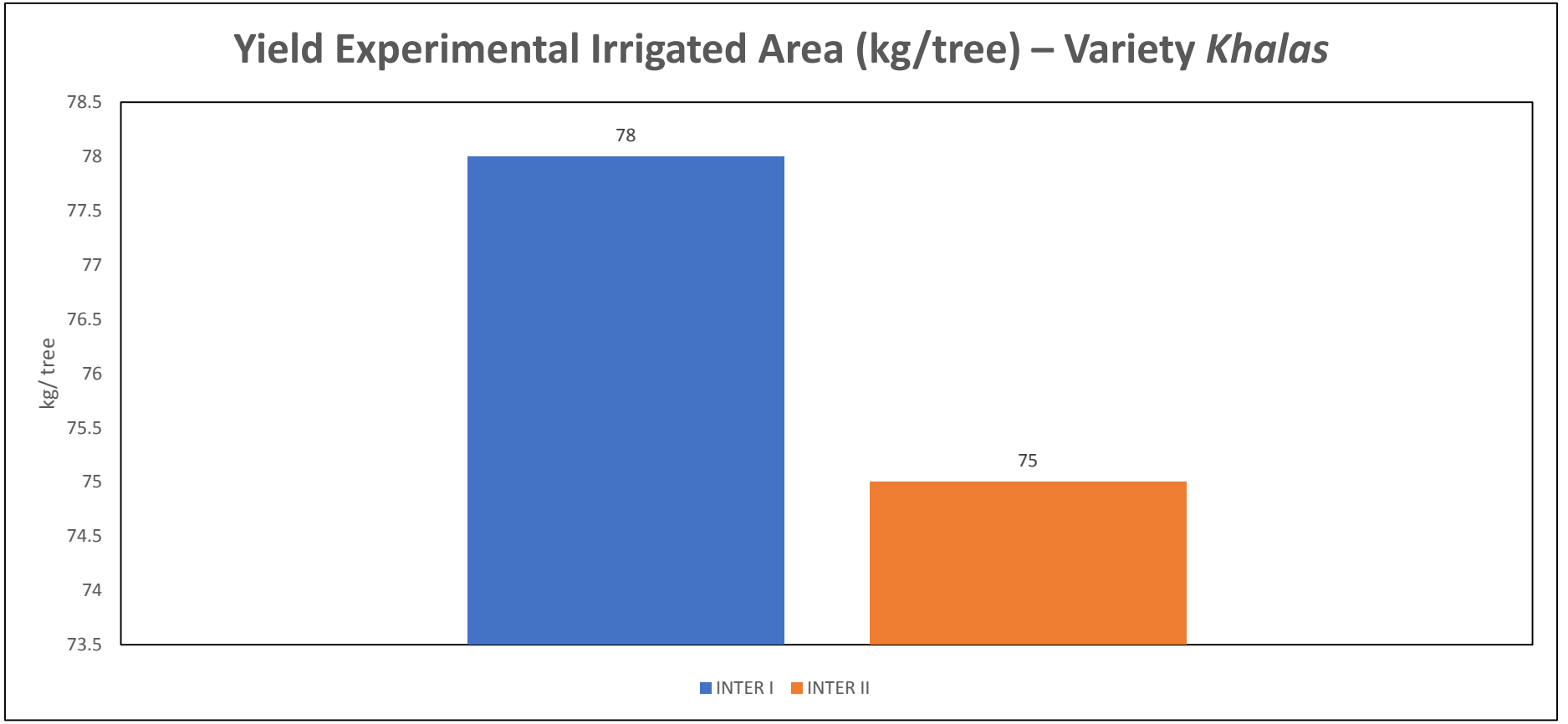
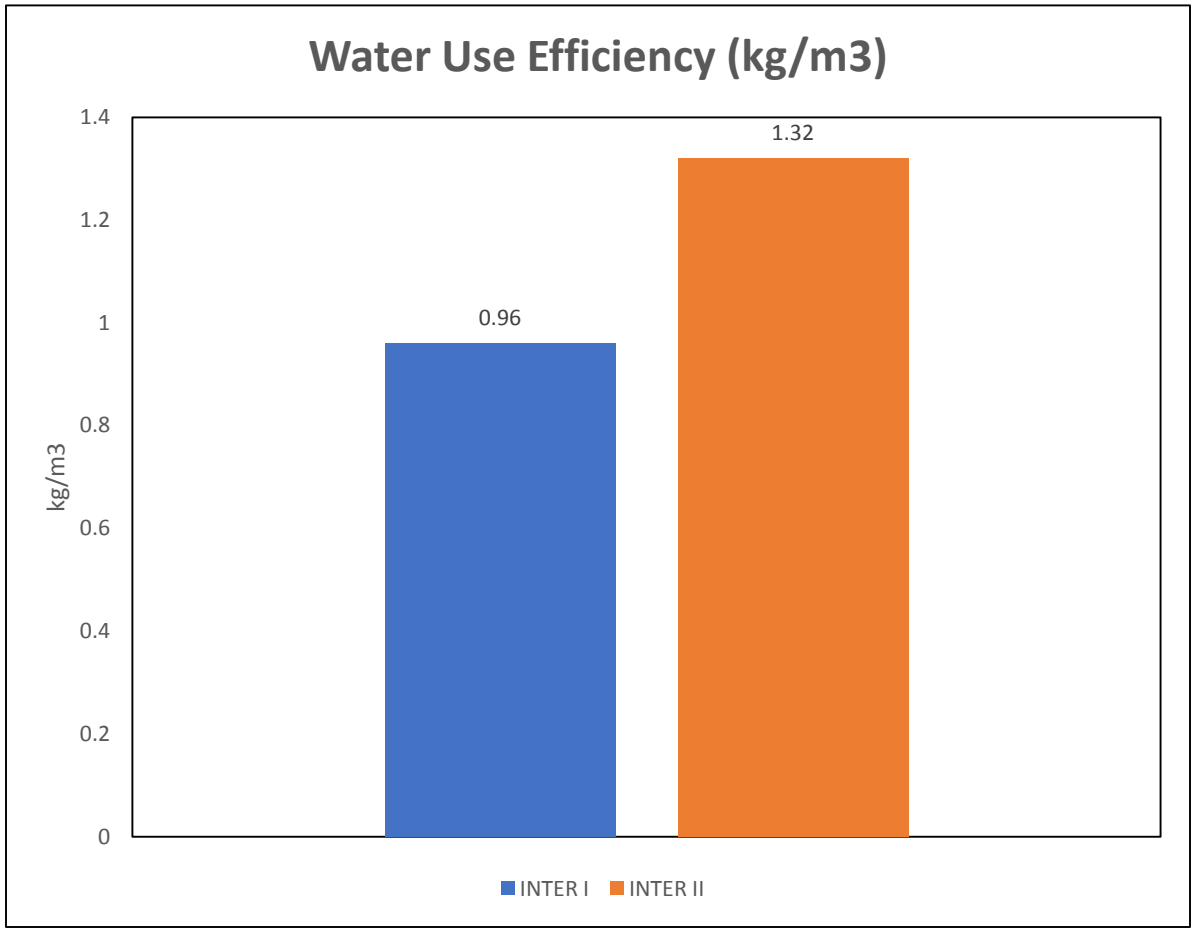
Empirical Research Findings
“Case of Saudi Arabia”

Economic Evaluation: Date Palm Yield

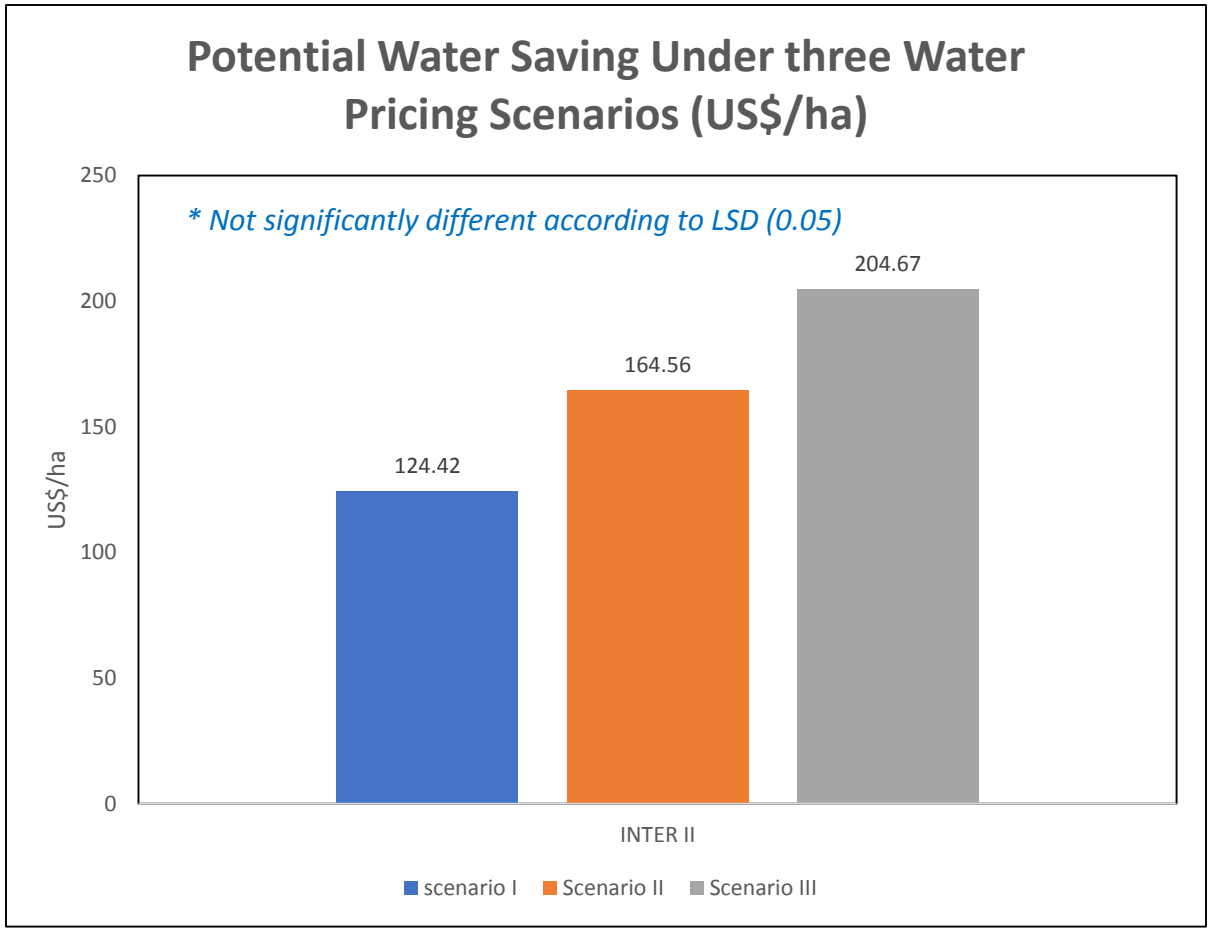


Note: No significant difference in the date palm productivity under intervention I (DI) and intervention II (SDI).

Environmental Evaluation: Water Use Efficiency (WUE)

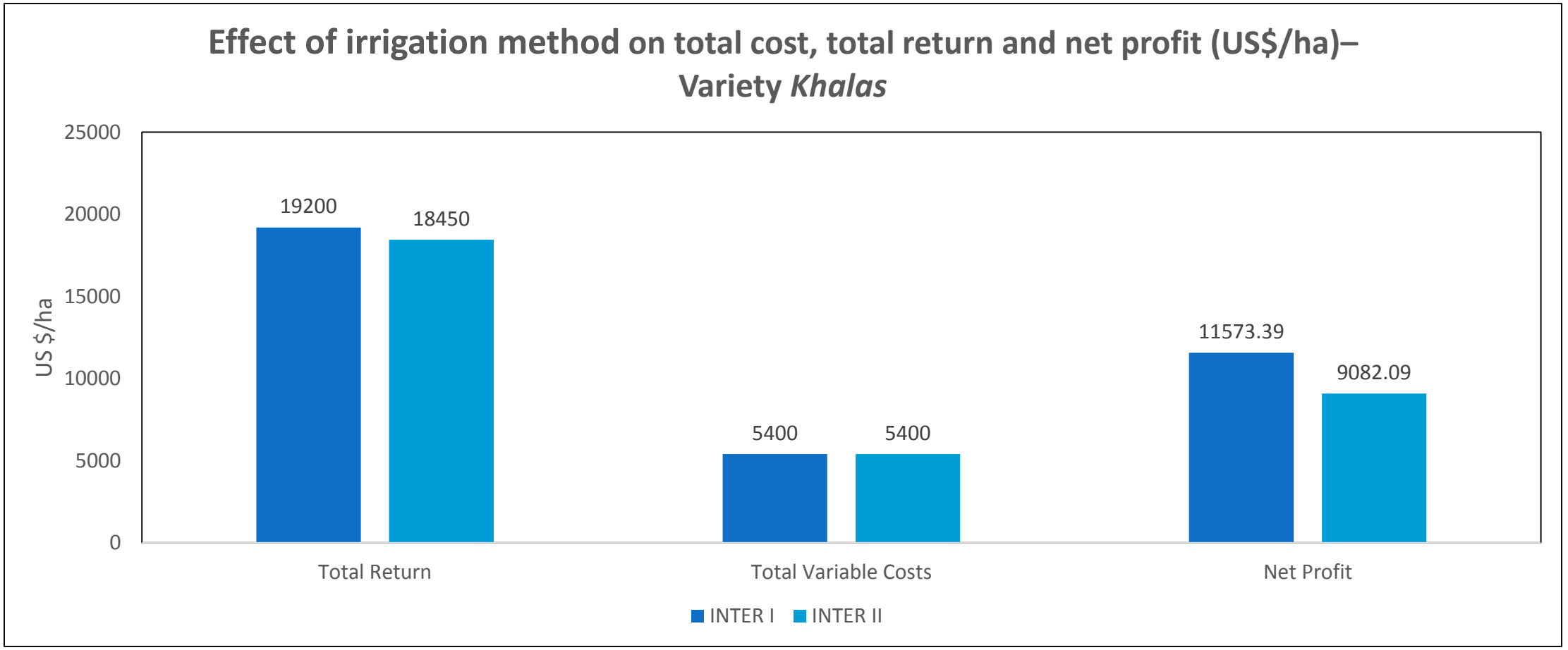


** Not significantly different according to LSD (0.05)*



Note: Cost of water pumping under Scenario I is US$0.031/m³ (Scenario I), under Scenario II is US$0.041, and under Scenario III is 0.051/m³

Economic and Financial Analysis



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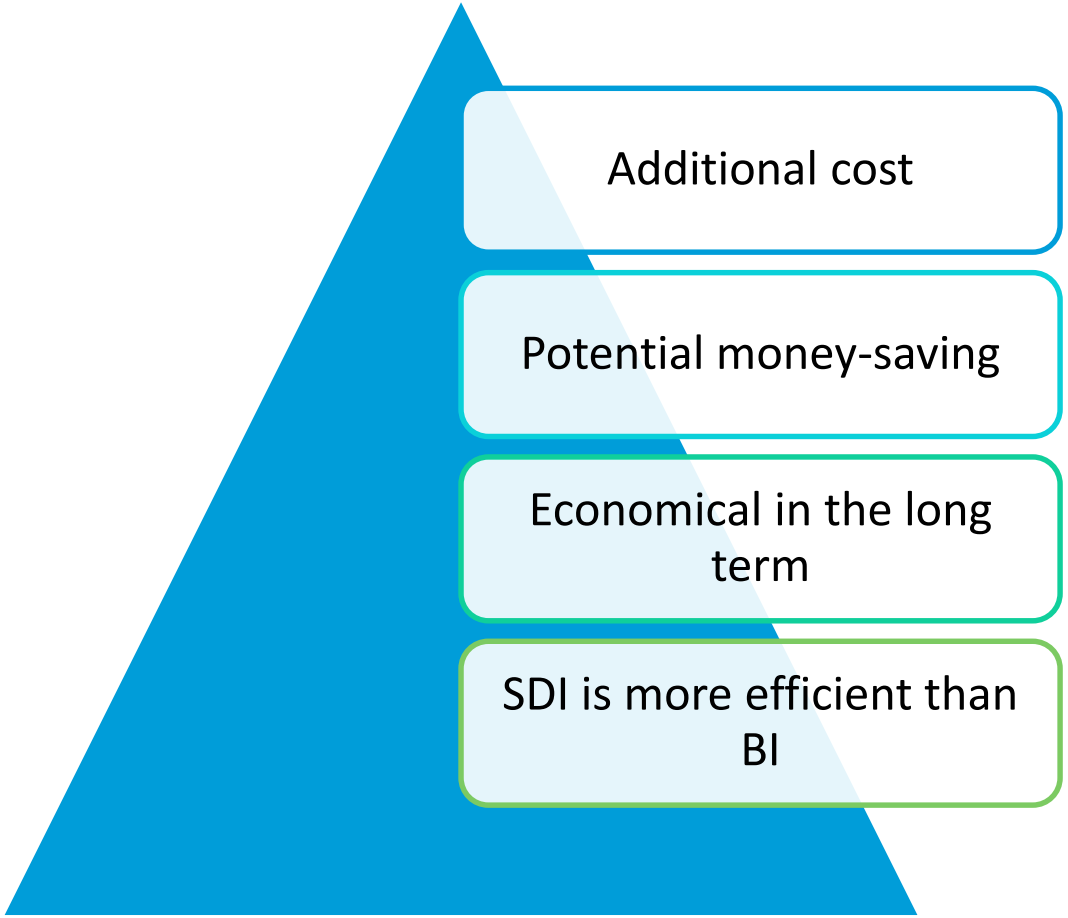
Concluding Remarks and Policy Recommendations

Concluding Remarks



Policy Recommendations

Oman Case

- Promoting the production and supply of low-cost SDI systems,
- Enhancing the adoption of SDI not only in date palm farming system but also in all existing farming systems
- The creation of networking among related institutions and public and private financial institutions and support services could be an example of mechanisms to enhance adoption of SDI given its technical efficiency and economic viability.

KSA Case

- Extension education programs are to be developed and implemented to enhance farmers' adoption rates of modern irrigation methods such as SDI, given its technical efficiency and economic viability.
- Further studies to be carried out to investigate the barriers to adopting this new irrigation methods,
- Developing solutions to overcome these barriers to conserve limited water resources for obtaining Saudi sustainable agriculture goals.

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- ***Disclaimers:*** *The views expressed in this presentation are the authors' own and do not necessarily reflect ICARDA, NARS, GCC, CGIAR or any involved research and development partners in this research program*

Thank You

Comments – Questions

GCC and ICARDA: Towards Sustainable, Productive and Climate-Friendly Date Palm Farming Systems Under Climate Change Complexity

دول مجلس التعاون الخليجي وايكاردا: نحو نظم مستدامة لإنتاج النخيل وصديقة للبيئة في ظل التغيرات المناخية المعقدة