

Technological Innovations and their Role in the Expansion of Irrigation Worldwide

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Mathematical tablet

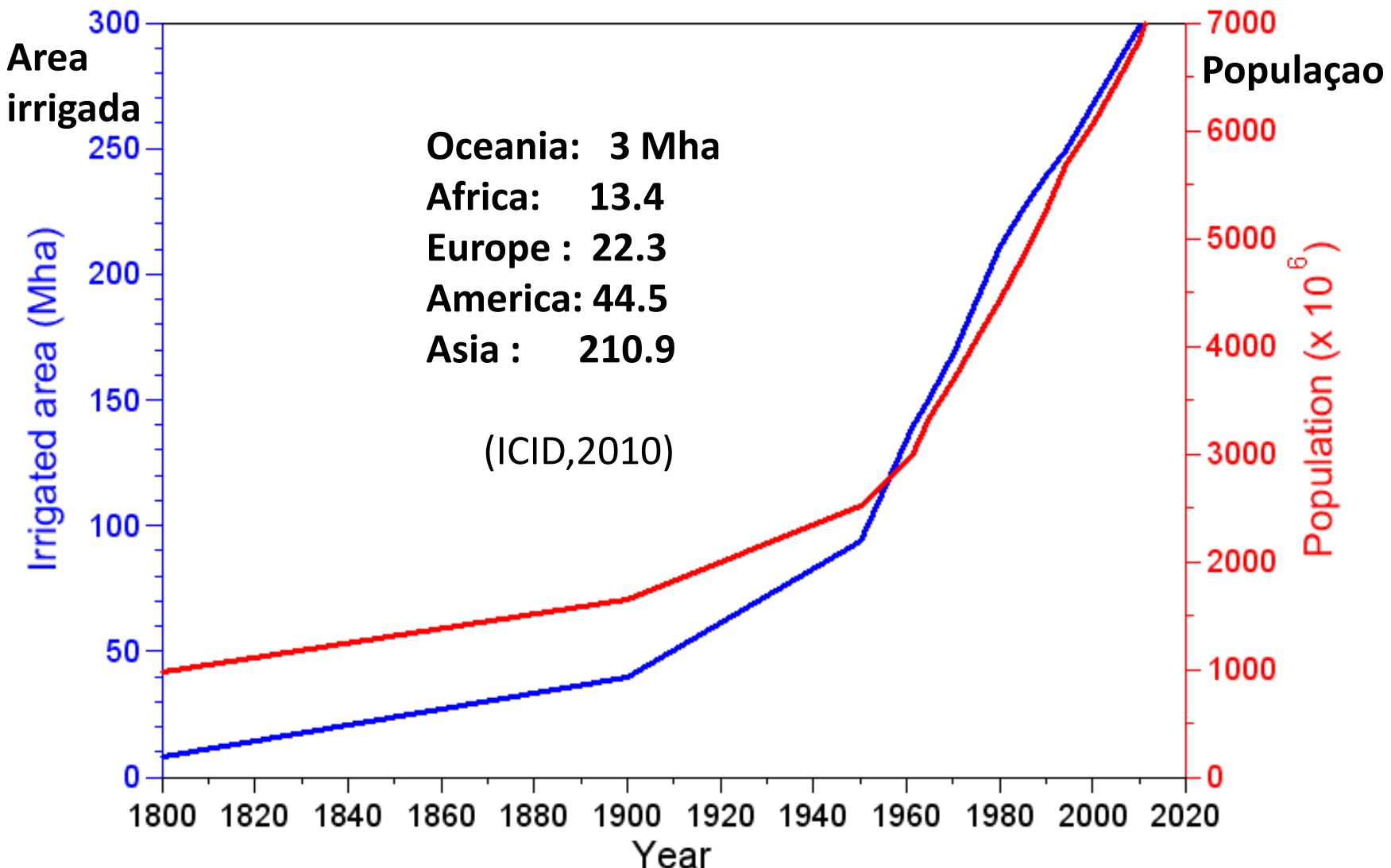
This tablet, which is partly illustrated, contains a set of problems relating to the calculation of volume, together with the solutions.

ME 15285

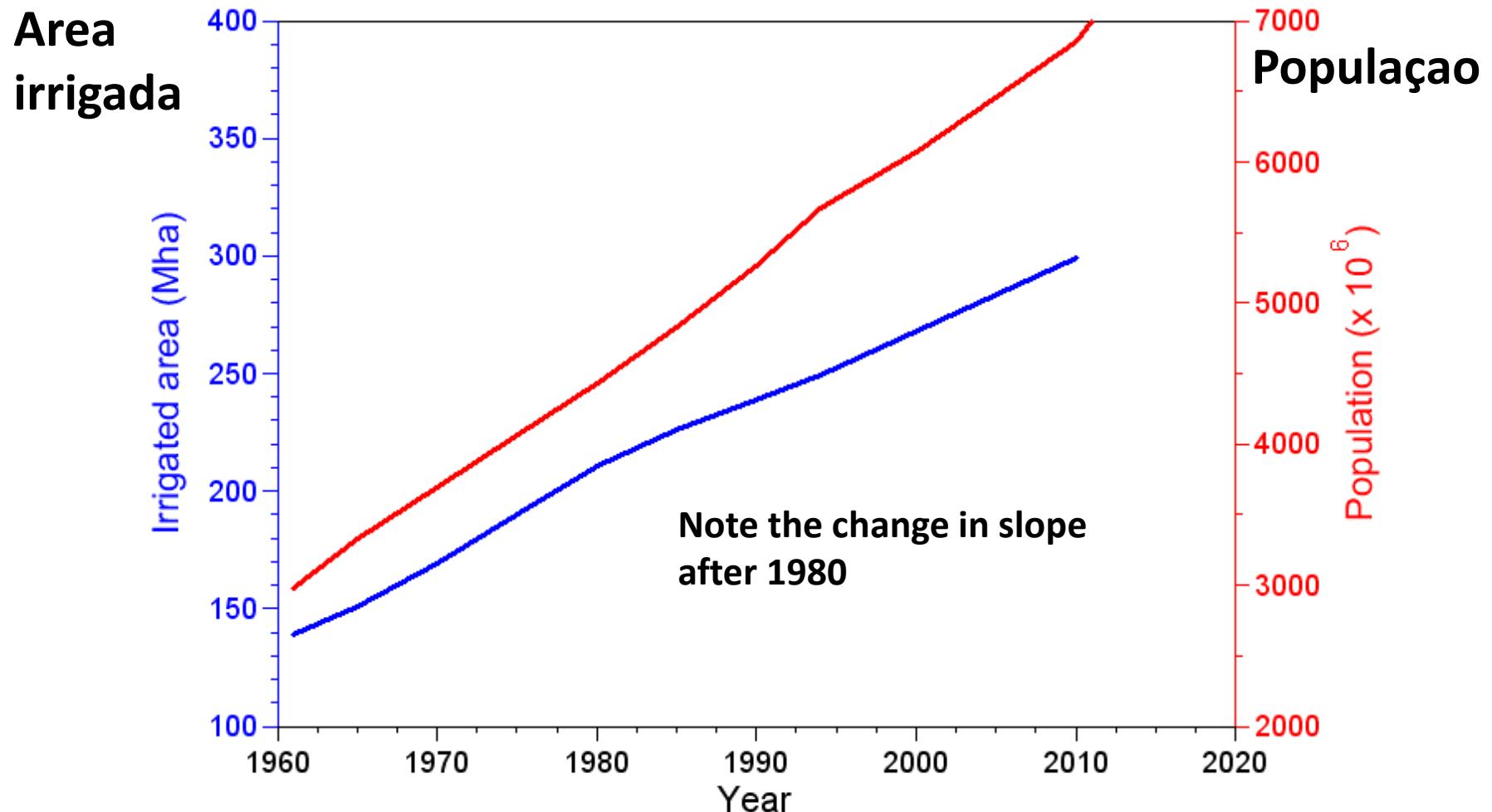
Ancient Technology (2000 BC)
From the British Museum of London

IRRIGATION IS A VERY OLD INNOVATION

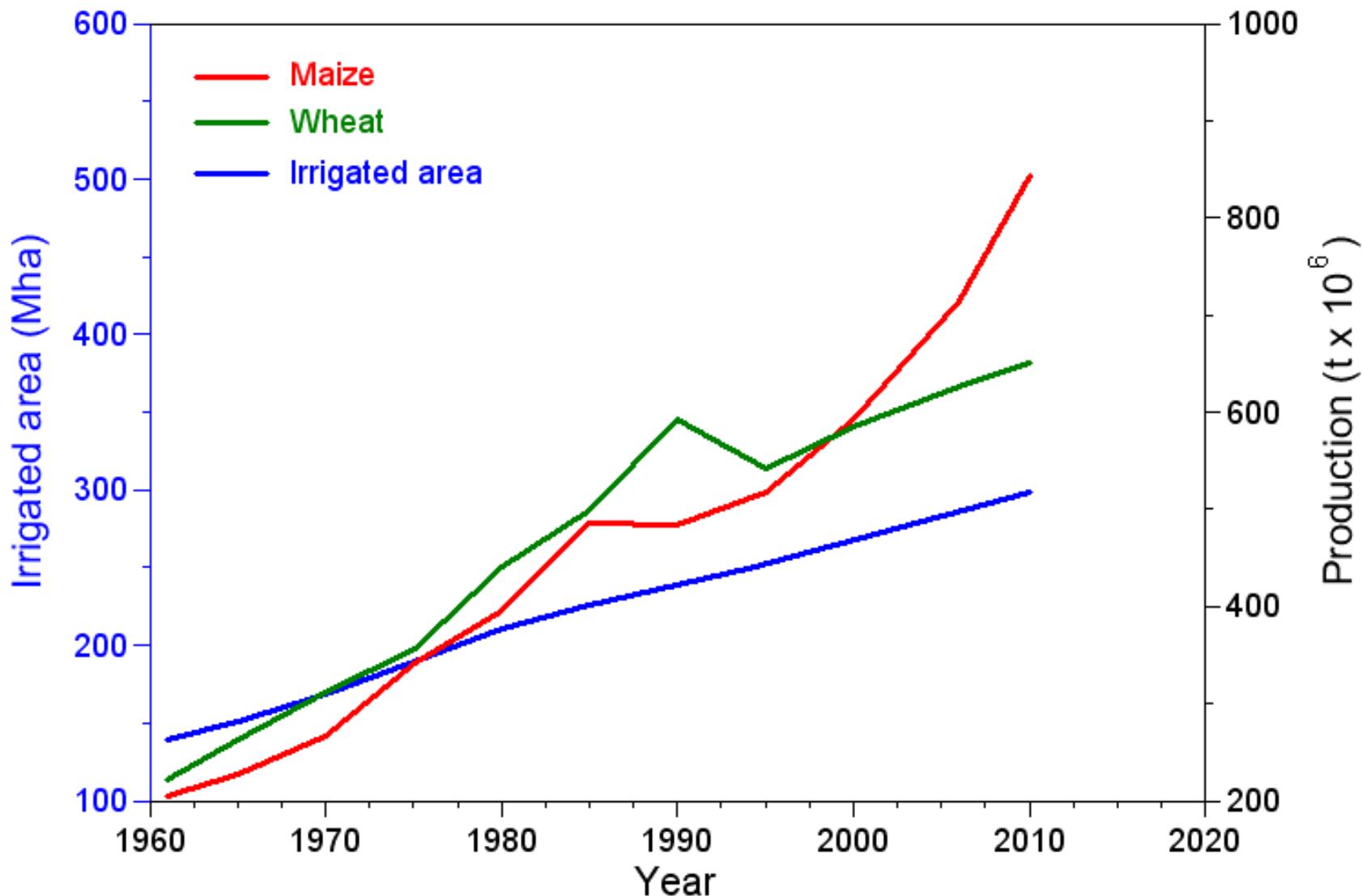
The expansion of irrigation in response to a driving force



Focus on the last fifty years



Irrigation contribution to AGRICULTURAL PRODUCTIVITY



**WATER PRODUCTIVITY
IS JUST ONE
COMPONENT OF
AGRICULTURAL
PRODUCTIVITY**



After Montoro et al., 2011

Focusing on the Irrigation Process

1. SECURE A SUPPLY OF WATER
2. DECIDE HOW MUCH AND WHEN TO USE IT
3. APPLY IT TO THE FIELDS AS BEST AS POSSIBLE
4. ASSESS THE DISPOSITION OF THE WATER

*ALL IN THE CONTEXT OF AN ECONOMIC
ENTERPRISE AND COMPLYING WITH
INSTITUTIONAL AND ENVIRONMENTAL*

REGULATIONS

IT IS A VERY DIFFICULT PROBLEM!

Focusing on the Irrigation Process

1. SECURE A SUPPLY OF SUFFICIENT WATER

THE PATH FROM THE WATER SOURCE TO THE FARM

ADVANCES IN: OPTIMIZATION OF WATER ALLOCATION,
AUTOMATED DISTRIBUTION, METERING, CANAL MANAGEMENT,
FROM OPEN TO CLOSED DISTRIBUTION SYSTEMS, MODERNIZATION
OF NETWORKS, COPING WITH WATER SCARCITY

PROGRESS IN COLLECTIVE ACTION AND IN THE
INSTITUTIONALIZATION OF IRRIGATION MANAGEMENT

ISSUES: THE WATER-ENERGY NEXUS

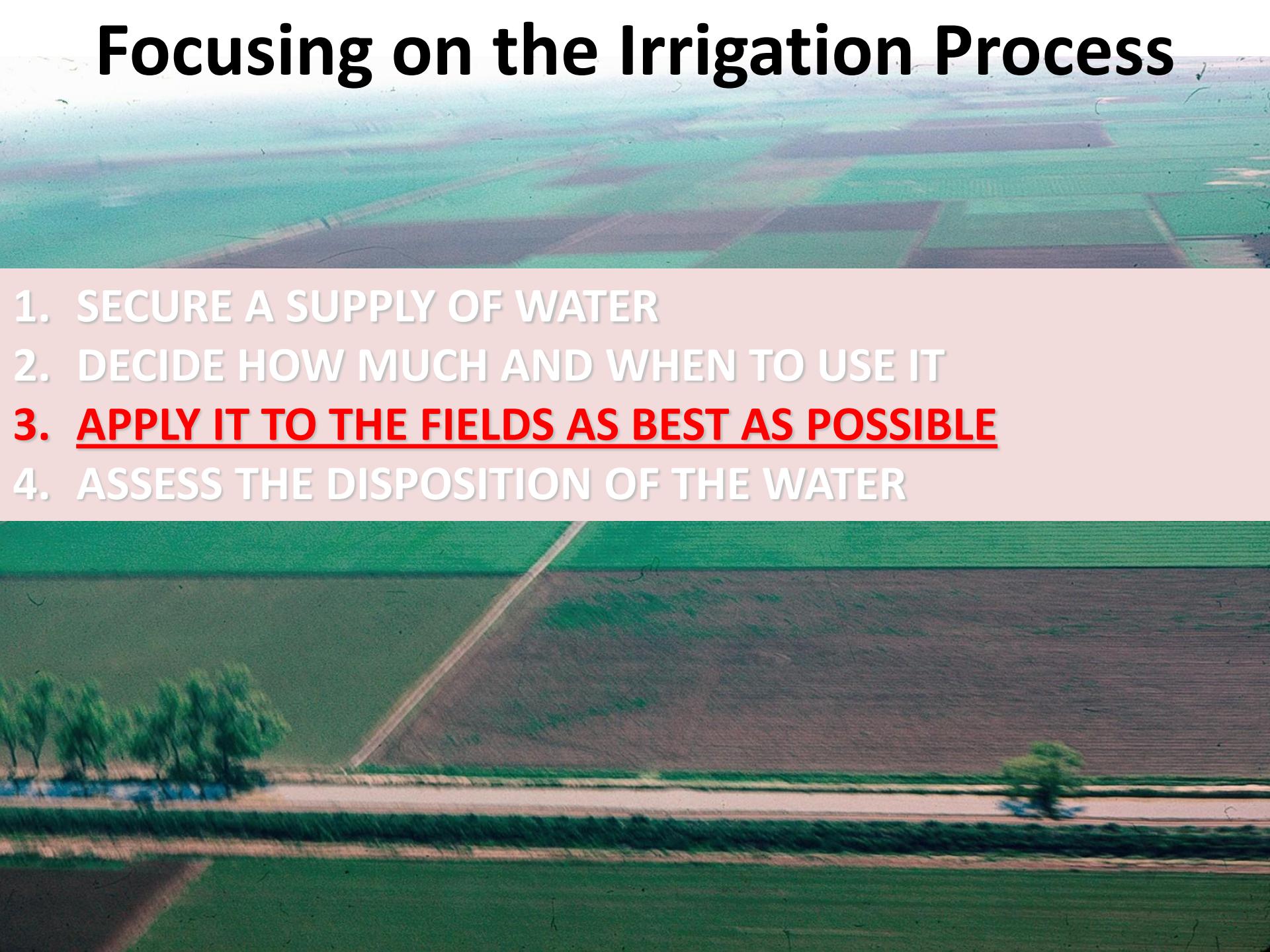
THE ROLE OF STAKEHOLDERS IN MANAGING THE
RESOURCE

Historically, irrigation networks were designed with insufficient capacity for a number of reasons: poor ET estimation, rigidity in cropping patterns, and above all, for social and political reasons.

Efficiency gains , improved allocation rules, and enhanced flexibility all have led to irrigation expansion and to increased irrigation water productivity.

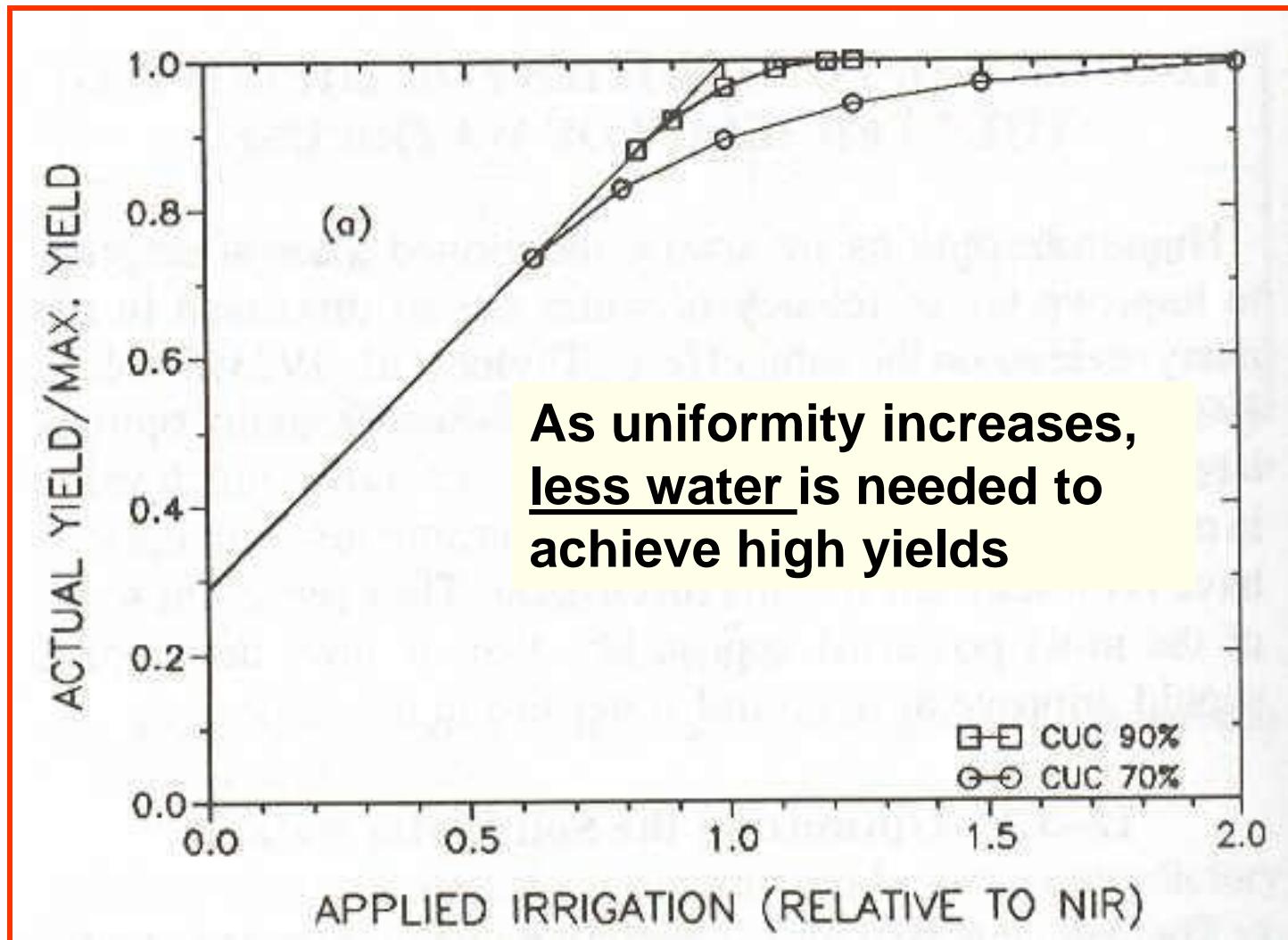


Focusing on the Irrigation Process

An aerial photograph of a rural landscape featuring several agricultural fields. Some fields are dark brown, likely plowed or fallow, while others are a vibrant green. A network of irrigation canals or drainage ditches is visible, creating a grid-like pattern across the land. The fields are separated by thin, light-colored paths or roads. In the foreground, there are some small clusters of trees and a few buildings, possibly farmhouses or barns, nestled among the fields.

1. SECURE A SUPPLY OF WATER
2. DECIDE HOW MUCH AND WHEN TO USE IT
3. **APPLY IT TO THE FIELDS AS BEST AS POSSIBLE**
4. ASSESS THE DISPOSITION OF THE WATER

EFFECTS OF IRRIGATION UNIFORMITY ON THE RELATION BETWEEN YIELD AND IRRIGATION WATER



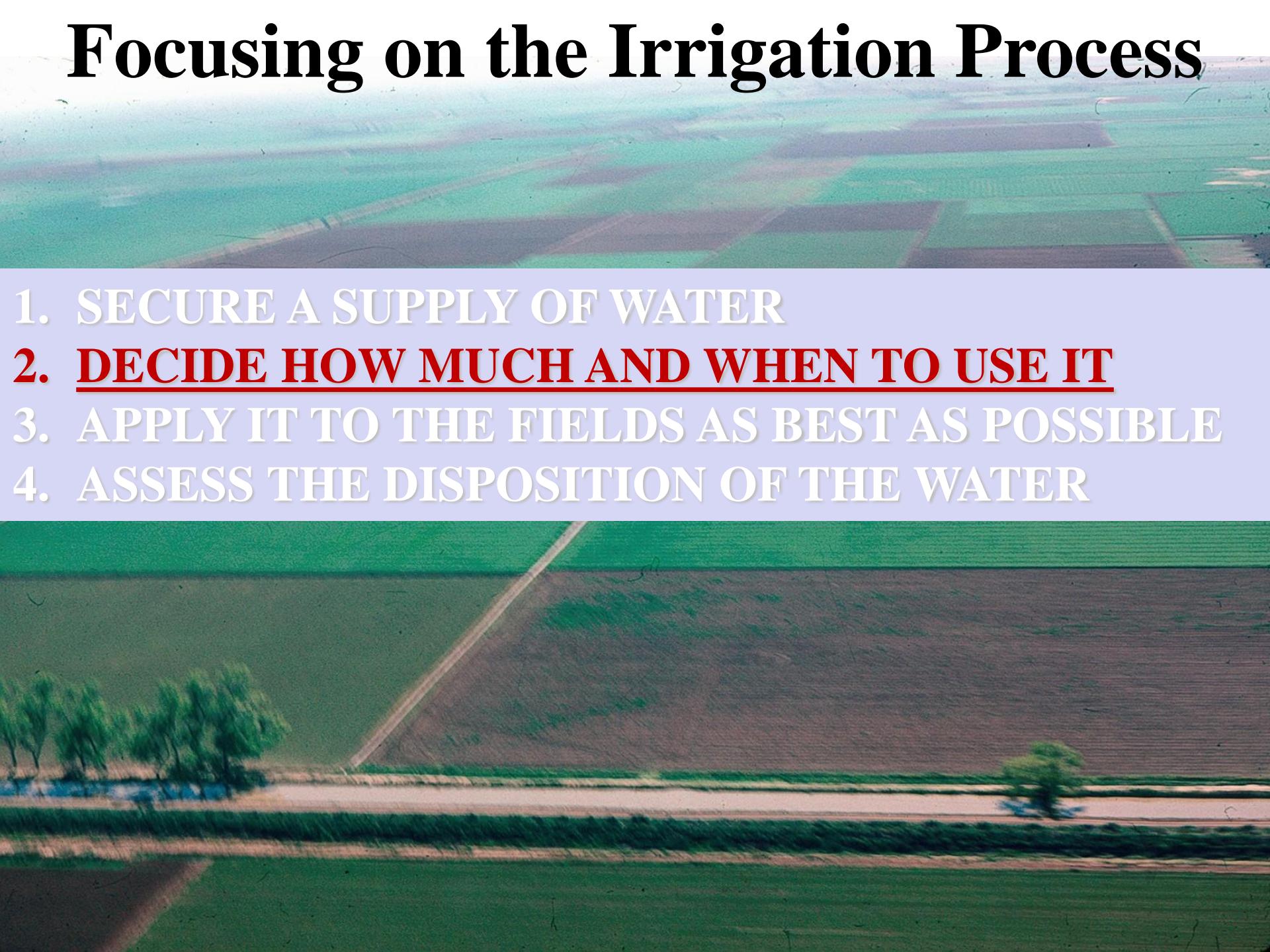
Mantovani et al., (1995)

THE CONTROL OF THE DEPTH OF INFILTRATED WATER FROM THE SOIL TO THE IRRIGATION SYSTEM

*THE IMPORTANCE OF PRESSURIZED IRRIGATION FOR PRECISION APPLICATIONS;
BUT WHAT ABOUT THEIR ENERGY REQUIREMENTS?*



Focusing on the Irrigation Process

An aerial photograph of a rural landscape featuring several agricultural fields. Some fields are green and appear to be in crop, while others are dark brown, likely plowed or fallow. A network of irrigation canals or roads cuts through the fields, creating a grid-like pattern. The fields are surrounded by patches of green vegetation and small clusters of trees. The overall scene is a mix of agricultural activity and natural environment.

1. SECURE A SUPPLY OF WATER
2. **DECIDE HOW MUCH AND WHEN TO USE IT**
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4. ASSESS THE DISPOSITION OF THE WATER

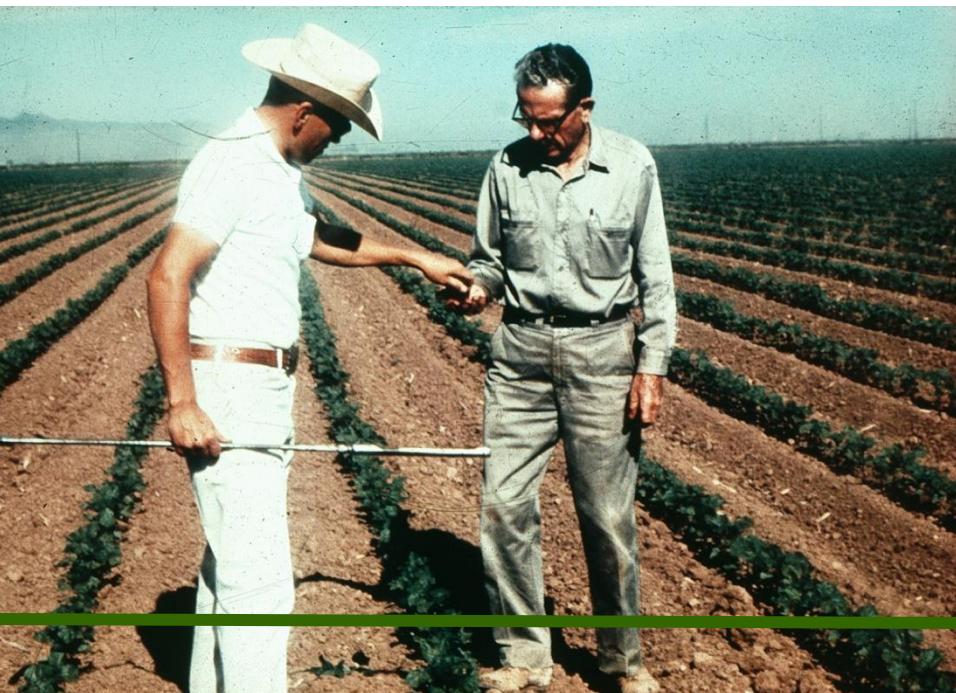


ACHIEVING A STANDARD FOR ETo ESTIMATION

THE FAO ID56 BY ALLEN ET AL (1998)

But what about specific crop needs, timing, amount?

In irrigation, engineering has always been ahead of the science



CROP YIELD RESPONSE TO WATER

FAO Irrigation and Drainage Paper No. 66



Crop yield response to water

FAO
IRRIGATION
AND
DRAINAGE
PAPER
66

by

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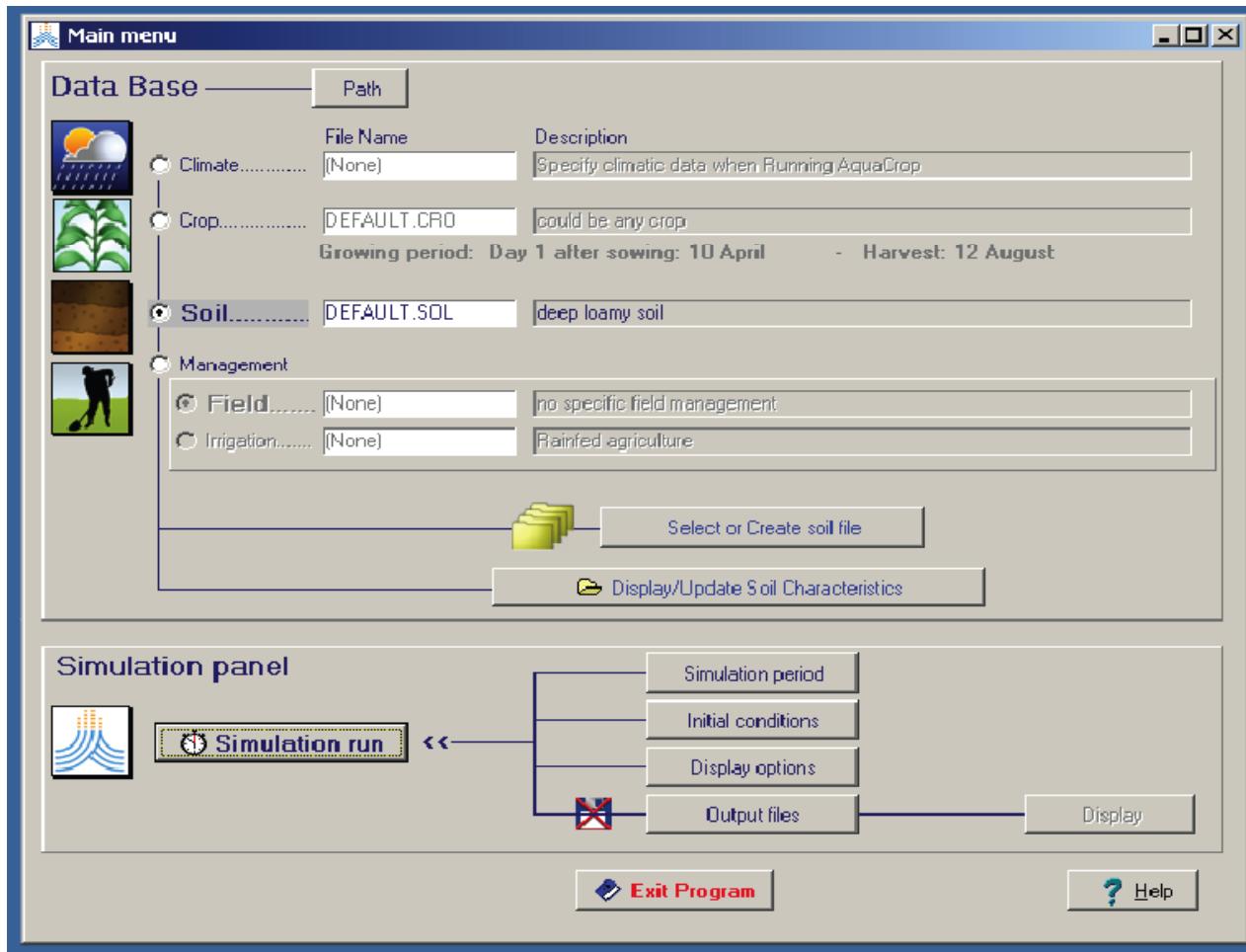


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How much can we produce with a given amount of water?

Use of simulation models for benchmarking

AquaCrop:
a simulation
model of water-
limited crop
production



HOW TO DEAL WITH WATER SHORTAGES? THE CASE OF PERMANENT CROPS

OPTION: DEFICIT IRRIGATION

**APPROACH: USE CROP-BASED KNOWLEDGE TO OPTIMIZE THE
IRRIGATION DEFICITS: THE CONCEPT OF REGULATED DEFICIT
IRRIGATION (RDI)**

**REDUCED WATER USE AND MAINTENANCE OF
FARMERS PROFITS, BUT ..**

INCREASED RISKS, THUS.....

**NEED MORE PRECISE
MONITORING FOR WATER
STRESS MANAGEMENT**



**TO DEAL WITH CHRONIC WATER SCARCITY,
A NEW RESEARCH PROGRAM WAS
LAUNCHED IN 2007 AIMED AT IMPROVING
THE WATER USE AND PRODUCTIVITY OF
SPANISH HORTICULTURE (PERMANENT
CROPS; FRUIT TREES & VINES)**

**THE 5-YR RESEARCH PROGRAM HAS BEEN CARRIED OUT BY FIVE
GROUPS IN FIVE DIFFERENT REGIONS OF SPAIN, WITH MORE
THAN 70 PERMANENT STAFF AND OVER 160 PEOPLE UNDER THE
GRANT PROGRAM CONSOLIDAR OF THE GOVERNMENT OF SPAIN.**

(CHECK THE WEB UNDER RIDEKO)

Crop water requirements of fruit trees: measurements and models

New method for measuring sap flow with increased precision

F. VILLALOBOS, L. TESTI & F. ORGAZ. IAS-CSIC & UCO



Buscar negocios Cómo llegar

REMOTE SENSING FOR MONITORING STRESS?

- thermal
- 090703_2_field25
- temperature
- 090701_2
- Method Sauvola

apas

Galería de Earth >>

- Base de datos principal
- Fronteras y etiquetas
- Lugares
- Fotografías
- Carreteras
- Edificios 3D
- Océanos
- Street View



About 127 ha

280 rows
150 trees each

42,000
trees

Tree spacing
5.8 x 5.2 m

Irrigated
Every 20 days

Irrigated
Every 10 days

36°58'43.76" N

119°57'50.56" O

elev. 97 m

Alt. ojo 2.15 km

madera

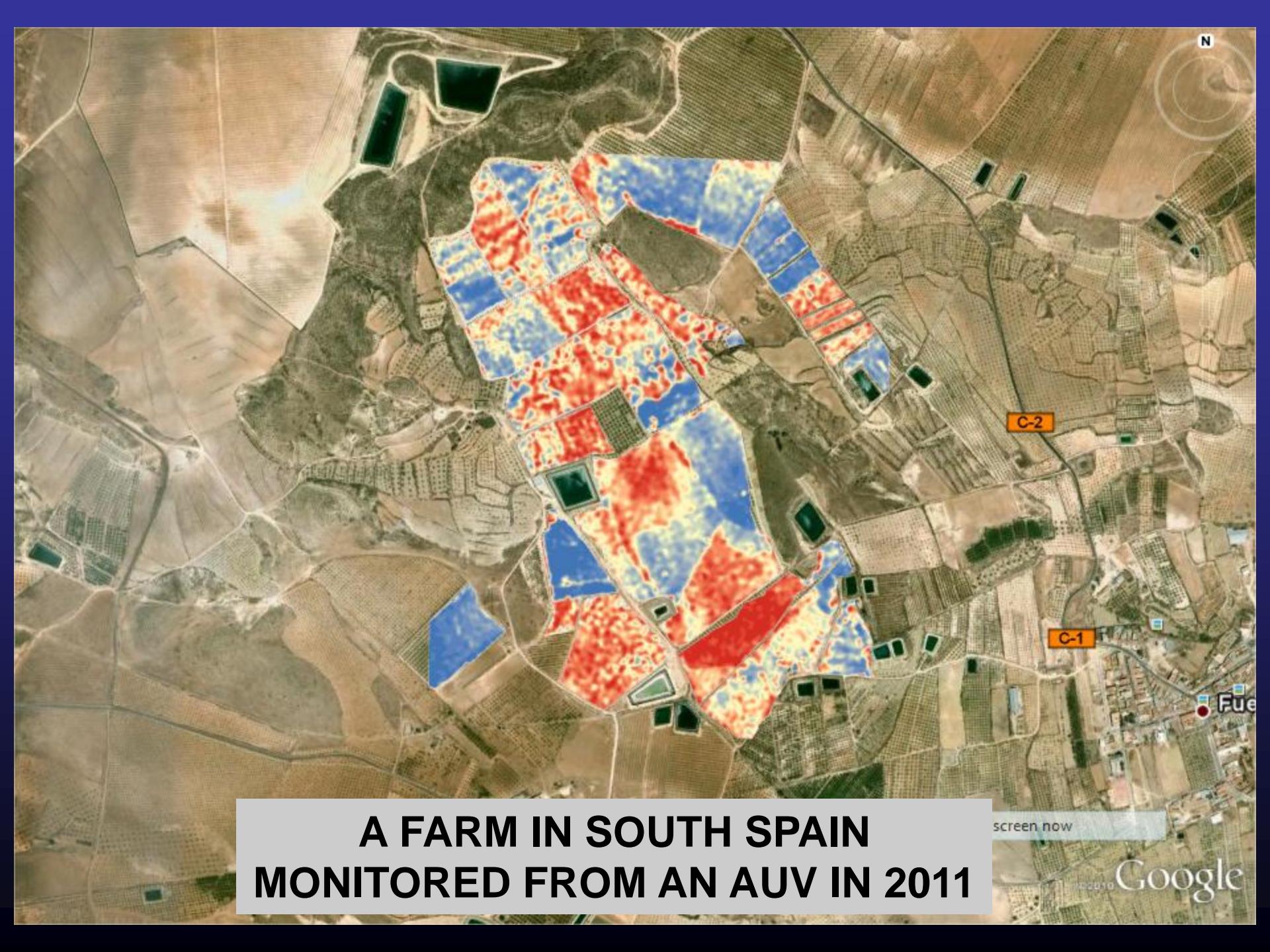
©2011 Google

HIGH RESOLUTION THERMAL IMAGES FROM AIRPLANES

P ZARCO, JAJ BERNI, V GONZALEZ-DUGO, L SUAREZ, A VERA, D NOTARIO.....



N

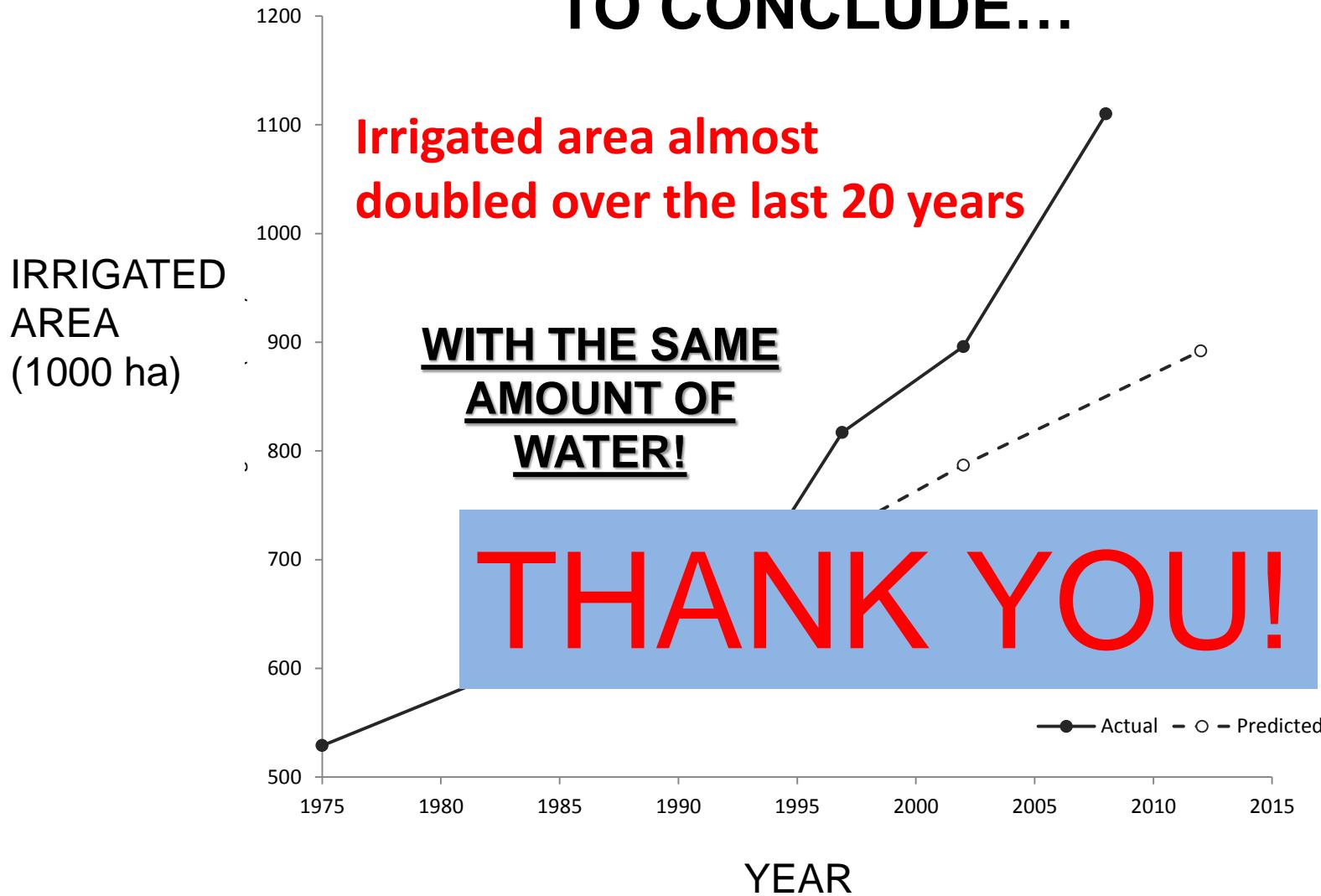


A FARM IN SOUTH SPAIN
MONITORED FROM AN AUV IN 2011

screen now

2010 Google

TO CONCLUDE...



Evolution of irrigated area in Andalusia, Spain