Technological Innovations and their Role in the Expansion of Irrigation Worldwide

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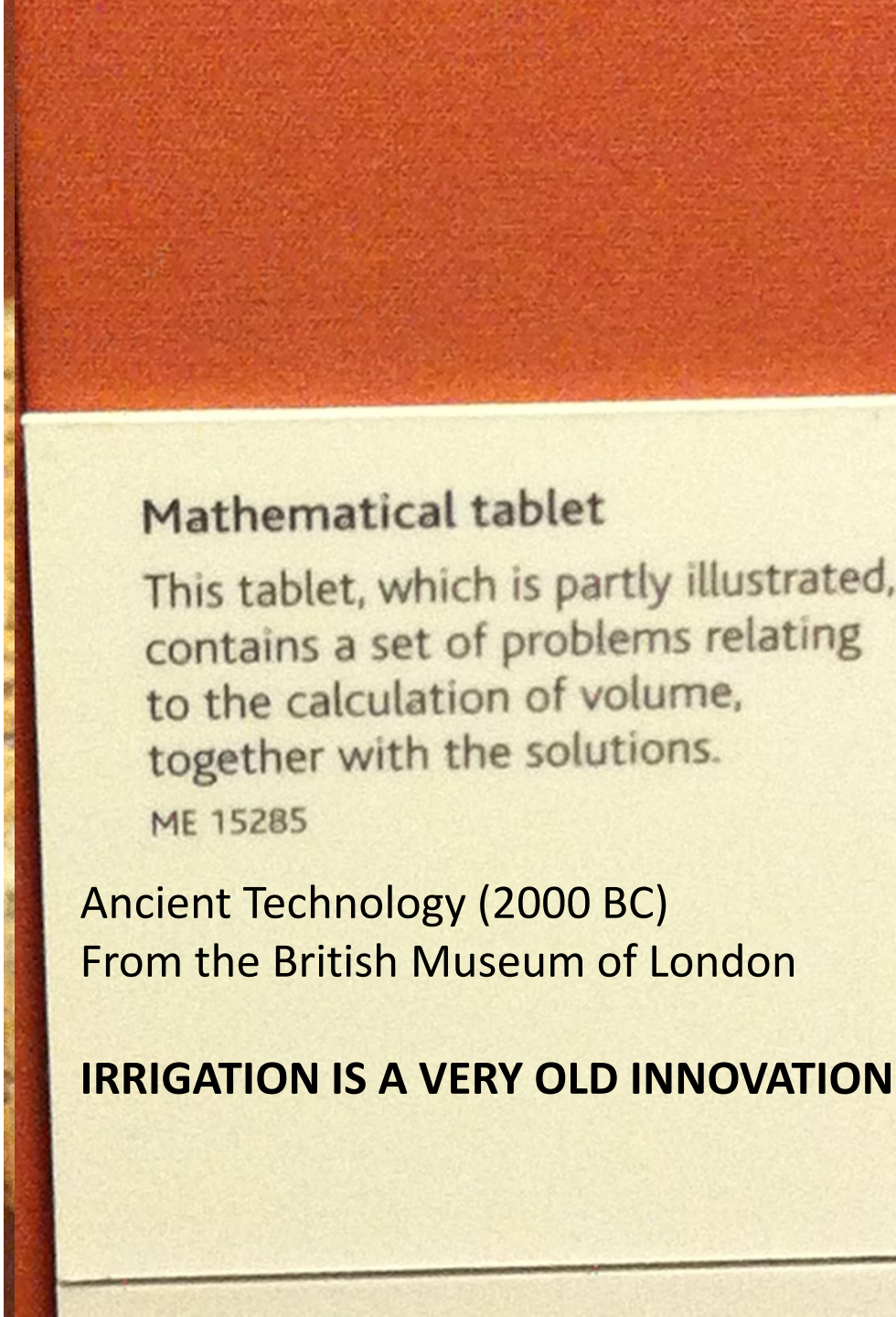
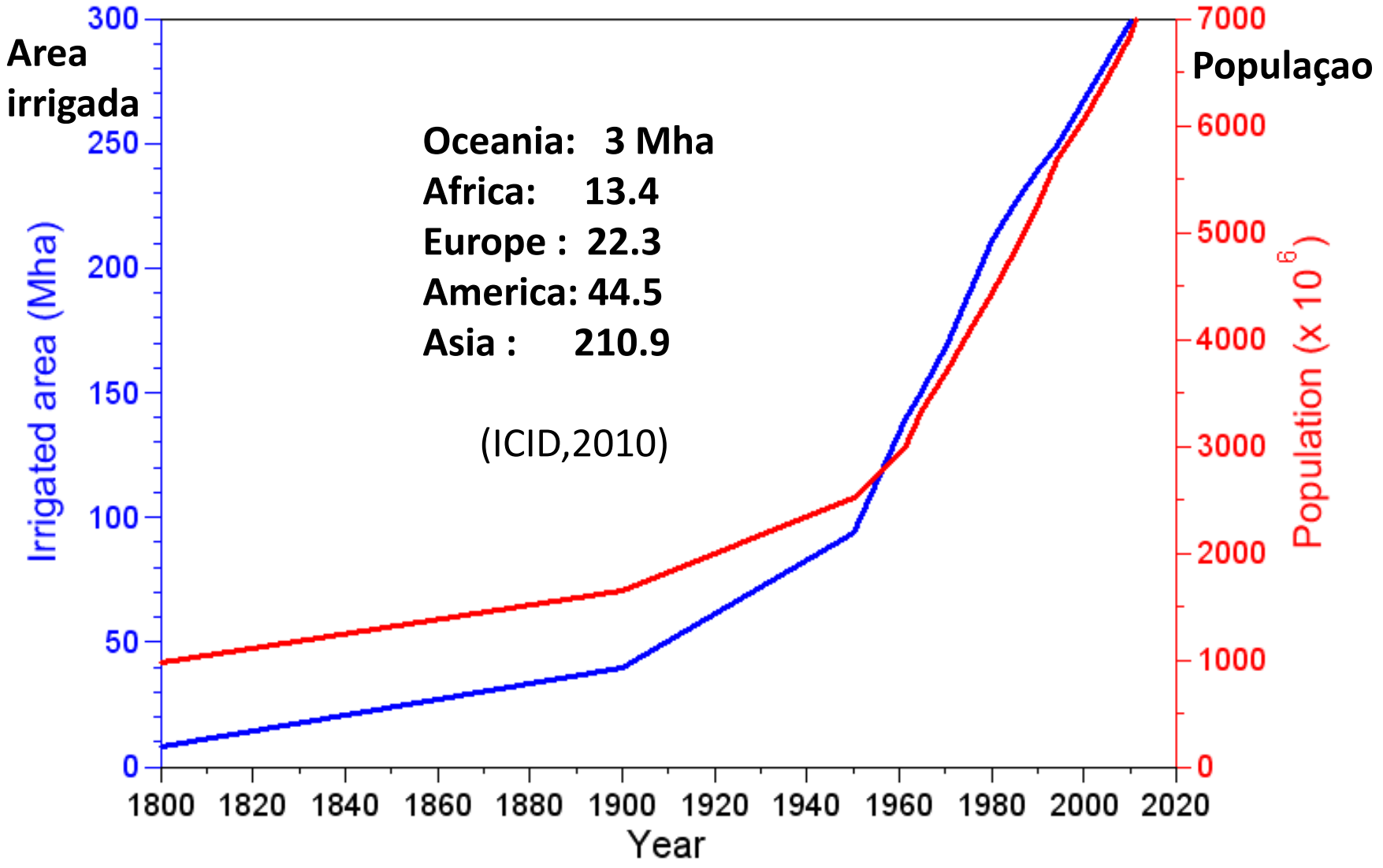


Ancient Technology (2000 BC)
From the British Museum of London

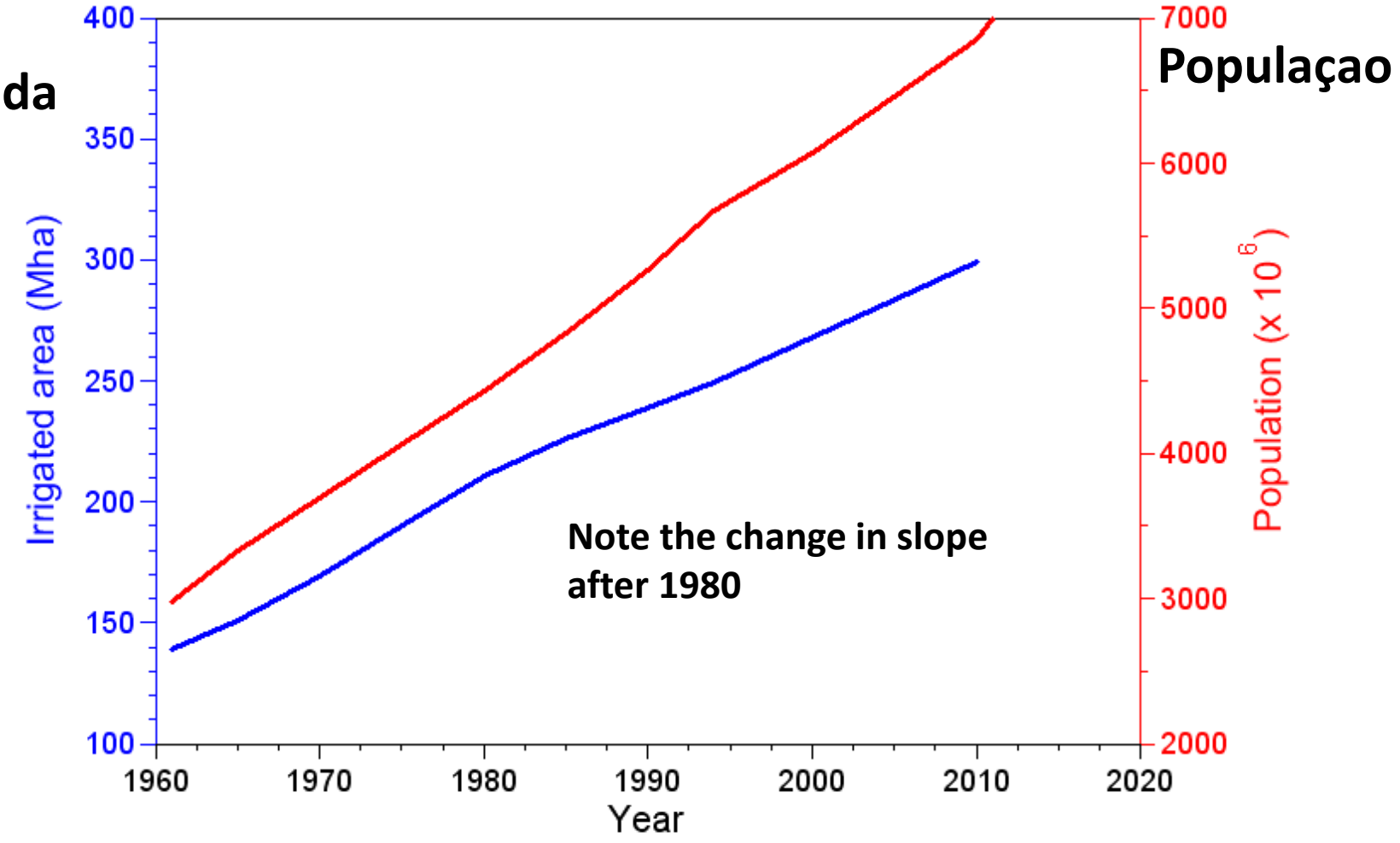
IRRIGATION IS A VERY OLD INNOVATION

The expansion of irrigation in response to a driving force



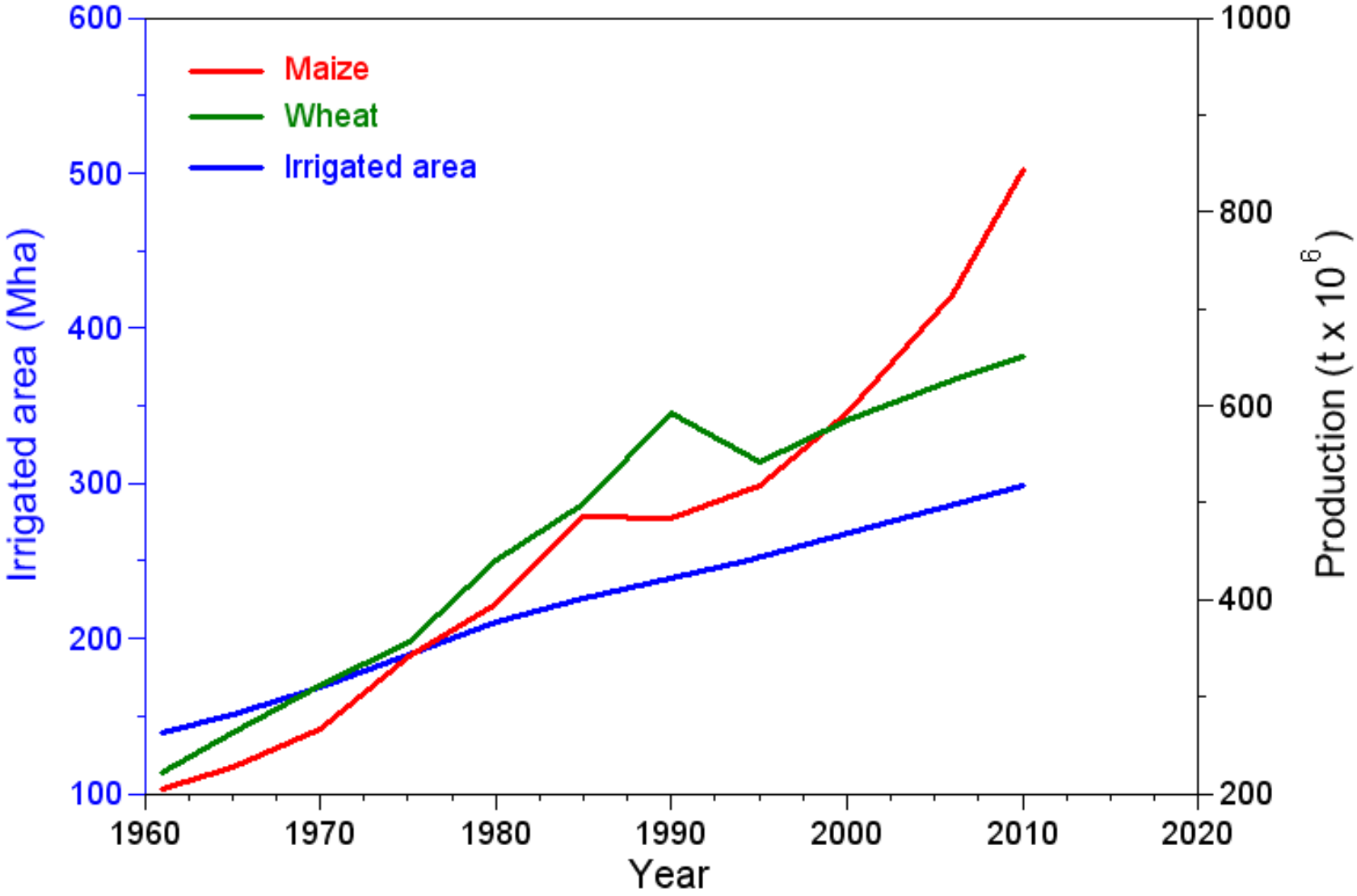
Focus on the last fifty years

Area irrigada



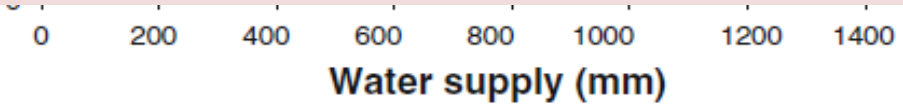
Populaçao

Irrigation contribution to AGRICULTURAL PRODUCTIVITY



YIELDS OF FARM PLOTS AS A FUNCTION OF TOTAL WATER SUPPLY

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

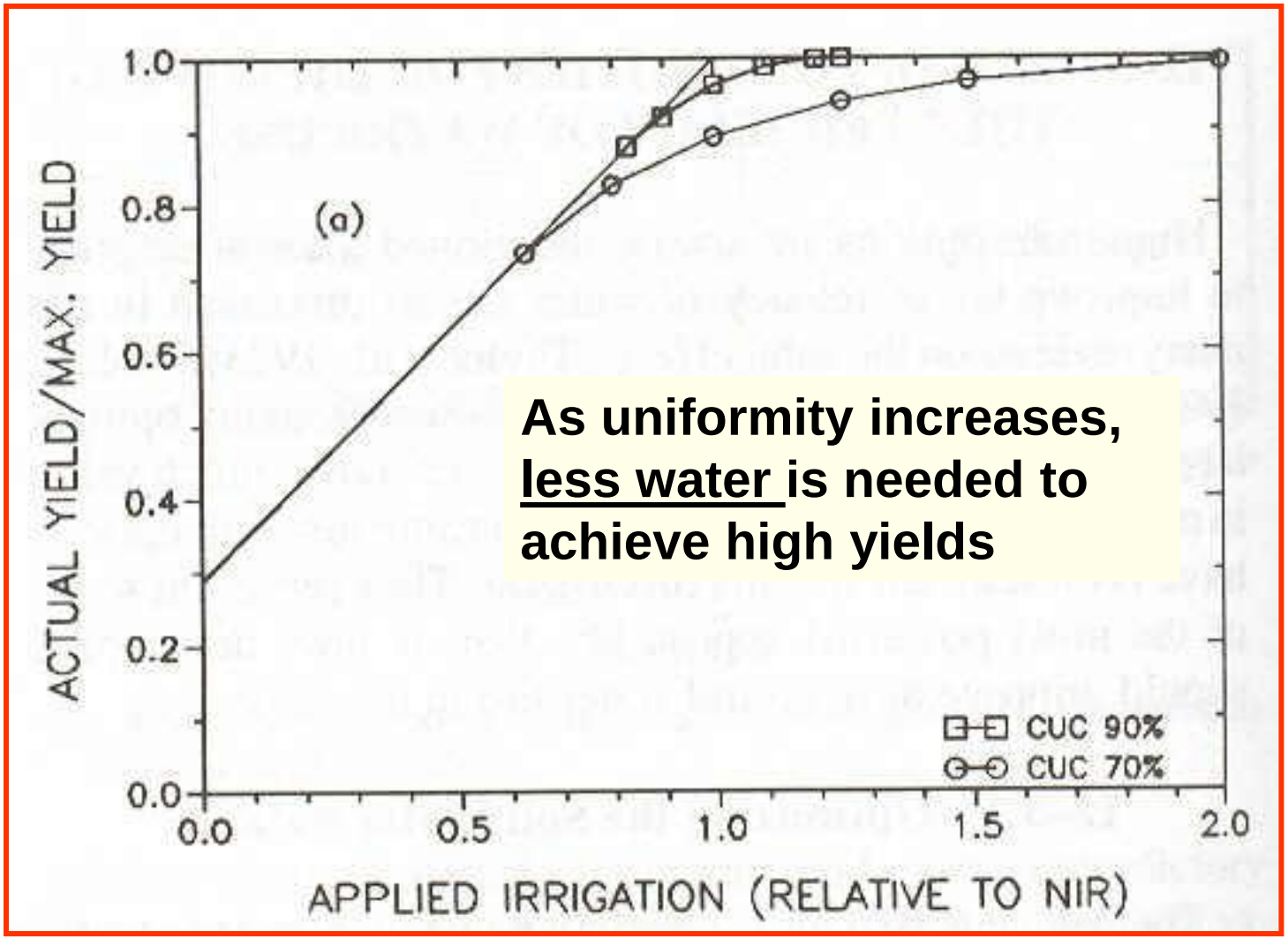
Historically, irrigation networks were designed with insufficient capacity for a number of reasons: poor ET estimation, rigidity in cropping patterns, and above all, for social and political reasons.

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

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?

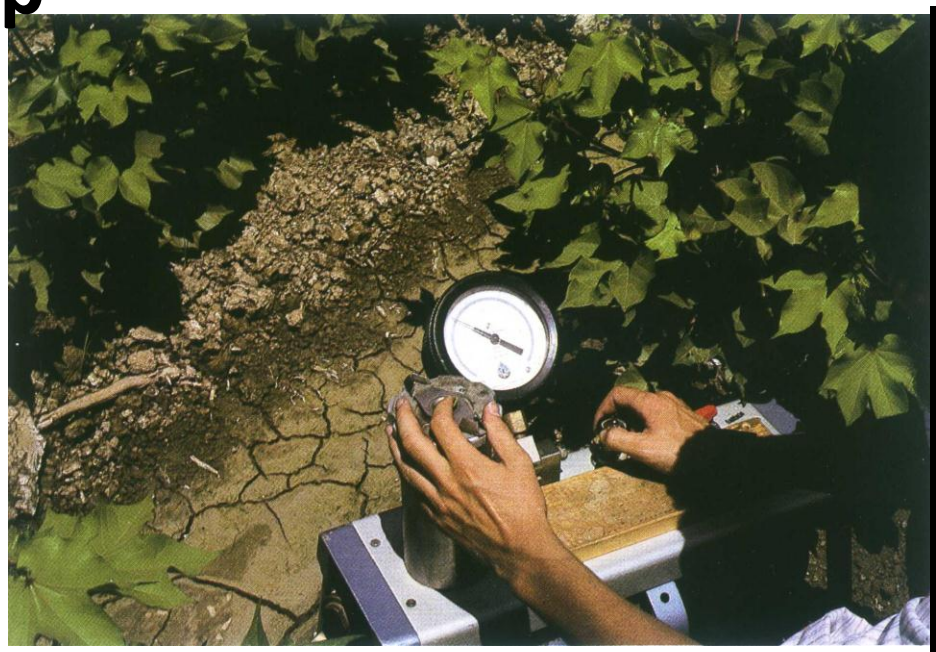
Focusing on the Irrigation Process

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

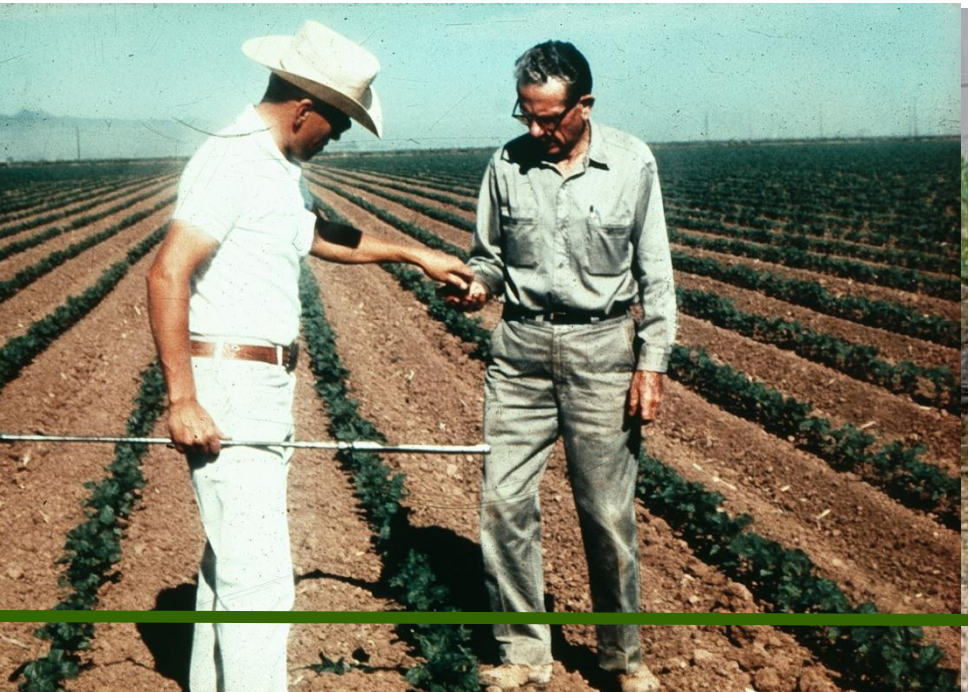
ACHIEVING A STANDARD FOR ETo ESTIMATION

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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Contents

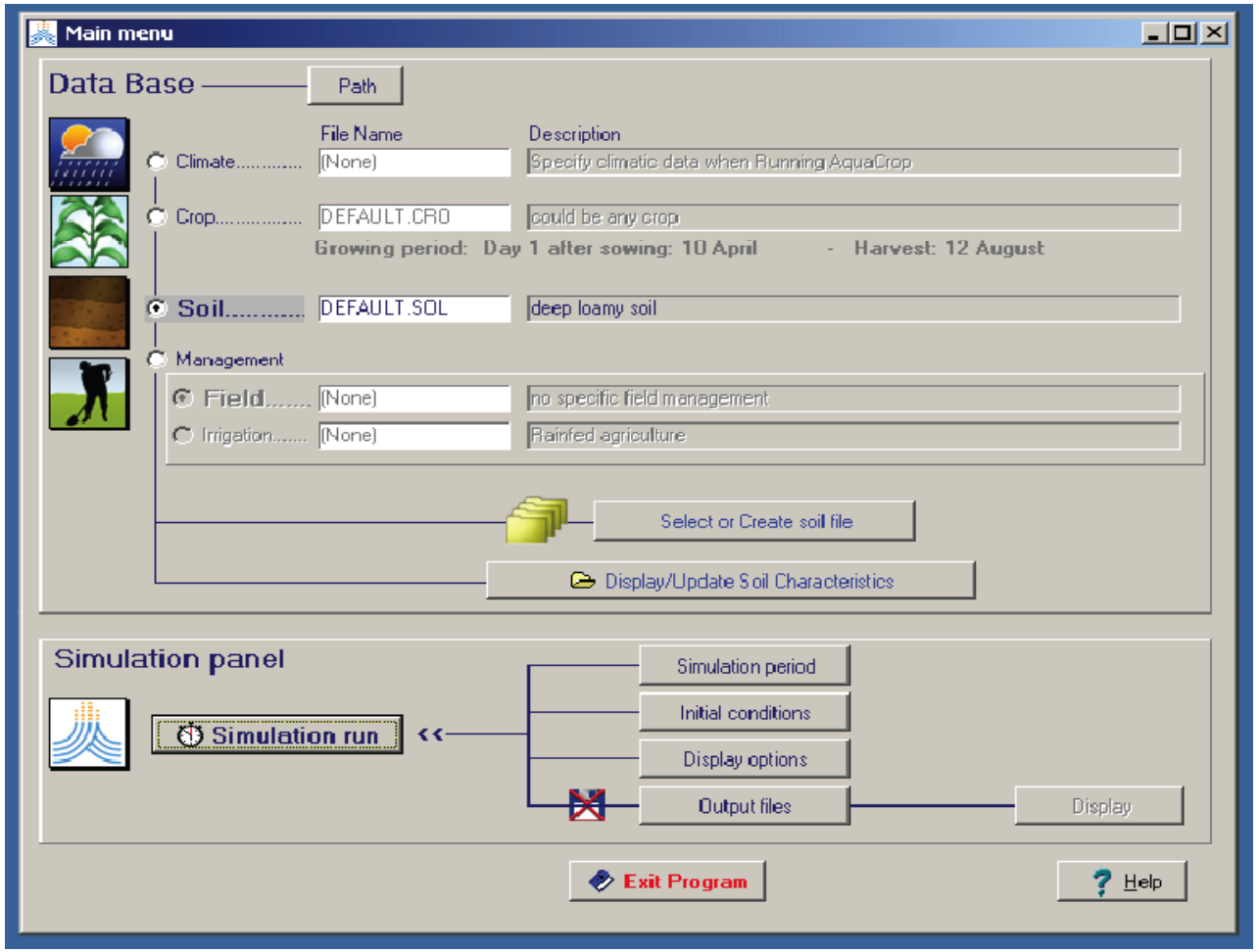
How much can we produce with a given amount of water?

Use of simulation models for benchmarking

AquaCrop:

a simulation model of water-limited crop production

AQUACROP
crop production simulator



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 CONSOLIDER OF THE GOVERNMENT OF SPAIN.

(CHECK THE WEB UNDER RIDECO)

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

Rideco

Consolider

Pistachio farm, Madera Co. California

REMOTE SENSING FOR MONITORING STRESS?

Tree spacing
5.8 x 5.2 m

HIGH RESOLUTION THERMAL IMAGES FROM AIRPLANES

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

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INSTITUTO DE AGRICULTURA SOSTENIBLE
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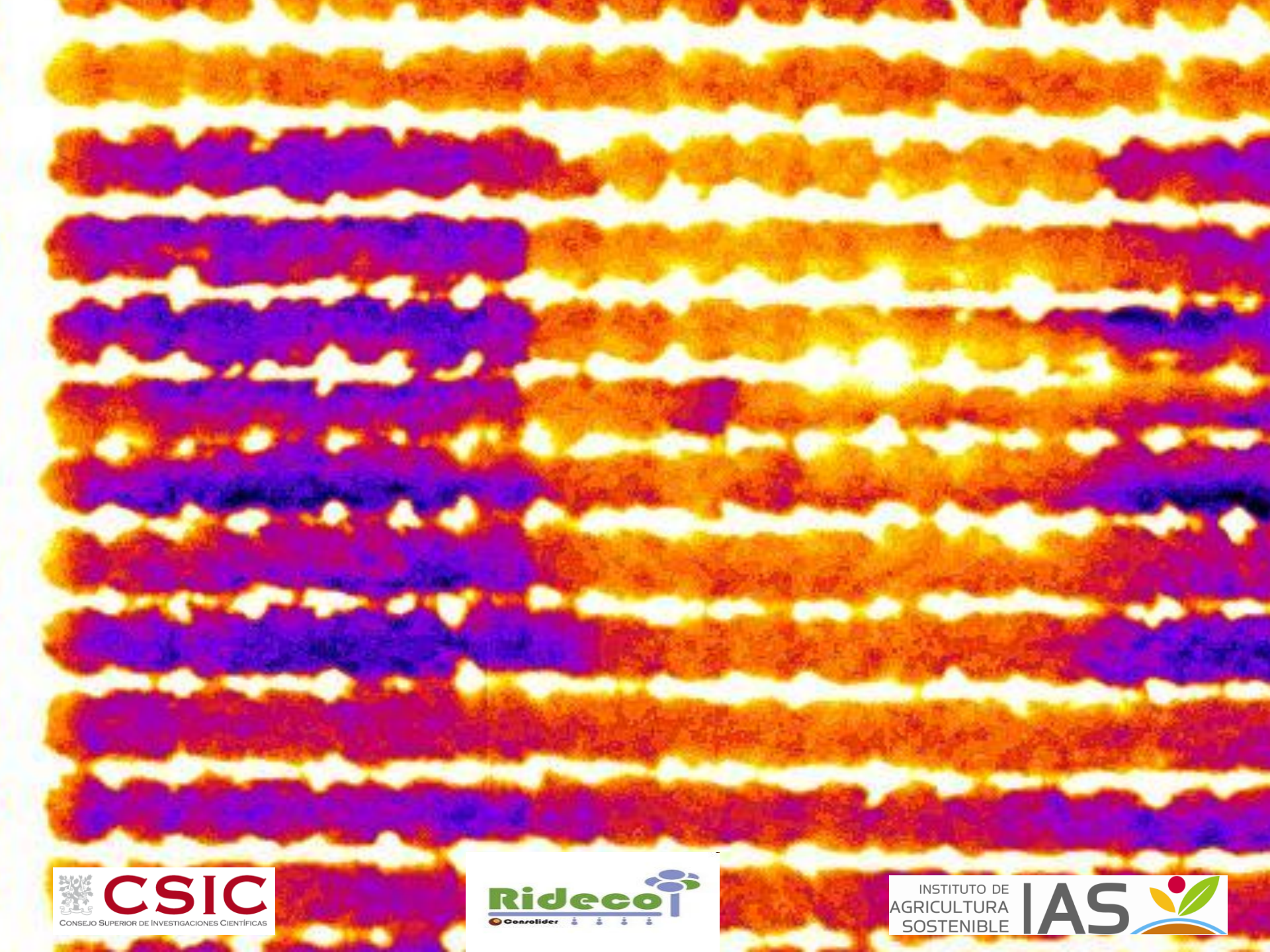

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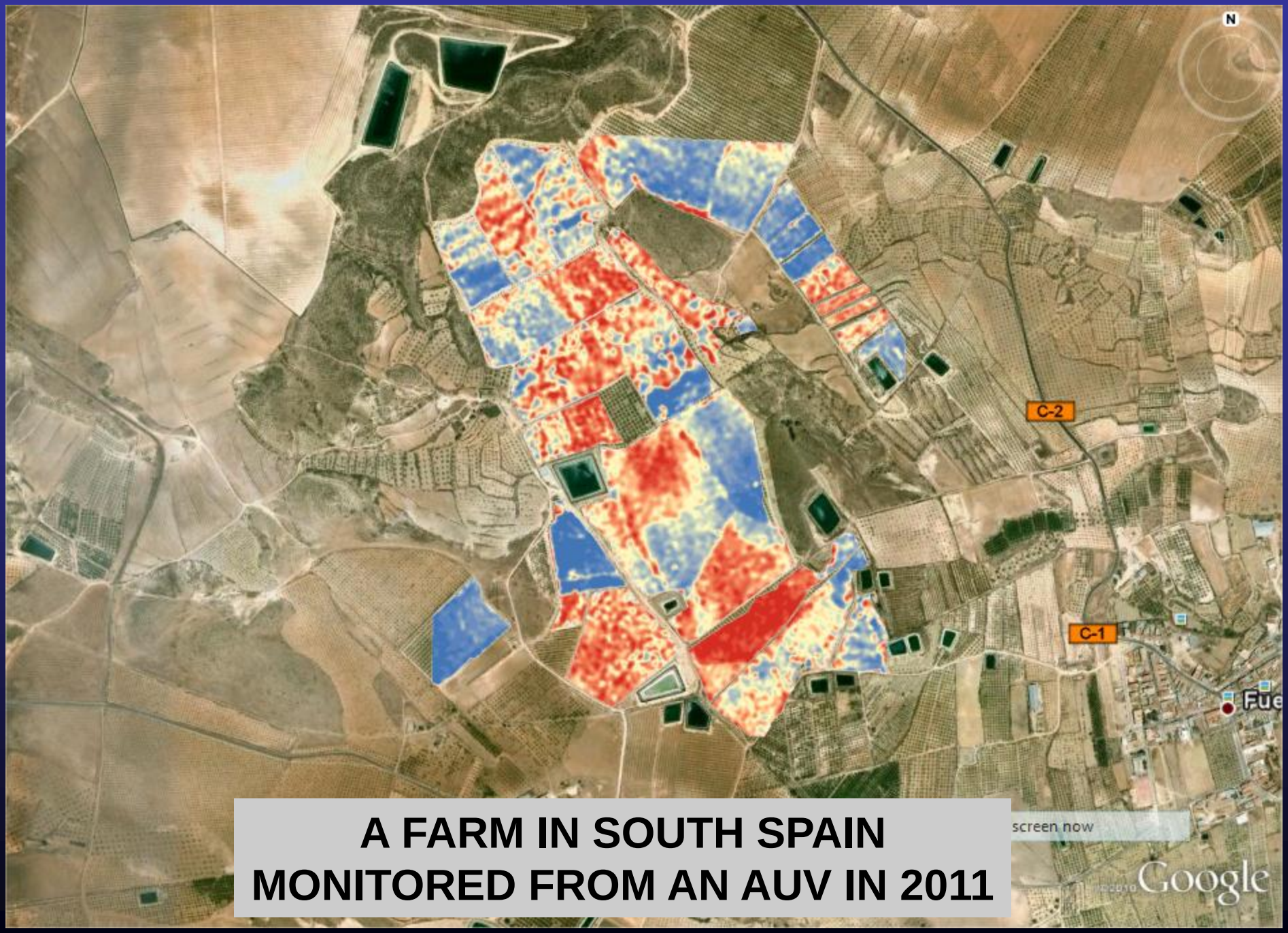
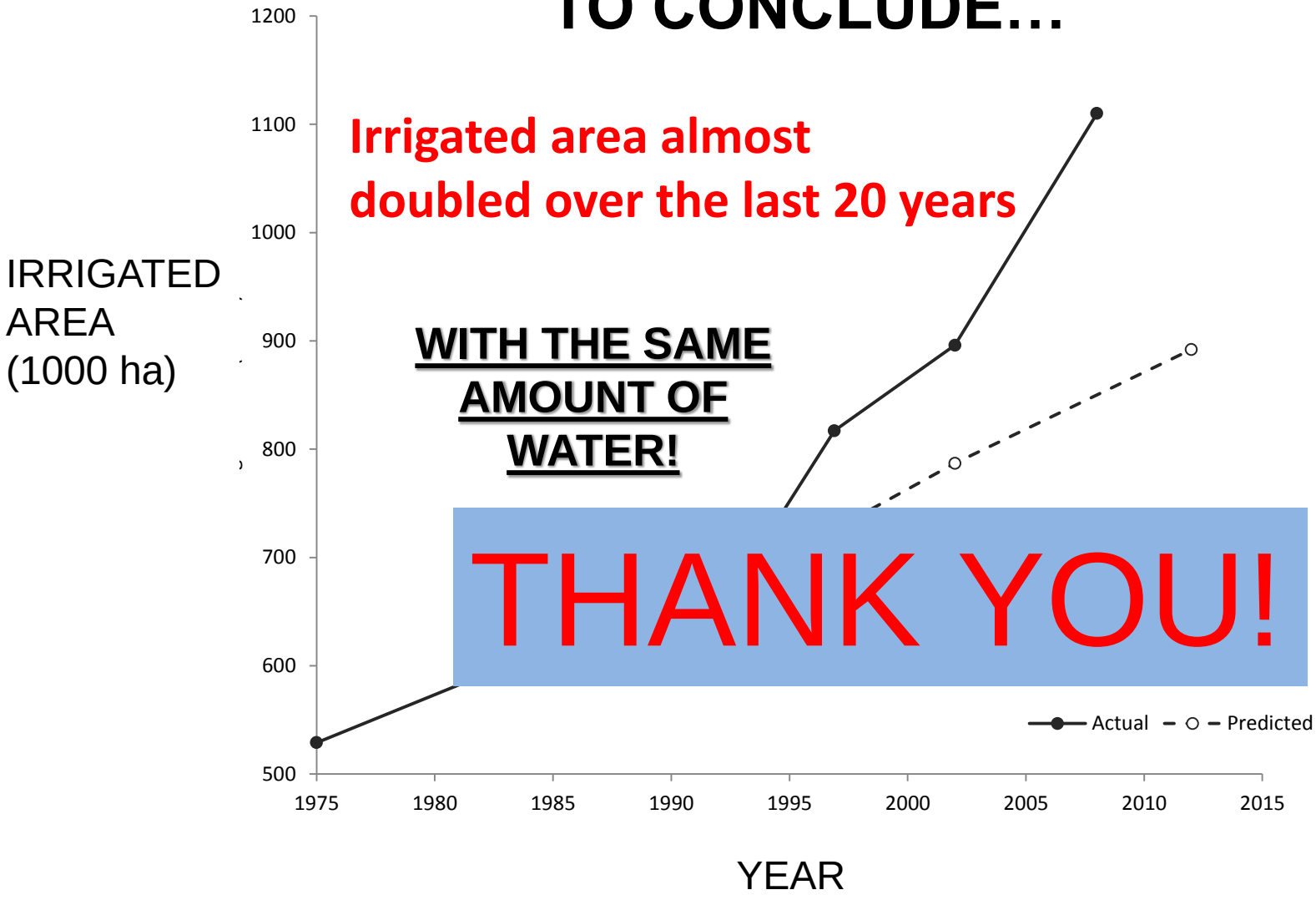


A FARM IN SOUTH SPAIN MONITORED FROM AN AUV IN 2011

TO CONCLUDE…



Evolution of irrrigated area in Andalusia, Spain