Sustainable irrigation management strategy in semi-arid climate conditions in South Italy

Bartolomeo Dichio

bartolomeo.dichio@unibas.it
There are not significant effects on mitigation of Climate Change

GLOBAL TEMPERATURES ARE LIKELY TO RISE BY 0.3 TO 5 °C BY THE END OF THE CENTURY.

Parties to the U.N. Framework Convention on Climate Change (UNFCCC) reached a landmark agreement on December 12 in Paris

Reaffirm the goal of limiting global temperature increase well below 2 degrees Celsius, while urging efforts to limit the increase to 1.5 degrees
Climate change in Europa

↑ winter rainfall (floods)
↑ sea levels
↑ hotter and drier summers
↑ crop yields, range

↑ sea / lake levels
↑ storms, floods
↑ hotter and drier summers
↑ growing seasons
↑ crop potential
↑ pests
↑ permafrost thaw

↑ temperature
↓ annual rainfall, water availability
↑ drought risk, heat stress
↓ crop yields
↓ suitable crop areas

↑ winter rainfall (floods)
↓ summer rainfall
↑ drought risks
↑ Soil erosion risk
↑ growing season length
↑ crop yields and range

http://ec.europa.eu
Esposito S. et al. 2014  Atti convegno Progetto Agroscenari

deficit = 855 mm

Precipitazione totale annuale media trentennio 1981 - 2010
Basilicata – ITALY

agriculture

Land use of the whole territory

- Agricultural land
- Forests
- Natural areas
- Artificial areas

12%
58%
29%
1%
BASILICATA: hydrographical system

- Ofanto
- Bradano
- Basento
- Cavone
- Sele
- Agri
- Noce
- Lao
- Sinni

5 main rivers
BASILICATA Region: WATER

Maximum capacity of dams:

950 Mm3
Distribution of water use between sectors

- Civil use
- Irrigation
- Industrial use

Irrigated fruit crops in Basilicata: 72%

Sharing of water resources with adjacent regions

- Basilicata 40%
- Puglia 58%
- Calabria 2%

640 Mm$^3$/year
CSA is agriculture that

- increases yields (poverty reduction & food security),
- makes yields more resilient in the face of worsening weather conditions (adaptation), and
- transforms the farm into a solution to the climate change problem (mitigation).

(World Bank, 2012)
Potential win-wins for Sustainable soil and Water Outcomes

- **Soil management**
  - **Nutrient management**
    - Integrated pest management
    - Reduced fertiliser/pesticide use
    - Precision agriculture
  - **Management combating SOM loss/erosion**
    - Permanent cover
    - Crop rotations
    - Low/zero tillage
    - Catch crops
    - Residue mgmt

- **Water management**
  - **Water quality**
    - Reduced nitrate run-off
    - Reduced pesticide pollution
    - Reduced eutrophication
    - Reduced sediment run-off
  - **Sustainable water use & water efficiency**
    - Optimised crop patterns
    - Improved water retention in soils
    - Reduced water use
    - Improved water efficiency
  - **Farm measures**
    - Water harvesting
    - Water re-use
    - Water metering
    - Precision irrigation
Optimization water use in Agroecosystem

\[ WUE = \frac{\text{Biomass (Kg)}}{\text{Transpired Water (m}^3)} \]

Marketable Yield value

\[ WP = \frac{\text{Irrigation water}}{\text{Water Productivity}} \]

\( WP = \text{Water Productivity} \)
**Sustainable**

- Peach orchard cv. Super Crimson/GF667
- 500 tree/ha

**Compost (15 t ha⁻¹)**

**Mineral N if necessary**

**Soil management**

- Untilled soil
- Spontaneous grass

**Fertilization**

- Mineral fertilizers

**Pruning material**

- Guided drip irrigation
- Crop evapotranspiration and Soil Water Balance

- Cipping pruning residues into the soil
Water balance implementation

Weather Parameters ($ET_0$)

Soil data → Soil water balance → Crop data

SWC measurements

Water balance Optimized
the continuous monitoring of soil water content along the soil profile give us information to correct the irrigation scheduling.
Wetted soil by irrigation 90 cm

Water Table 120 cm
Optimization and Application of Regulated deficit irrigation

From bud break to Harvest 100% ETc

Post-harvest

Deficit application 50% ETc

March/July

At the end of September

How much water can be saved with summer pruning?

Summer pruning 10 m² p⁻¹

24 L d⁻¹ p⁻¹ 60-80 g

about 750 m³/ha

About 1000 m³/ha

2,3 litri H₂O x m² of leaves

Daily w. transpired 66 lt/tree
Increase soil water holding capacity

Mechanical tillage reduces water infiltration causing runoff and erosion processes

Sustainable management practices increase infiltration rate and water storage in soil

$K_{sat}^{13} \text{ (mm d}^{-1})$

2934 m$^3$/ha

$K_{sat}^{160} \text{ (mm d}^{-1})$

4250 m$^3$/ha

$>1.300 \text{ m}^3$/ha
Irrigation volume (m³ ha⁻¹)

Dichio et al. 2011
Water footprint (L)/Kg of fruit

<table>
<thead>
<tr>
<th></th>
<th>Sustainable</th>
<th>Conventional</th>
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<tbody>
<tr>
<td>Sustainable</td>
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<td></td>
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<tr>
<td>Conventional</td>
<td>380</td>
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</table>

Marketable Yield value (€)

\[
W.P. = \frac{\text{Marketable Yield value (€)}}{\text{Irrigation water (m}^3\text{)}}
\]

Cumulative Yield t/ha

<table>
<thead>
<tr>
<th>Year</th>
<th>Sustainable</th>
<th>Conventional</th>
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</thead>
<tbody>
<tr>
<td>2004</td>
<td>20</td>
<td></td>
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<td>2005</td>
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<td>2006</td>
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<td>2007</td>
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<td>2008</td>
<td>100</td>
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<tr>
<td>2009</td>
<td>120</td>
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</table>

- Sustainable: € 2,11
- Conventional: € 1,34
New Technologies in agriculture

Profiler GSSI EMP-400
5000 values $EC_a$ for site (1 hectare)

Elaboration & validation data (-8%)

To obtain soil variability maps (soil $EC_a$)
(data interpolation: kriging)

Orchard management support (nursery, establishment, irrigation, nutrition, etc)
Validation and implementation of the innovations at field level (testing, scaling up, demonstration, training)
MATERA 2019
EUROPEAN CAPITAL OF CULTURE

VENUE FOR
IX ISHS INTERNATIONAL SYMPOSIUM
ON IRRIGATION OF HORTICULTURAL CROPS.

Conveners
Prof. Bartolomeo Dichio
Prof. Cristos Xiloyannis

BASILICATA
Italy's secret garden
Thank you
Promoting water efficiency and supporting the shift towards a climate resilient agriculture in Mediterranean countries

INFORMATION
T.: +30 2310 250601-3, e-mail: yotos@otenet.gr, site: www.lifeagroclimawater.eu