SUSTGREENHOUSE

A project co-financed by the European programme LIFE+

www.sustgreenhouse.eu

"The Sustainable Greenhouse: demonstrative action for zero emission intensive greenhouse agriculture"

February
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Regione Lazio
ASSESSORATO ALL'AGRICOLTURA

Arsial
AGENZIA REGIONALE PER LO SVILUPPO E L'INNOVAZIONE DELL'AGRICOLTURA DEL LAZIO

ALMA MATER STUDIORUM
UNIVERSITA DI BOLOGNA

Localisation:

Salto di Fondi site, Latina province, in protected area: Regional Park Monti Ausoni (Ausoni mountains), SCI Fondi Lake

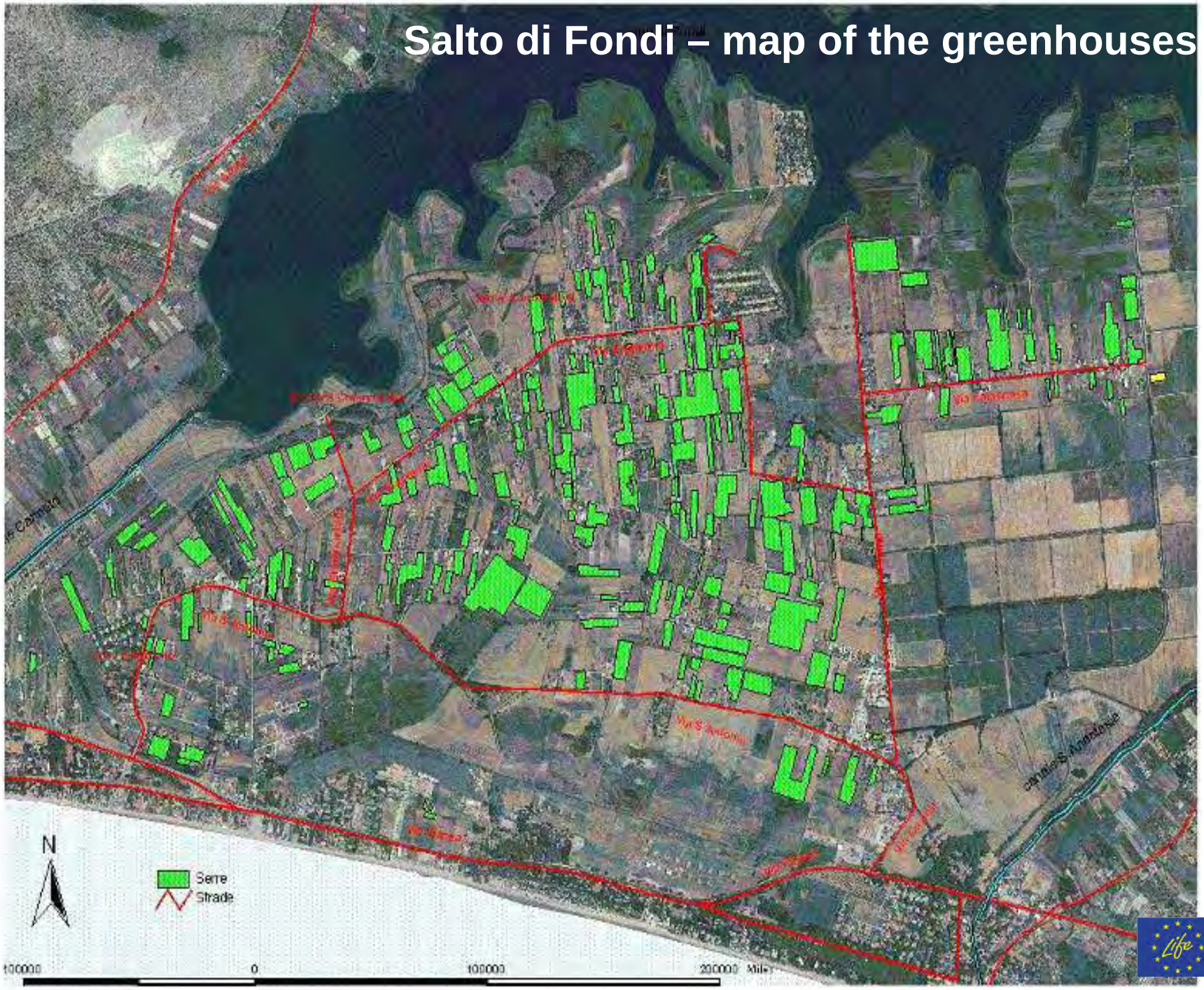
General greenhouse farming problem in Italy:

- 140.000 TEP for heating (2007 data)
- from 10 to 20 chemical treatments/crop

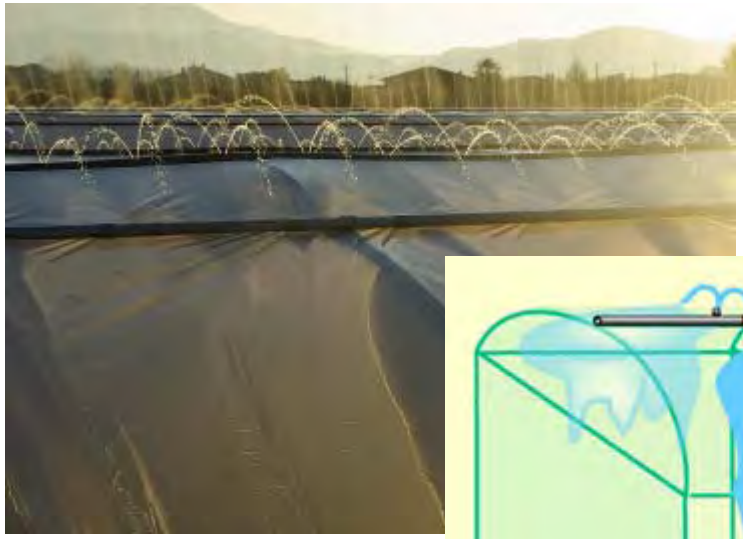
Specific environmental problem:

- Total Farming Surface = 634 ha
- Greenhouse crops = 85 ha
- Water yearly consume for heating = 15,7 Mio litres/ha
- Lowering of the groundwater , saltiness, lowering of the soil
- micro-nutrients excess in the soil (phosphorus and potassium)

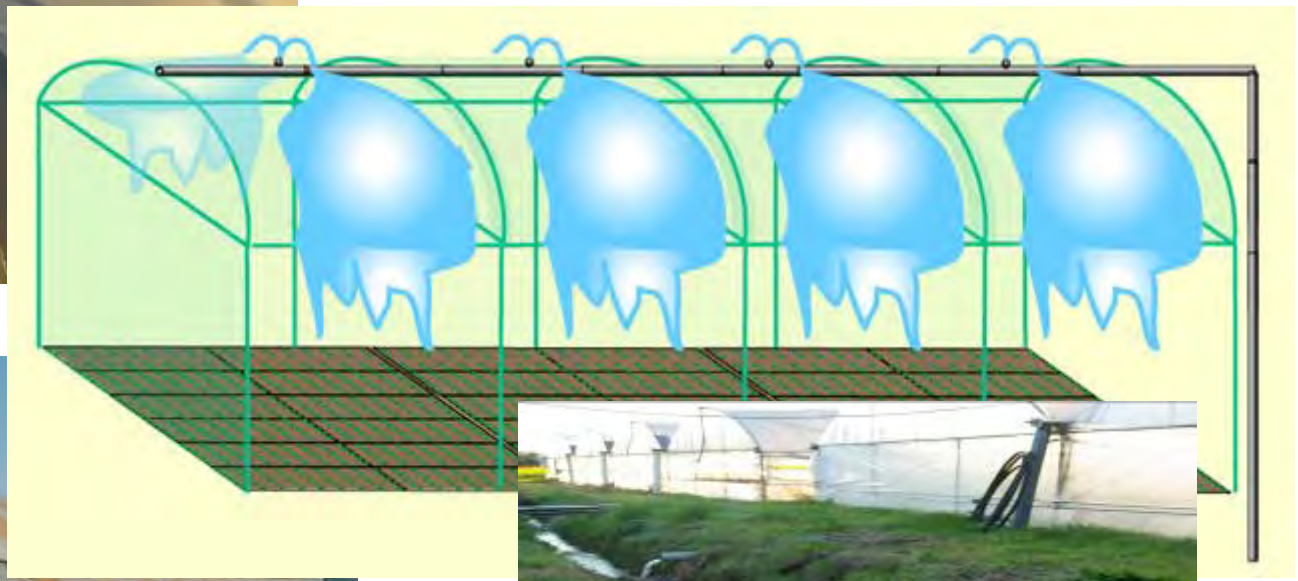
Salto di Fondi – map of the greenhouses

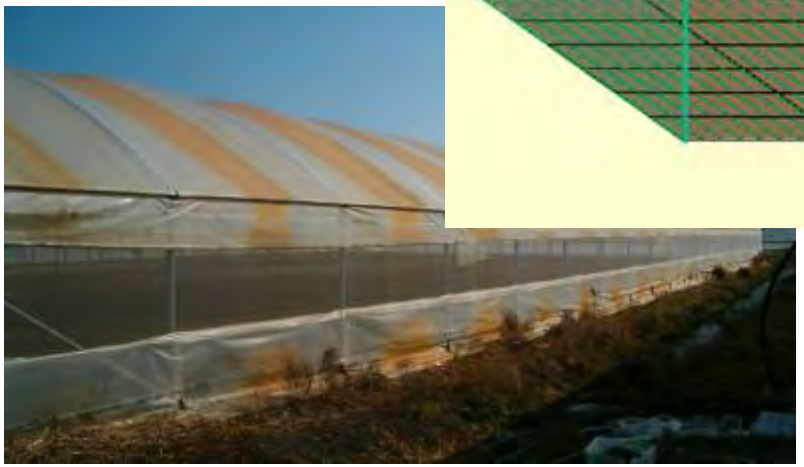


The irrigation heating system, known as “idroserra” presently utilised in Fondi



Sbrinex pipe = huge use of water from underground well : 1 litre/minute/ha;
iron salt layer on the cover





The Idroserra ha a strong environmental impact, because realised on open cycle pumping underground water without recycling:

- waste of millions of cubic meters of freshwater every year and consumption of the wells with greater dangers because on an area subject to:
- soil lowering
- saltiness intrusion inside the wells
- underground water irreversible loss
- soil erosion
- seasonal over-labour for the hydraulic area maintenance compelled to bring up huge water masses
- rise of the area consortium management costs reflected on the public users

Sustgreenhouse objectives

➔ to reduce energy, water an chemical input

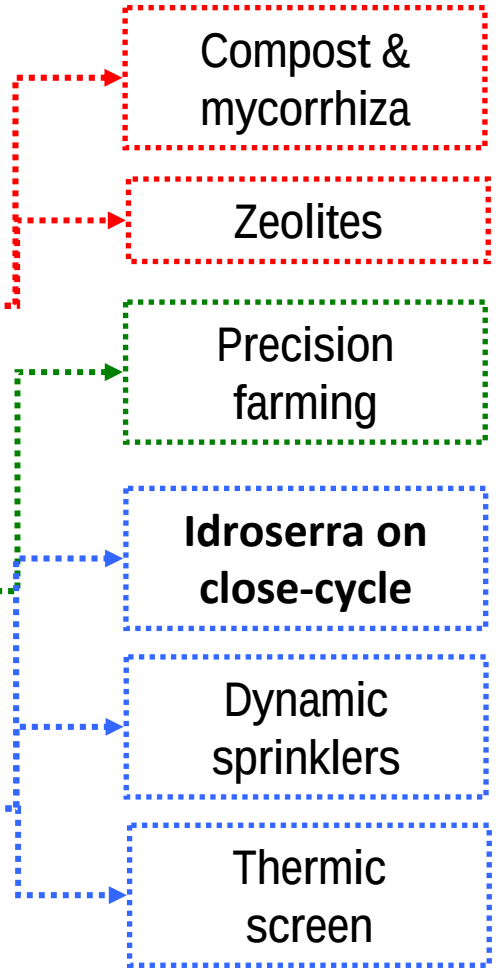
➔ to reduce CO_2 output

Sustgreenhouse Metods

a) growing substrates to enhance soil fertility and biodiversity, to increase root adsorption, to reduce chemical nutrients and irrigation water, to increase CO_2 adsorption and sink.

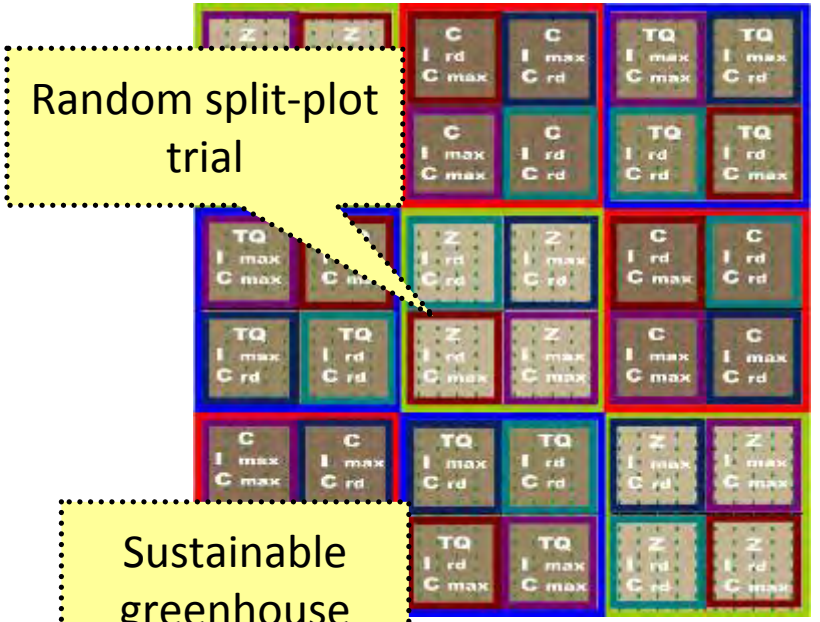
b) provisional and/or diagnostic tools in order to optimise irrigation and fertilizing and to reduce waste and use of water and nutrients.

c) tools to protect greenhouse crops from the low winter temperatures, alternative to the conventional “Idroserra”

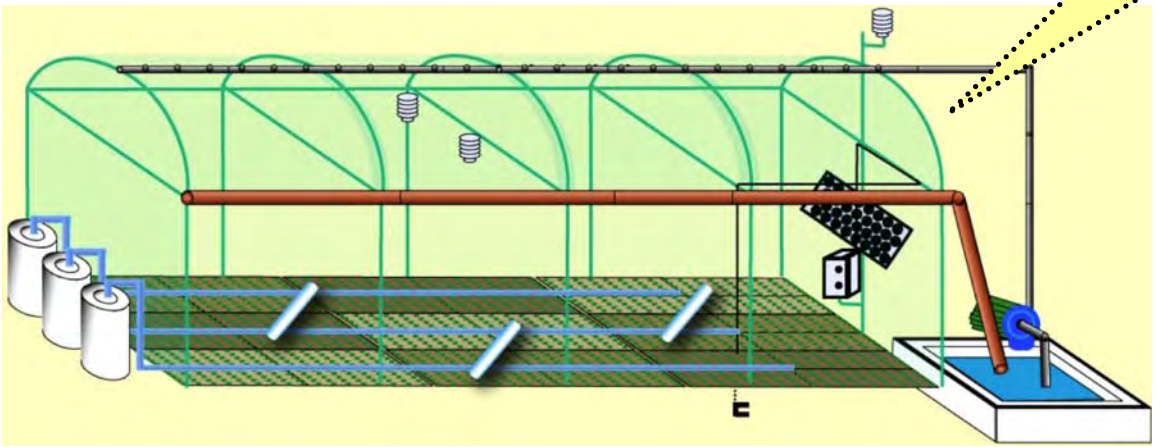


Sustgreenhouse Demostration 2009-11

- ➔ crop results comparison between conventional and sustainable greenhouse
- ➔ 4 crops alternating zucchini and tomato
- ➔ demonstration split-plot scheme with 36 random blocks with 3 trials and 4 under-trials repetitions



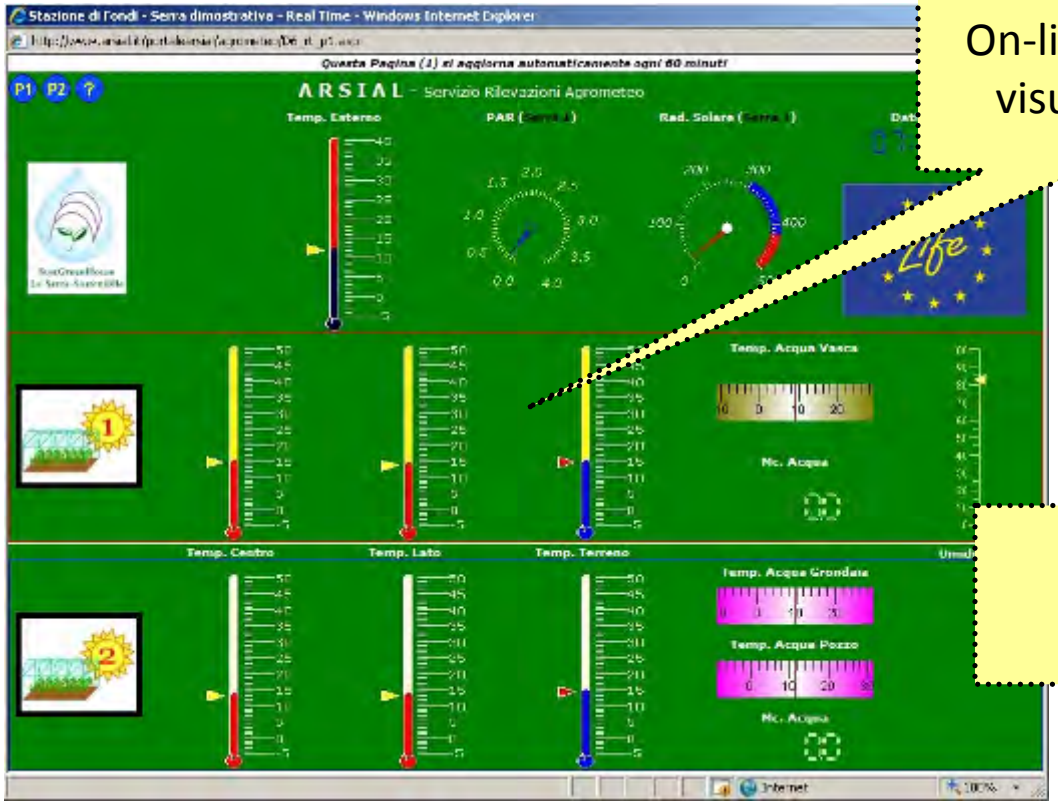
Sustainable greenhouse



Root monitoring device

Sustgreenhouse demonstration 2009-11

➔ environmental monitoring equipment for soil, crops and roots, on-line real time link on Internet, production sample analyses and data collection, economic and environmental LCA assessment



On-line sensors visualisation

FDR soil moisture sensor

Ciras 2 soil respiration analyser

Cropscan soil radiation analyser

Crop results analyses scheme

Comparison of the growth substrates:

TQ = standard soil

Compost = soil added with compost & mycorrhiza

Zeolite = soil added with zeolites

Provisional and/or diagnostic tools based on 2 irrigation management methods (precision farming):

Imax = in compliance to the Latium Regional Authority standards

Irid = reduced on the demand as detected by the sensors

Factorial combined with 2 different methods of fertilizing management:

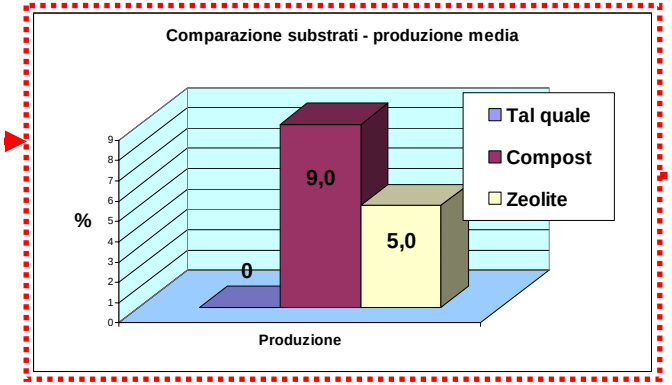
Cmax = in compliance to the Latium Regional Authority standards

Crid = reduced on the demand as detected by the sensors

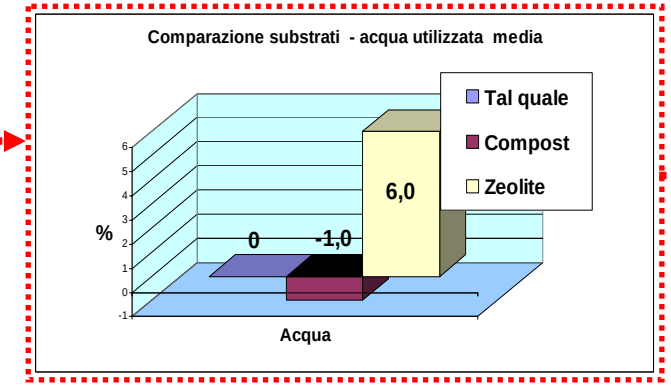
Sustgreenhouse 4 crops mean results

Comparison of growth substrates:
- Tal Quale = Standard,
- **Compost**-mycorrhiza,
- **Zeolites**

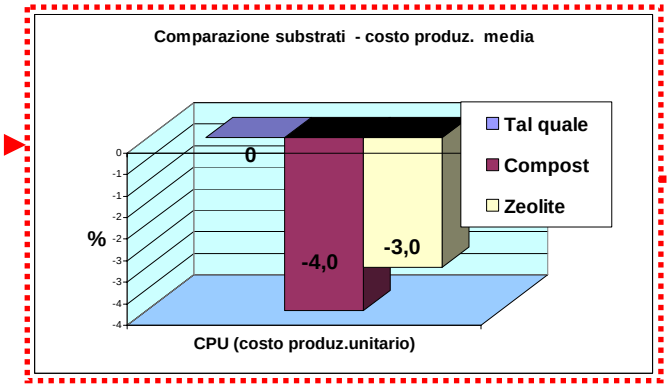
for a Nitrogen levelled input (87,3 Kg/ha)



Production t/ha
Standard 78,7
Compost 85,5
Zeolites **82,6**



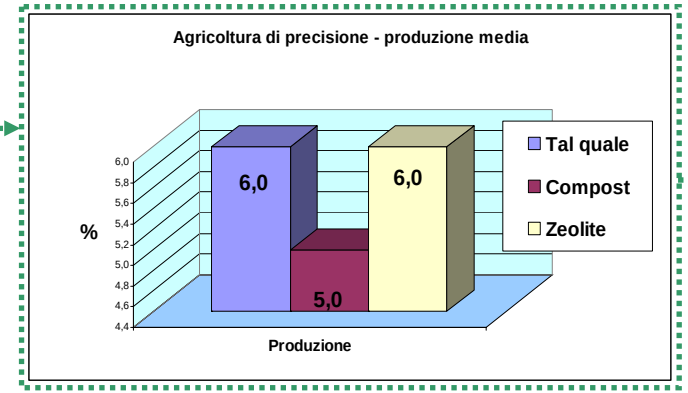
Water m3/ha
Standard 2073
Compost 2052
Zeolites 1103



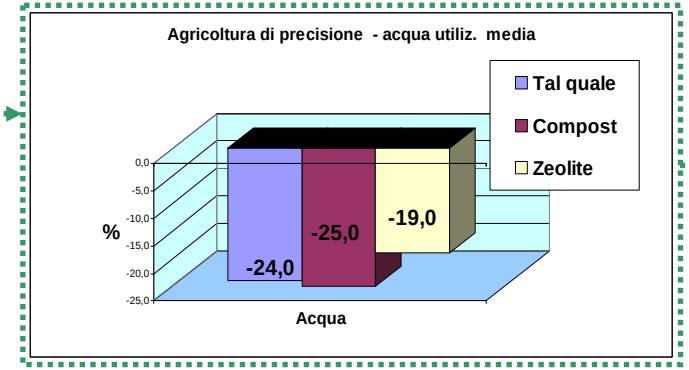
Cost €/kg
Standard 1,80
Compost 1,75
Zeolites 1,77

Sustgreenhouse 4 crops mean results

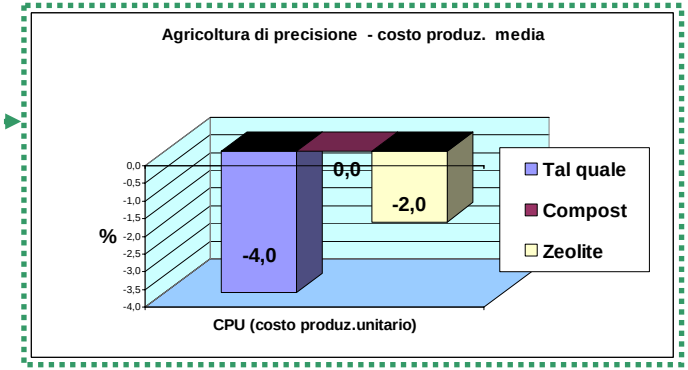
Precision farming with reduced irrigation and fertilizing as result to the sensors monitoring:
Irid + Crid
for a **Nitrogen** levelled input **-31%** (60,3 Kg/ha)



Production t/ha
Standard 83,4
Compost 82,6
Zeolites 83,4



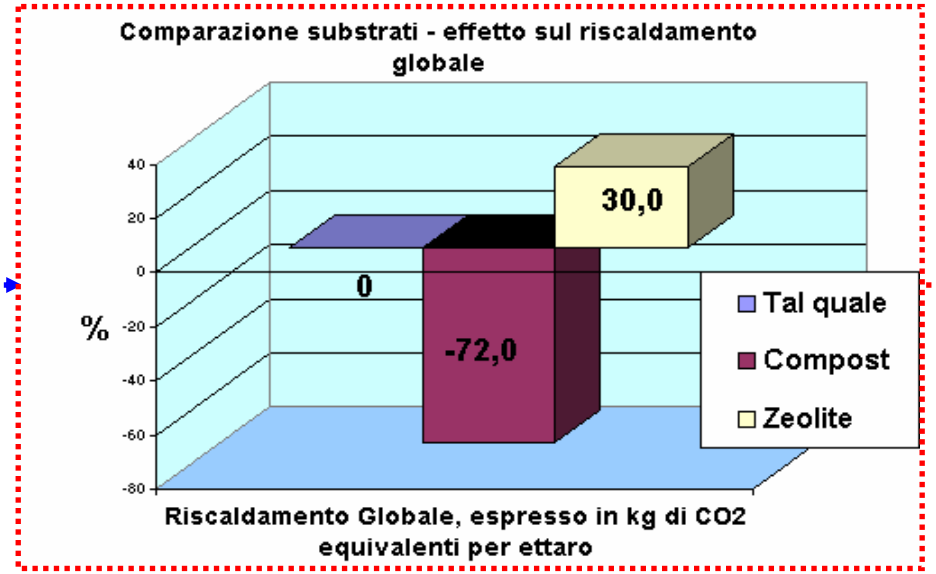
Water m3/ha
Standard 1576
Compost 1555
Zeolites 1679



Cost €/kg
Standard 1,75
Compost 1,82
Zeolites 1,79

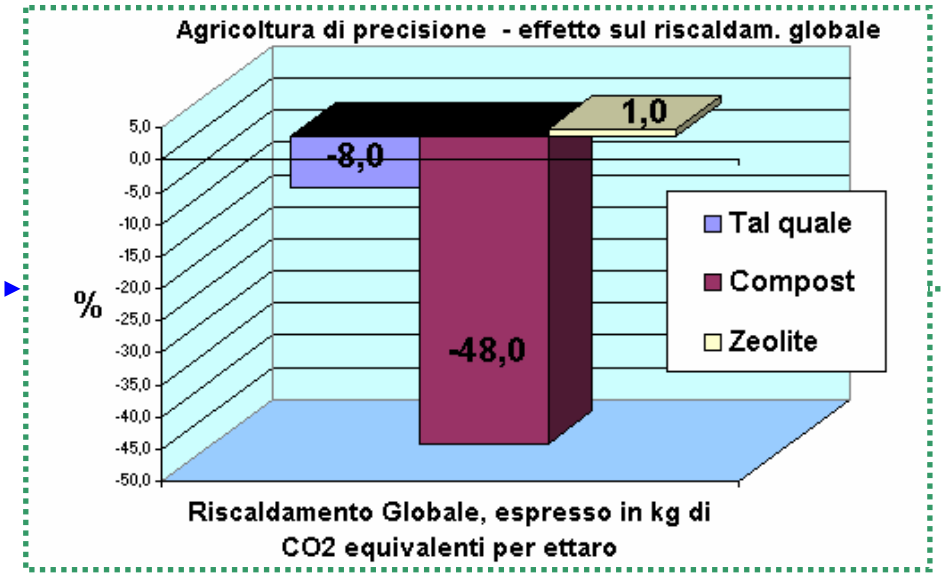
LCA analysis Sustgreenhouse 4 crops mean

LCA analysis: effect of the comparison of growth substrates and of precision farming on Global Warming given as CO2 kg for hectare of harvest



Kg CO2 / hectare.

- Standard 9
- Compost 2,5
- Zeolite 11,7

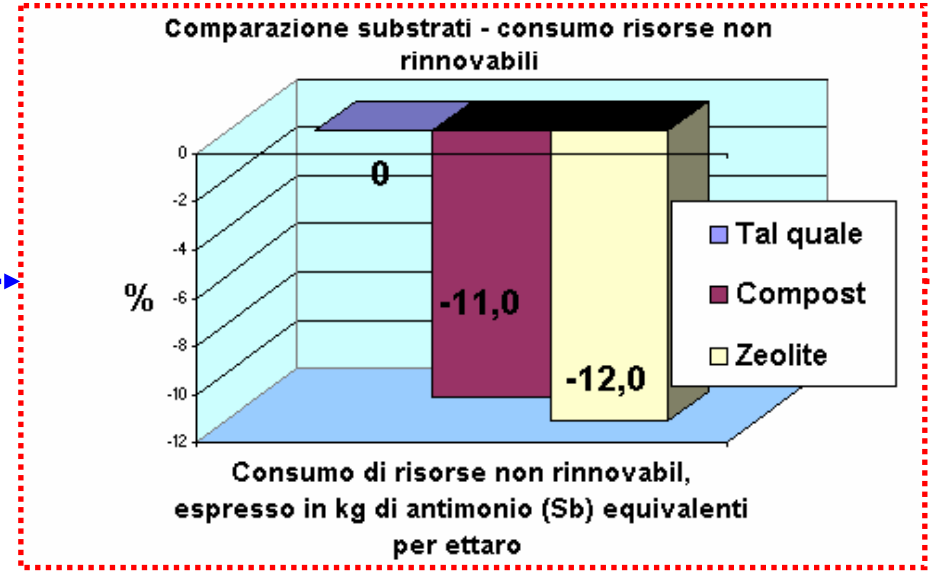


Kg CO2 / hectare

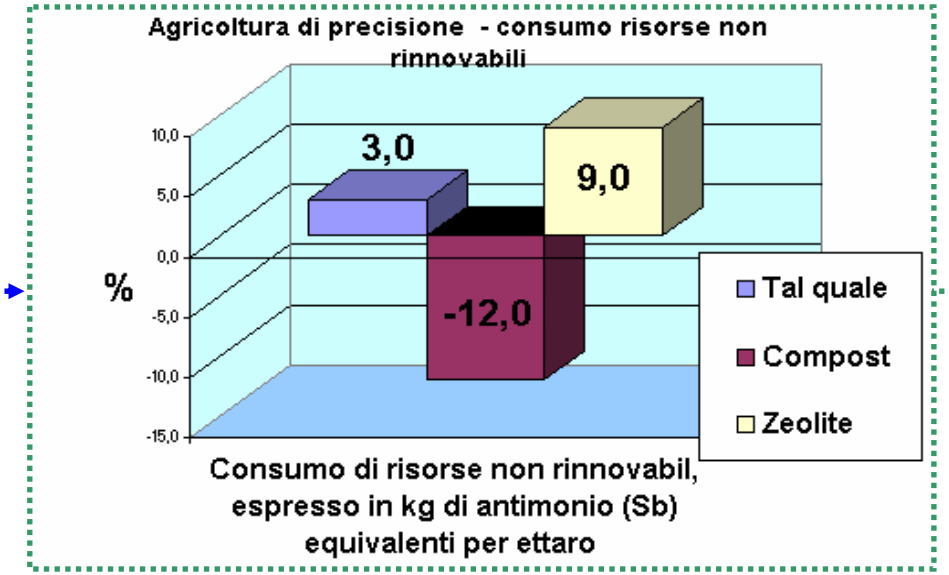
- Standard 8,3
- Compost 2,3
- Zeolite 9,1

LCA analysis Sustgreenhouse 4 crops mean

LCA analysis: effect of the comparison of growth substrates and of precision farming on the utilisation of un-renewable resources, given in kg of antimony (Sb) equivalent per hectare of harvest



Kg SB / hectare.
- Standard 60,8
- Compost 54,1
- Zeolite 67,5



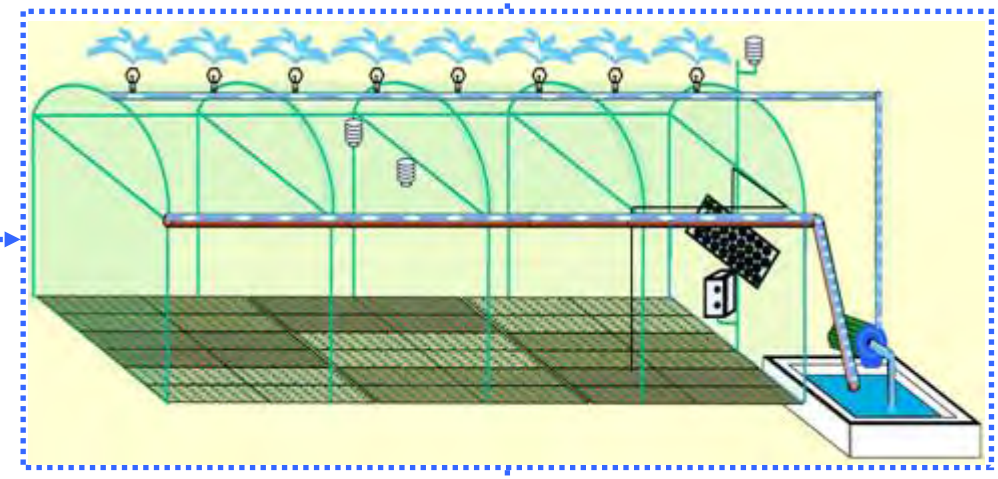
Kg SB/hectare.
- Standard 62,6
- Compost 53,5
- Zeolite 66,3

Sustgreenhouse Idroserra results

TEST 1

Comparison between:

- idroserra with recycling pool (m^3 19,5) = S1
- standard idroserra (open cycle) = S2



- Internal central air Temperature S2 > S1 = + 1,7 ° C
- Internal side air Temperature S2 > S1 = + 1,5 ° C

Water used m^3:

- S1 = 114 (96 recycled + 18 pool)
- S2 = 96 (wasted)

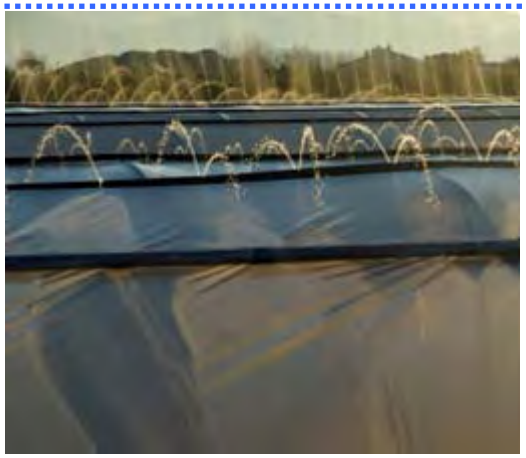
Water saved: 81%

Sustgreenhouse Idroserra results

TEST 2

Comparison between:

- water drill pipe irrigation (sbrinex pipe)



m^3/night-trial water used: 61,8

- water nebulisation sprinklers

m^3/night-trial water used: 47,8

Water saved: 22,3 %

Sustgreenhouse Idroserra results

TEST 3

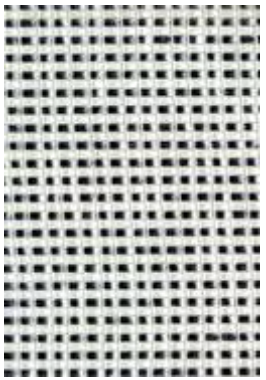
Utilisation thermal screen, comparison between:

- standard idroserra (S2)
- Thermal screen idroserra (S1)

Before water start:
Inside air temperature S 1 > S 2
= + 1,8 ° C
During idroserra functionning
S 1 > S2 = + 0,6 ° C

Water saved: 86 %

Screen used:
BONAR BV (NL)
Alluminium foil
PH 55 FP Flame protect
Shading 55%
Energy save 58%
Anti UV treament
Weight: 84 gr/mq
Anti-condense



SUSTGREENHOUSE work team thanks you

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