Friendly Fruit

PRACTICES PERFORMANCES & RESULTS

Evaporative cooling for heat waves management

Federica Rossi, Slaven Tadić, Camilla Chieco
CNR-IBE

01.01.2018 to 31.12.2020

Supported by: eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

History of experiments and selection of practice

The objective of the experiment was to assess the feasibility of evaporative cooling to reduce the impact of summer heat waves in apple orchards. The study aimed to evaluate the plants physiological reactions and productive performances with dripline and over-canopy irrigation in extreme temperature conditions. The two practices have been compared to estimate the potential positive effect of evaporative cooling.
The practice has demonstrated to help in decreasing 2-4°C the canopy temperature during extreme heat wave events.

Future heat wave occurrences in Europe have been predicted by a targeted model to identify the apple cultivation areas most prone to such hazard. With such issues becoming more probable, the practice demonstrated to reduce heat stress in orchards to guarantee stability of production.

Description of the practice selected for the leaflet

What ?

Implementation of the evaporative cooling practice in apple orchards.

Why ?

This practice tackles heat waves, caused by high temperature and radiation, to help farmers maintain high productivity in extreme scenarios

Status ?

Ready to use with some technological upgrade (i.e. irrigation automatically driven by temperature sensors)

Main steps to implement this practice

1. Setup of dripline irrigation: 2900 m/ha with 28 drippers/ha positioned at a 40 cm; flow: 1,6 mm/h.

2. Setup of additional over-canopy irrigation: 800 m of PE, in 6 lines, with 34 sprinklers/ha; flow: 4.5 mm/h; density 16.8 m x 17.5 m.

3. Installation of air temperature sensors

4. Activation of over-canopy sprinklers at 30°C for three hours.

Expected Key result / Message to take home

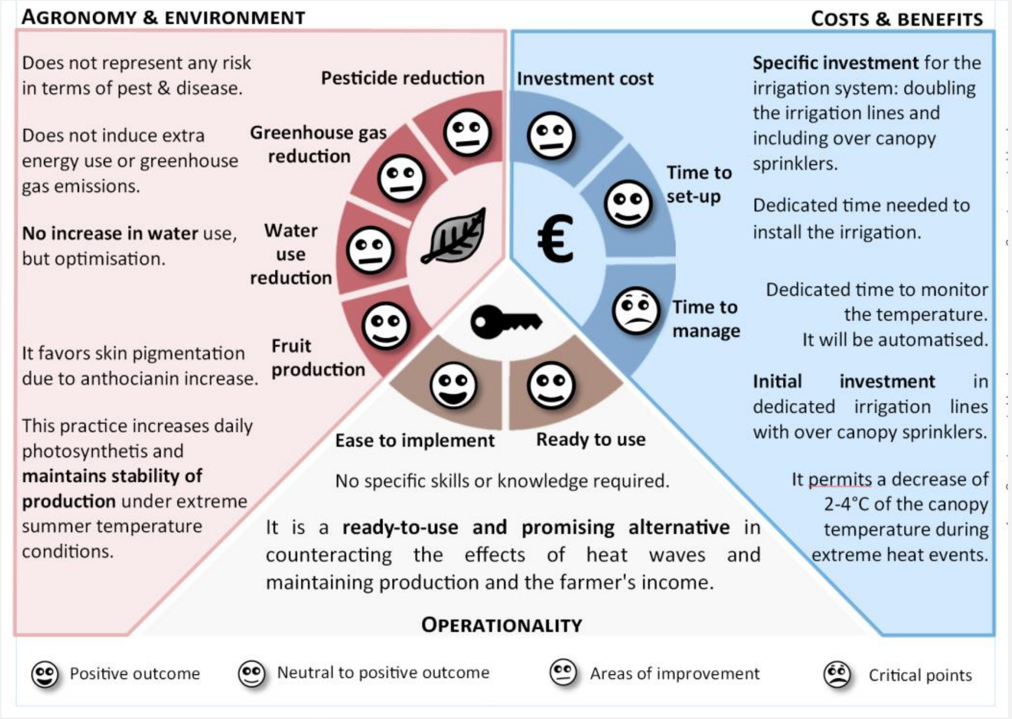
Evaporative cooling has demonstrated to help in decreasing leaf and fruit temperatures during extreme heat wave events. By decreasing the temperature in orchards it manages to retain the standard orchard productivity and quality expected by today’s markets.

Take home message: Evaporative cooling is a viable tool in the farmer's arsenal in tackling climate change and its impacts on tree performance and productivity.

Practice Performances

Most positive outcome:
This practice increases daily photosynthesis and maintains stability of production under extreme summer temperatures

Main negative outcome:
Specific investment for the irrigation system: doubling the irrigations lines and including over canopy sprinklers



Roadmap for transfer– Next steps

- The dissemination of the practice to European farmers will be worthwhile due to the proven increasing occurrence of summer heat waves.
- The irrigation systems that are currently in use in European apple orchards are mostly driplines. Growers should be instructed on how to efficiently integrate over canopy sprinklers within the irrigation apparatus.
- An agrometeorological weather station, or at least a temperature sensor, should be installed near the orchard to provide information on the temperature threshold (around 30°). Growers should be informed about the opportunity to manually start and mantain for at least 3 hours the evaporative cooling to alleviate potential hazards.
- If feasible, an automatic irrigation control, when the threshold is reached, should be set-up.

Friendly Fruit

PRACTICES PERFORMANCES & RESULTS

Pumping Solar System in Strawberry Production

Giuseppe Toscano, Sara Fabrizi, Daniele Duca

01.01.2018 to 31.12.2020

Supported by: eit Climate-KIC

Climate-KIC is supported by the EIT, a body of the European Union

History of experiments and selection of practice

- Photovoltaic panels convert sunlight into electricity without the use of fossil fuels. It’s also useful for stand-alone system
- Where to place the panels
- Lifting water from wells → irrigation

Description of the practice selected for the leaflet

What ?

Use of photovoltaic system to produce electricity to support strawberry cultivation and eventually post-harvest operations, such as:

- Solar pump
- Refrigerator system
- Other devices

Why ?

Reducing high environmental cost (CO2eq) of electricity from fossil fuels. Strawberry farming is highly water demanding in hot and dry climate and requires pumping from wells or ponds. Photovoltaic systems are suitable for dry and hot weather, isolated area and can occupy marginal areas.

Status ?

Promising results requiring additional experimentation

Main steps to implement this practice

- System fits for South-European or North-African climates
- Located outside greenhouse to avoid shading
- Water intake and energy need evaluation
- Context analysis (irradiation)
- Choice of different solutions (conventional system, dual sides, with reflecting panels, solar trackers…)
- Sizing and design
- System placement
- Performance monitoring and maintenance

Expected Key result / Message to take home

The use of a solar pump to extract the water needed for irrigation improves the environmental sustainability of strawberry cultivation.

More than 200 gCO2eq saved for 1 kg of strawberry

50 m^2 photovoltaic panels → quantity of water necessary annually

Message to take home

The use of renewable energy is nowadays an essential element to make environmental friendly the plantations ensuring accessibility to a key production factor such as water.

Practice Performances

Agronomy & Environment

Pesticide reduction effect not expected.

Substitution of fossil fuel with renewable energy and stand-alone electricity production (mitigation of GHG emission).

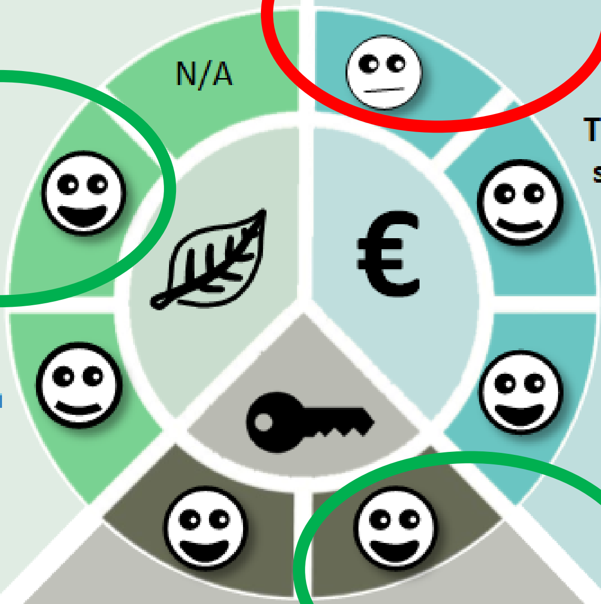
No effect on **yield** and fruit **quality**.

Replacement of non-renewable resources' use. GHG emission reduction. No impact on the agronomic practice

Pesticide reduction

Global warming potential

Fruit production



Investment cost

Time to set-up

Time to manage

Ease to implement

Ready to use

Costs & Benefits

Initial investment required.

Low time required for setting-up of the practice.

No extra time required for management.

Maintenance costs are very low. Service life at least 12 years The cost is less than 5c€/kg strawberry.

The practice does not require highly skilled staff.

Sustainable and effective energetic solution for south-European & north-African context.

Operationality

Positive outcome | Neutral to positive outcome | Areas of improvement | Critical points

Roadmap for transfer– Next steps

Transfer of the prototype to Morocco, set up and performance test

Sizing, design and sustainability and performance evaluation

Update of the system for real energy and water need (if requested)

Thanks for your attention