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CO_2 Fluxes of *O.ficus-indica* trees in relation to water stress

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Most experiment on gas exchange in *O. ficus-indica* have been done on single cladodes, with instantaneous measurements, taken at specific intervals during the night, putting the cuvette of the gas analyzer on spot points in both faces of the cladodes surfaces.

To our knowledge there is no data on gas exchange integrating all cladodes on a tree or an entire cladode od a certain age or position.

Aims

- Individuate a continous monitoring system of carbon fluxes for *Opuntia ficus-indica*;
- Measure CO_2 Fluxes of *O.ficus-indica* plants in relation to water stress;
- Measure CO_2 of single cladodes.

Materials and Methods (1)

Plant material:

3-year-old potted plants of *Opuntia ficus-indica*

- 3 plants irrigated
- 3 plants non- irrigated

Climatic measurements:

hourly measurements/day of air temperature, RH, soil water content and PAR (HOBO weather station and LI-COR quantum sensor)

Materials and Methods (2)

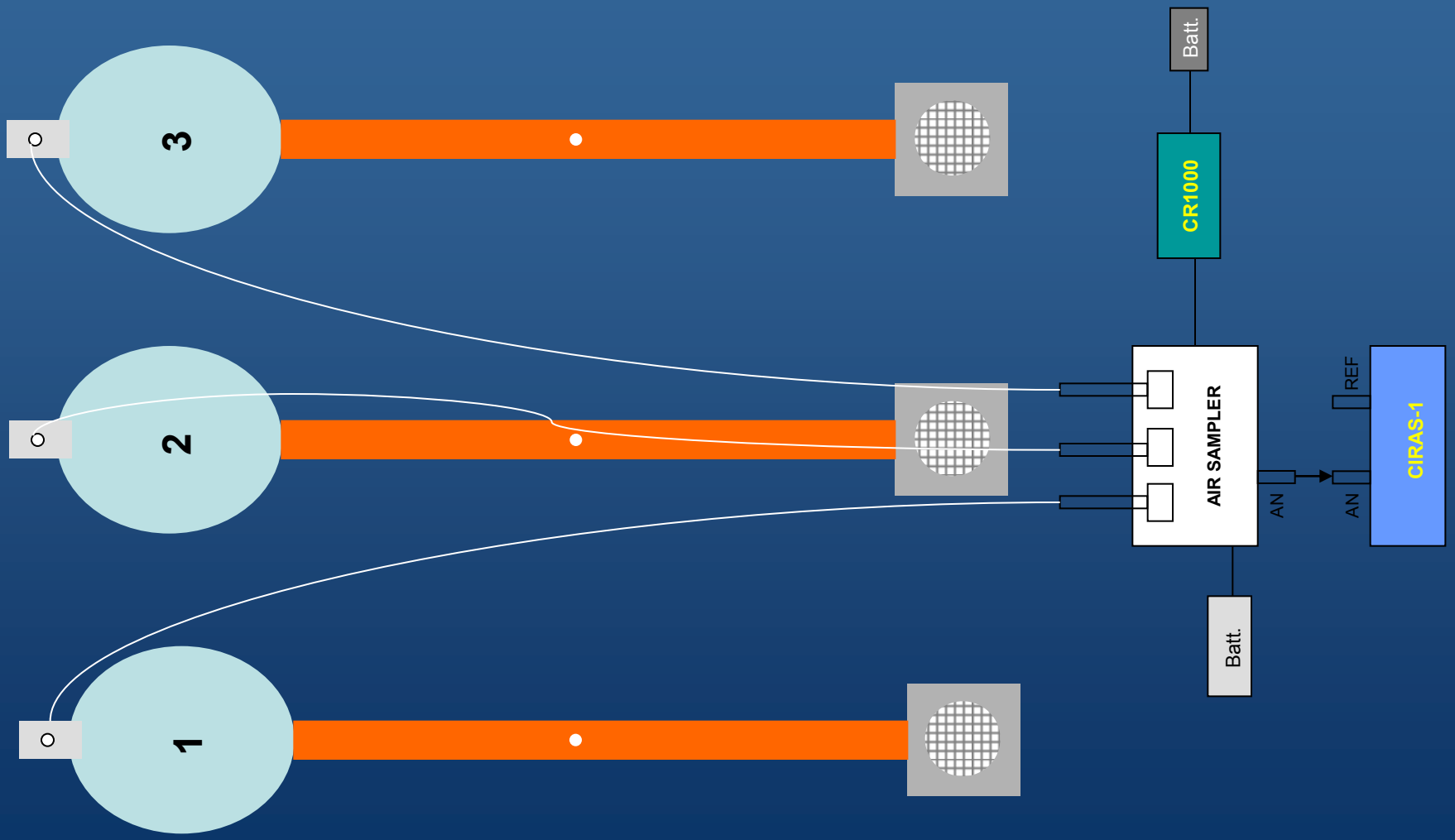
CO_2 measurements

Baloon system made up by:

- portable Infra Red Gas Analyzer (CIRAS-1, PP Systems, UK);
- air sampler;
- data logger (CR1000)

- ventilators and tubes

Monitoring system of carbon fluxes



baloon

IRGA, air sampler and data logger

Climatic condition at the experimental site

date	temperature			RH	Soil water content	
	Mean night (C°)	Mean day (C°)	mean (C°)	(%)	irrigated (% in Vol.)	non-irrigated (% in Vol.)
June	19.2	29.3	26,0	50,8	12,0	4,0
July	23.8	29.5	25,9	64,5	22,0	2,0
August	23.6	28.5	27,1	64,3	17,0	<2

Cladodes surface:

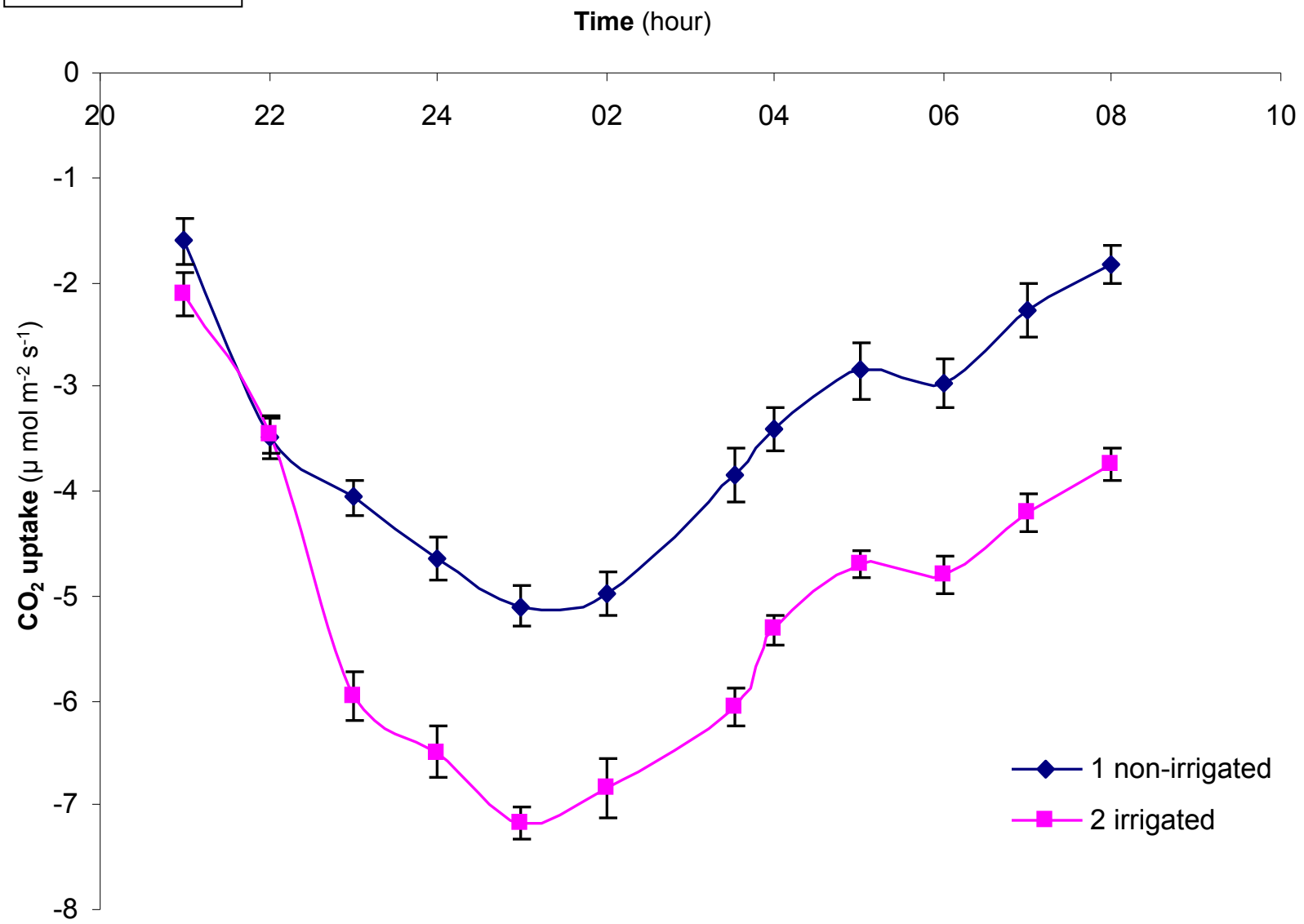
1> 0.90 m^2

2> 1.02m^2

June 2010

Dayly PPF: 27.3 mol m^{-2} d^{-1}

Day/Night temp: 29/19°C



Cladodes surface:

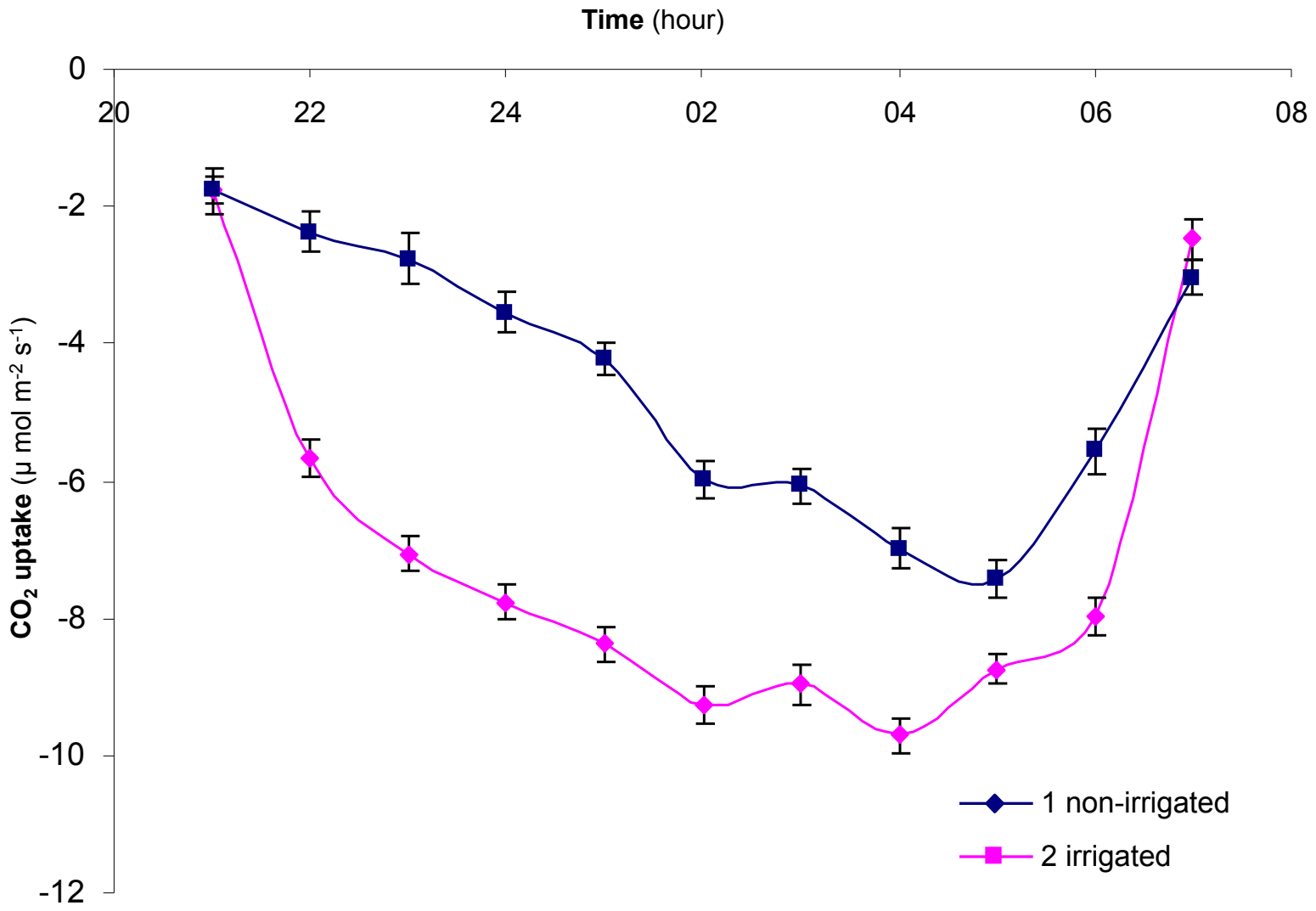
1> 0.97 m^2

2> 1.02 m^2

July 2010

Dayly PPF: 35.1 mol m^{-2} d^{-1}

Day/Night temp: 29/24 °C



Cladodes surface:

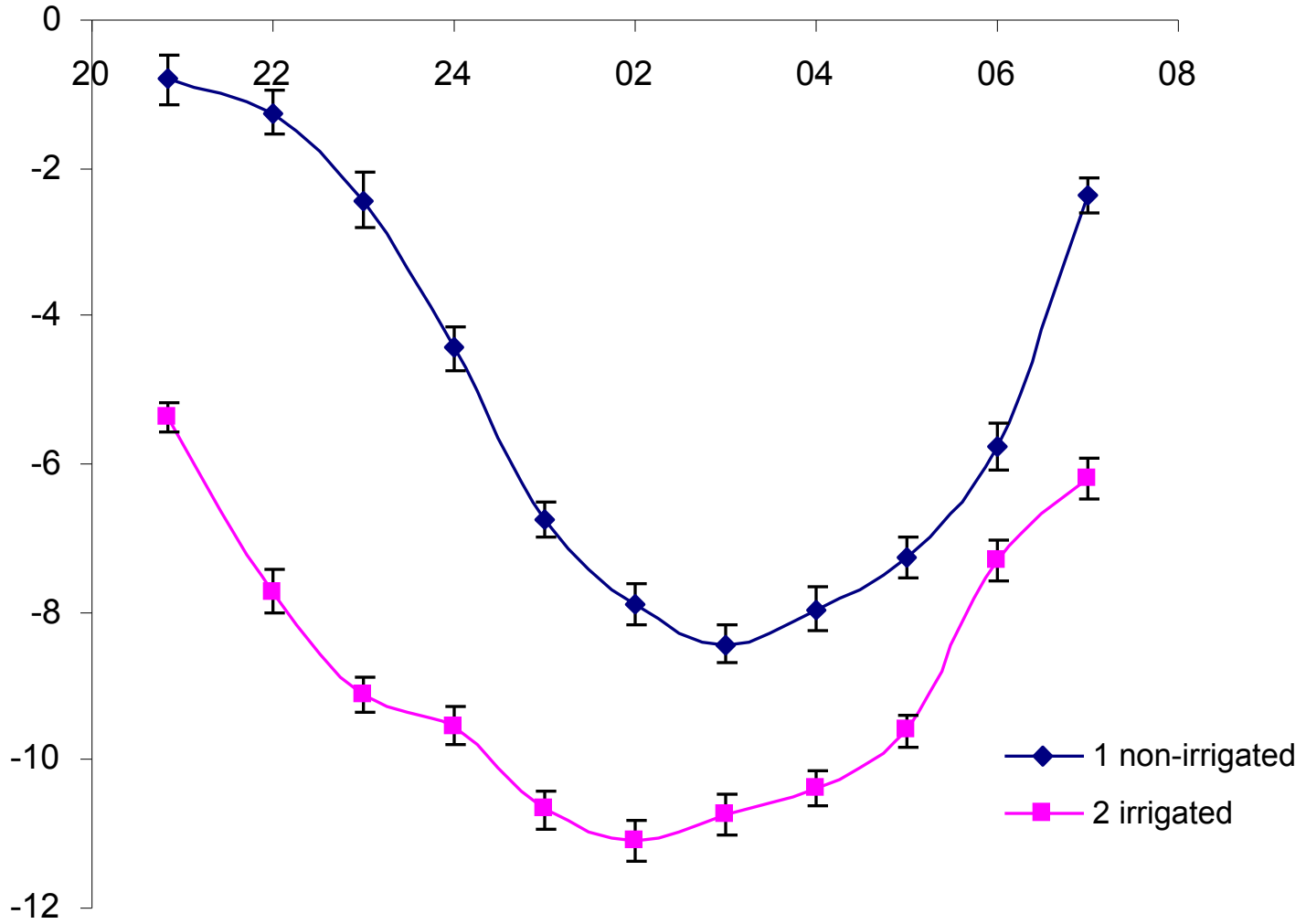
1> 1.16 m^2

2> 1.45 m^2

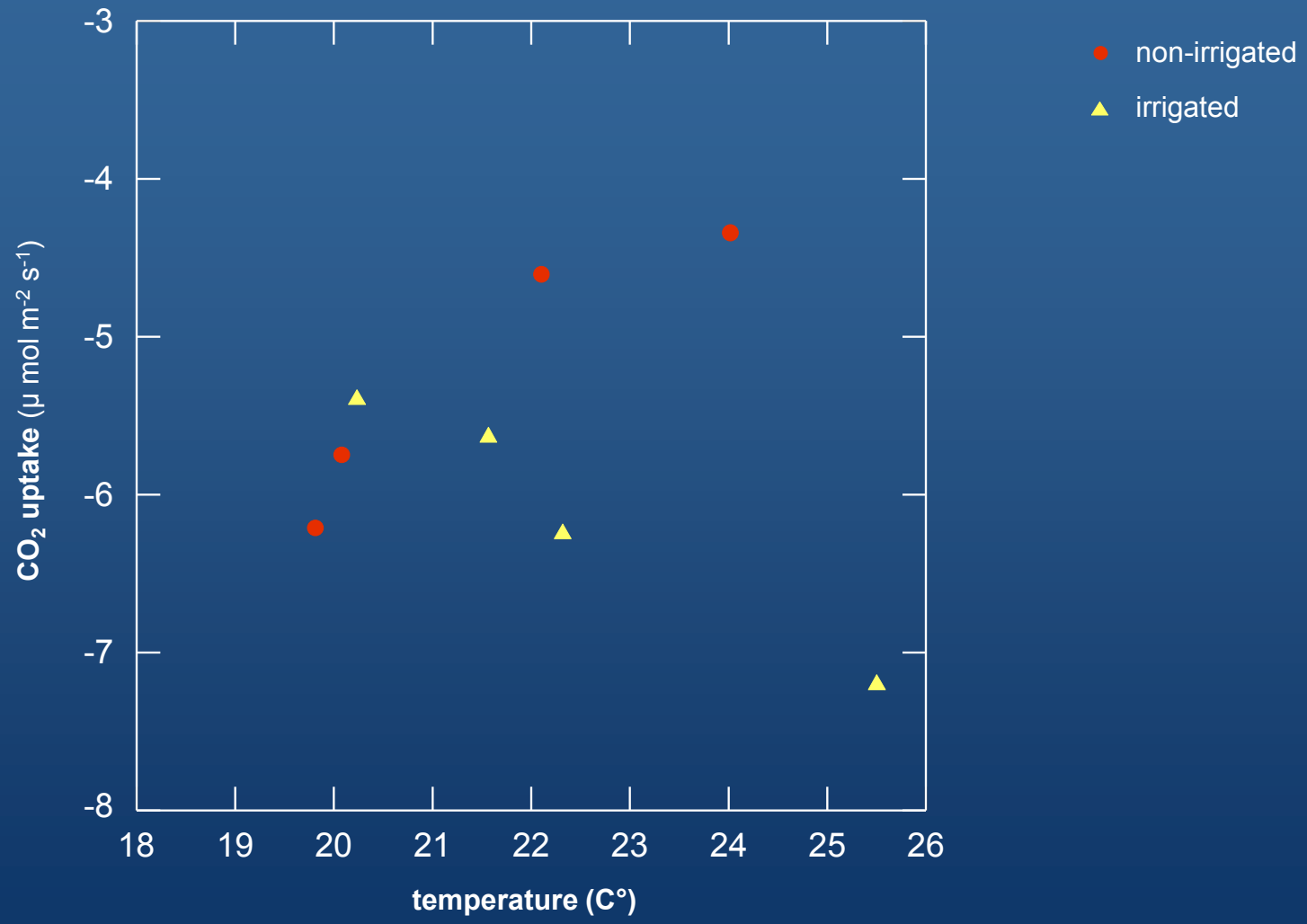
August 2010

Dayly PPF: 39.2 mol m^{-2} d^{-1}

Day/Night temp: 28/24 °C



CO2 uptake vs Temperature



Cladode surface growth during the experiment

Tree management	Cladode surface (S_0) (m^2)	Cladode surface (after 3 months) (m^2)	
irrigated	1.02	1.45	+30%
non-irrigated	0.90	1.16	+23%

CONCLUSIONS (1)

- this monitoring C fluxes system used in *Opuntia ficus-indica* allowed daily continuosly measurements during the year;

- the monitoring system was useful to measure in *Opuntia ficus-indica* the differences in carbon uptake under stressed and no-stressed conditions.

- Cactus pear trees continue their activity even after 60 days of drought, with less than 3% of soil water content (in vol.), probably due to the activity of the thick 2-yr-old cladodes which last their activity longer than current-yr and 1-yr-old cladodes

Material and Methods

Plant material:

8-year-old plants of *Opuntia ficus-indica*

- "mickey" no fruits
- "mickey" comm. production

Climatic measurements:

hourly measurements/day of air temperature, RH, soil water content and PAR (HOBO weather station and LI-COR sensor)

CO_2 uptake in *Opuntia ficus-indica*

1: no fruits

2 : commercial production

CO_2 Uptake monitoring system

Baloon

IRGA, air sampler and data logger

Cladodes surface:

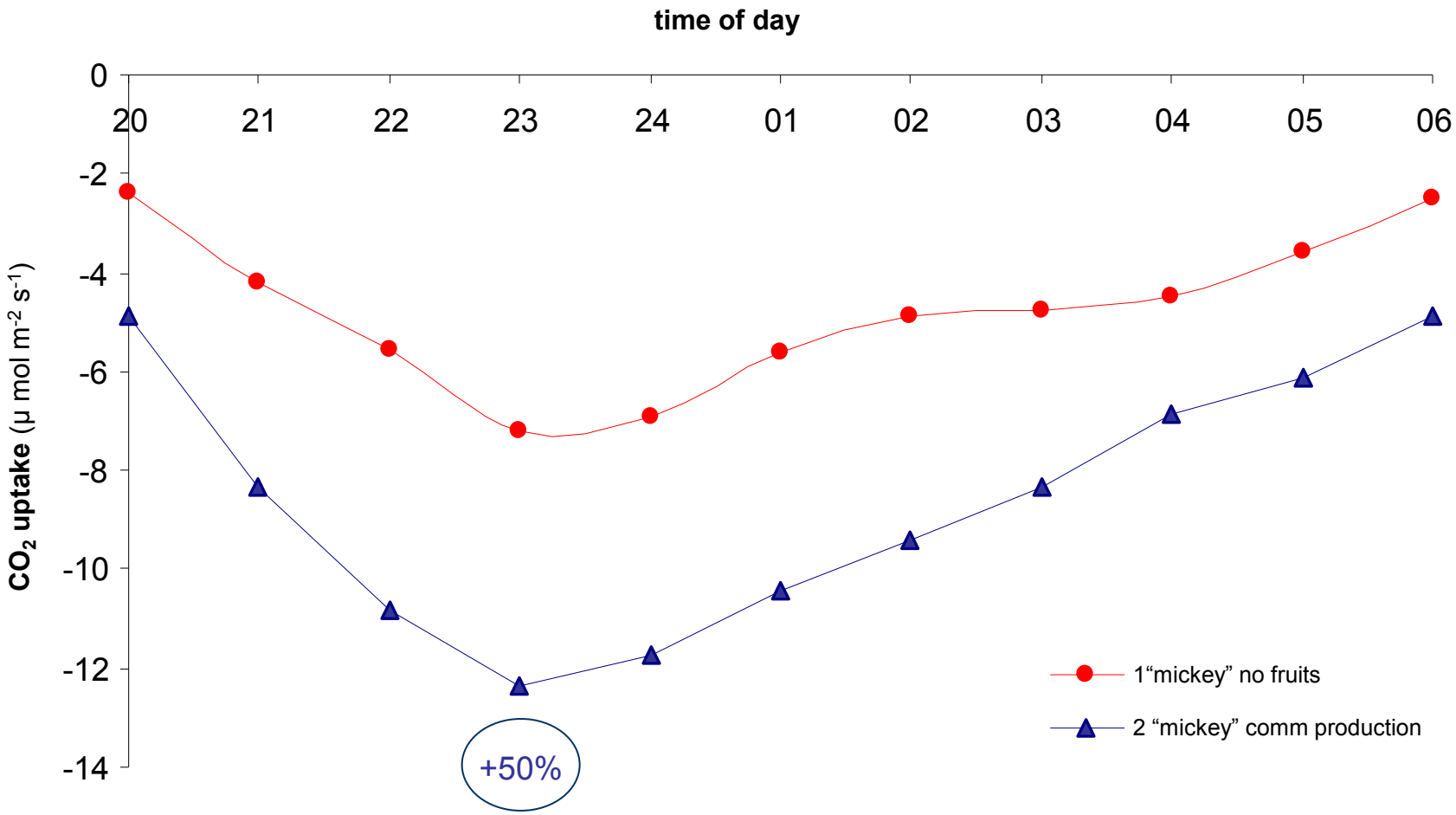
1> 0.29 m^2

2> 0.26 m^2

July 09 (15 days after bloom)

Dayly PPF: 29.03 mol m^{-2} d^1

Day/Night temp: 24/18 °C



Cladodes surface:

1> 0.26 m^2

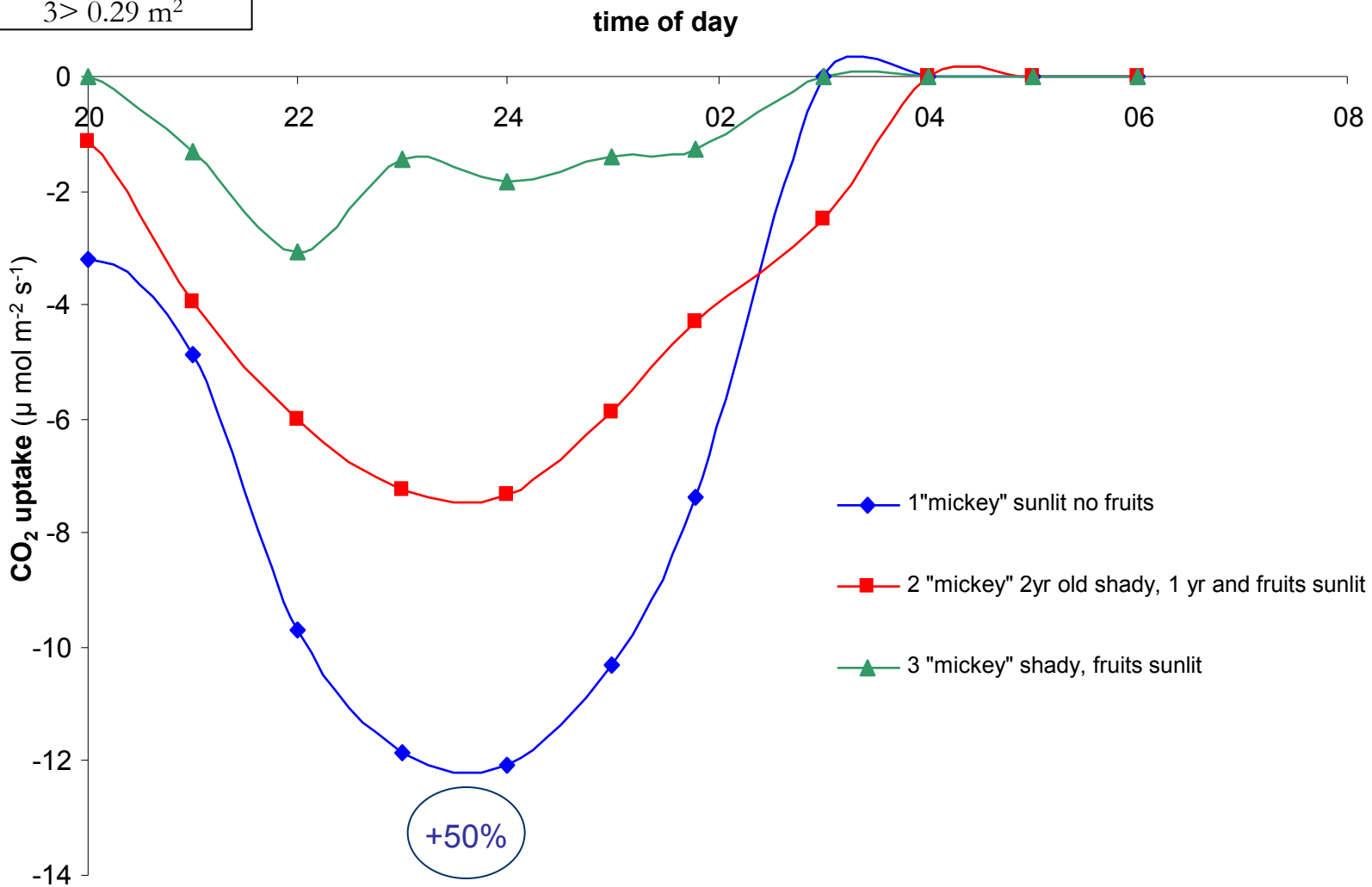
2> 0.29 m^2

3> 0.29 m^2

October 07 (78 days after bloom)

Dayly PPF: 18.81 mol m^{-2} d^{-1}

Day/Night temp: 24/20 °C



CONCLUSIONS (2)

- the monitoring system was useful also to measure differences in carbon uptake of single cladodes of *Opuntia ficus-indica,* differentiated by age and by presence or absence of fruits.