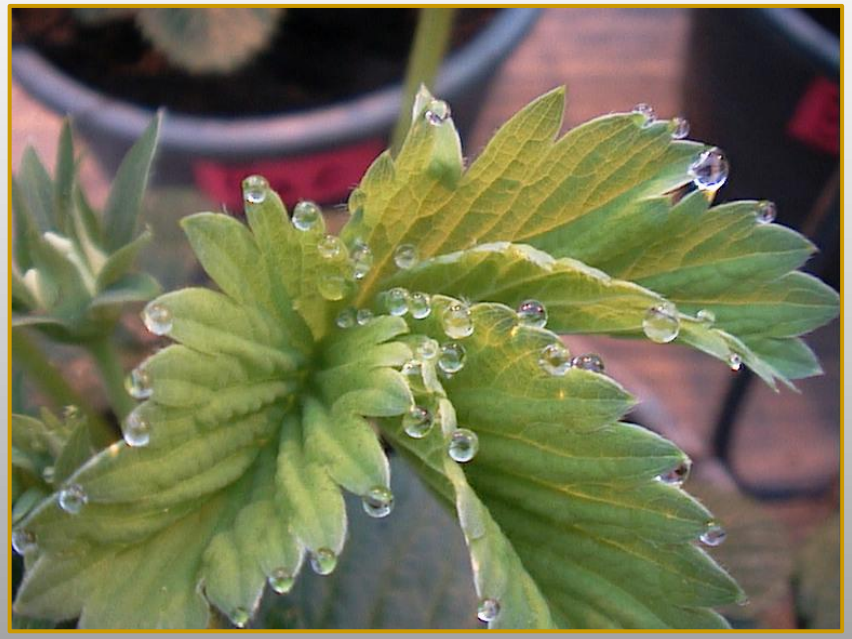
InHort
SKIERNIEWICE

IRRIGATION SCHEDULING



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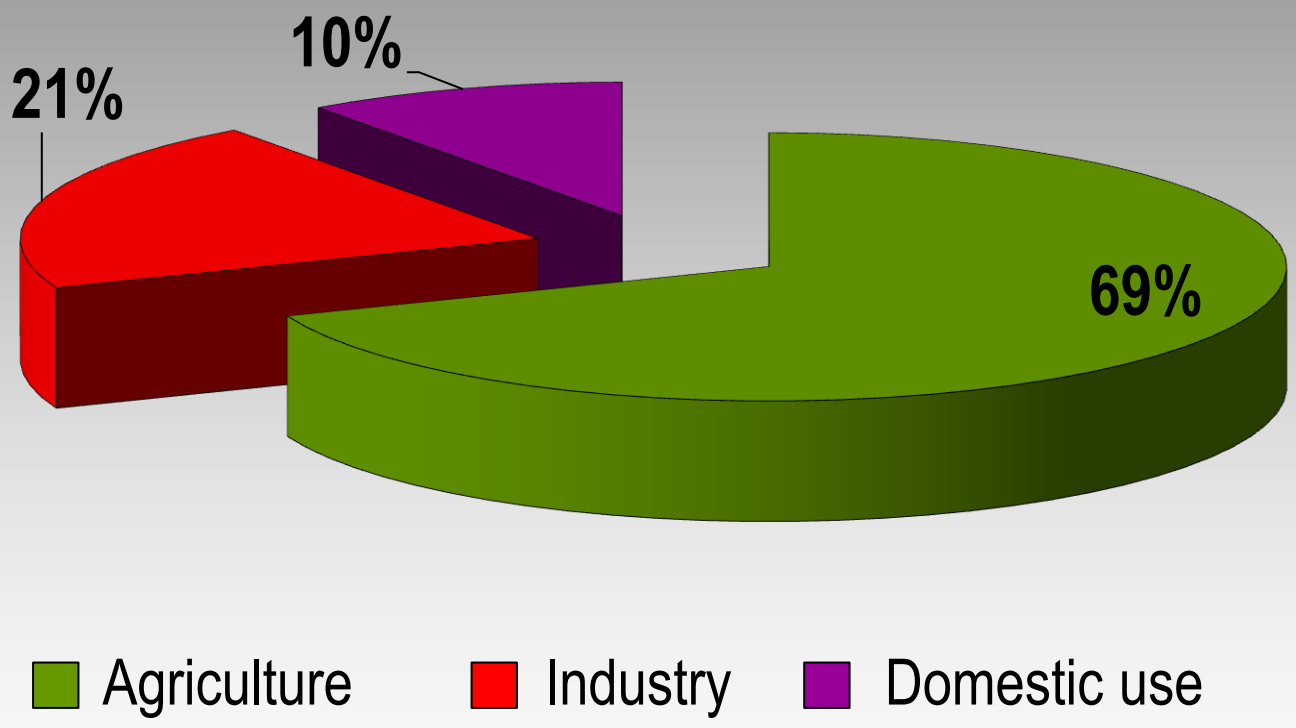
Water consumption



NATIONAL GEOGRAPHIC

Irrigation scheduling and management

Climate factors

Water budget

Outputs	Inputs
Evapotranspiration	Precipitation
Deep percolation	Capillary rise
Runoff	Irrigation

EVAPOTRANSPIRATION

water loss from bare soil (evaporation)

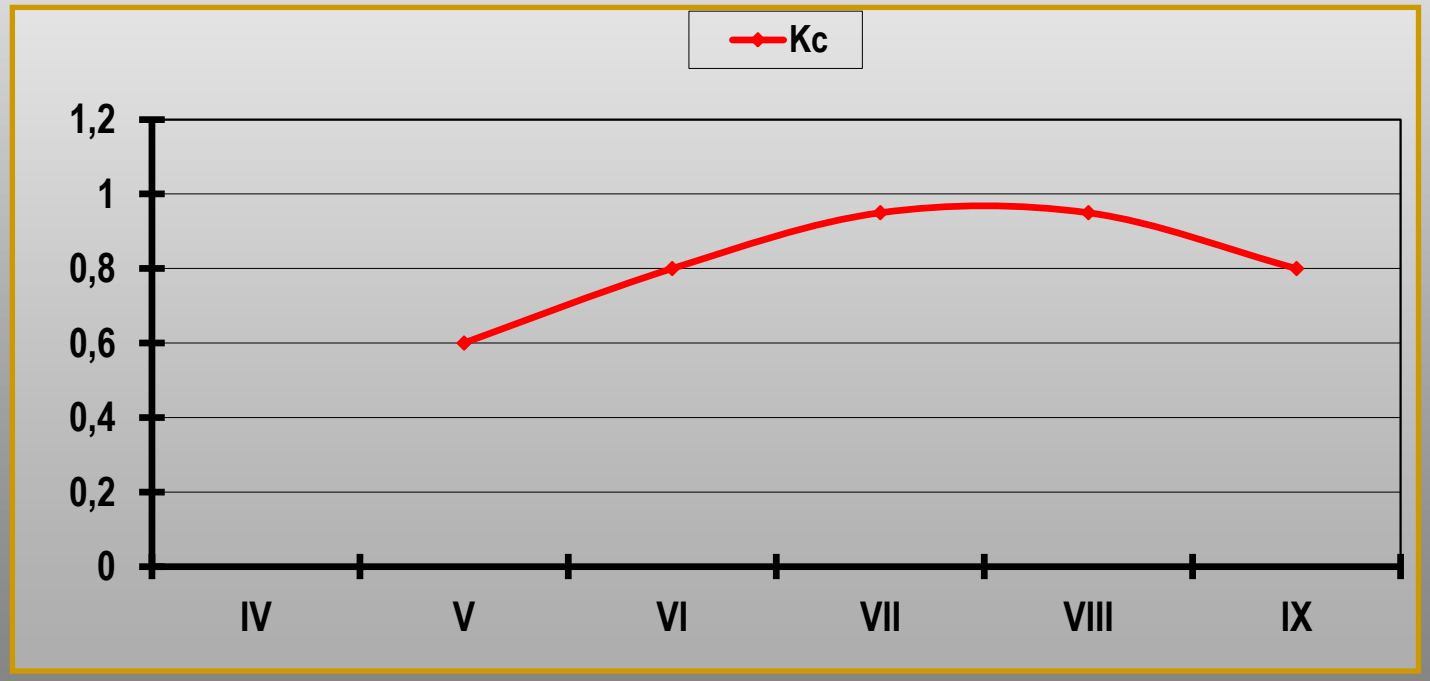
water loss from living-plant surfaces (transpiration)

REFERENCE EVAPOTRANSPIRATION (ETo)

CROP EVAPOTRANSPIRATION (ET_c)

Kc (crop) factor

ETc = ETo x kc



Soil based criteria

Methods of measurement of soil water status:

- **Soil water potential** – a measure of the energy status of the soil water. It tells how tightly the water is being held by the soil. It is measured in units of pressure (Pa, bars)

- **Soil water content** (volumetric) - the quantity of water present in a given volume of soil

Measurement of soil water potential

Tensiometers

A tensiometer measures the soil water tension that can be related to the soil water content for specific soils.

Advantages:

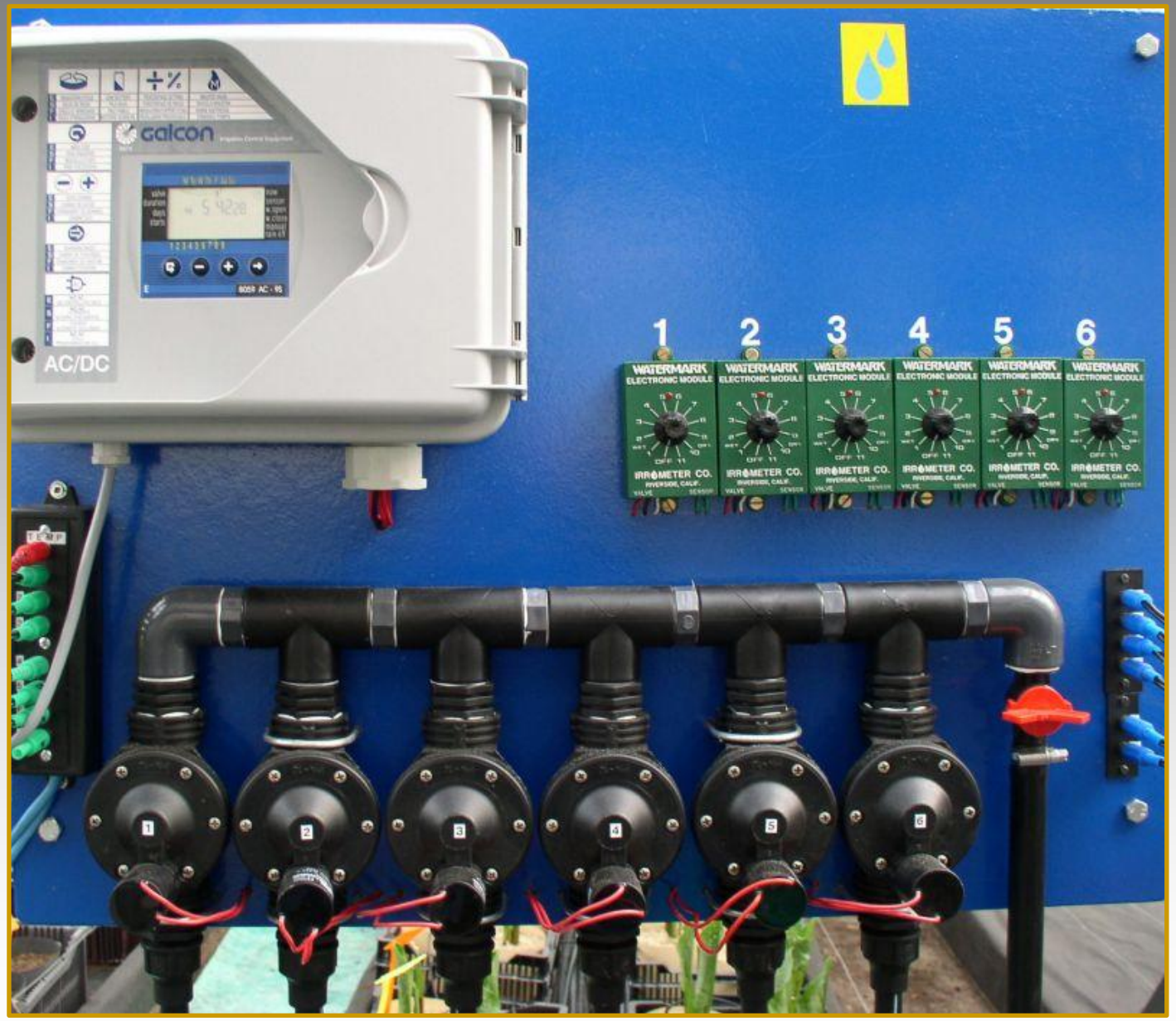
- Cheap and simple use.
- Results are not affected by salinity.
- Continuous reading possible when using pressure transducer.

Disadvantages:

- Limited soil suction range (<100 kPa).
- Slow response time.
- Additional knowledge is needed to interpret obtained results – calibration of the specific soil type must be done to establish the relationship. between soil water content and soil water tension.
- Sampling small volume - using many tensiometers in order to monitor the all field.
- After installation – frequent care in needed (refilling).

Gypsum blocks

They measure the electrical resistance to current flow between electrodes embedded in a material resembling fine sand surrounded by a synthetic porous material. High resistance readings mean lower block water content and therefore higher soil water tension.


galcon
AC/DC
1
2
3
4
5
6
WATERMARK
ELECTRONIC MODULE
IRROMETER CO.
RIVERSIDE, CALIF.
VALVE
SENSOR
OFF 11
TEMP

Advantages:

- Simple and inexpensive.
- Can be used to control irrigation systems (suited for irrigation where only "full" and "refill" points are required).
- Higher (compared to tensiometer) measuring range (~200 kPa).

Disadvantages:

- Additional knowledge is needed to interpret results – relationship between soil water content and soil water tension.
- Low accuracy (limited use in research).
- Sensitive to salinity.
- Slow reaction time.

Measurement of soil water content

Gravimetric method

Advantages:

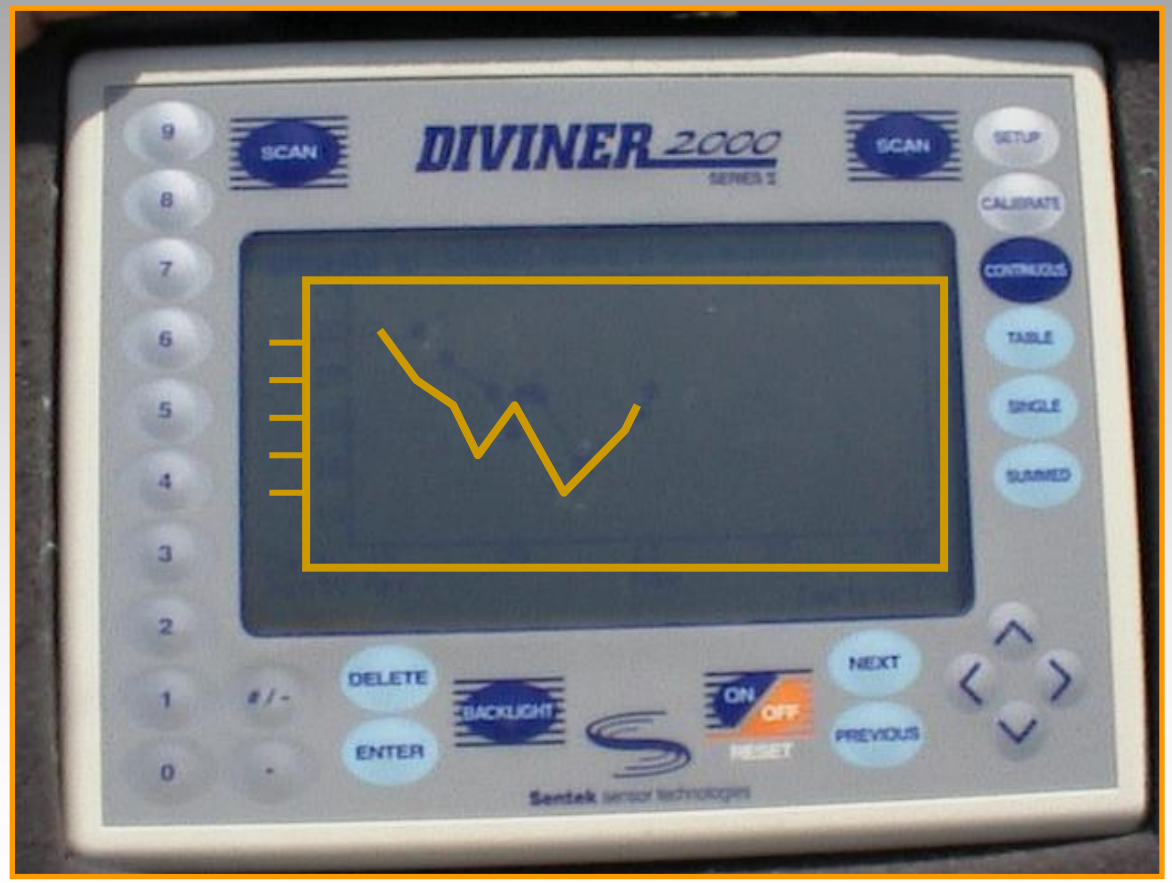
- Reference method.

Disadvantages:

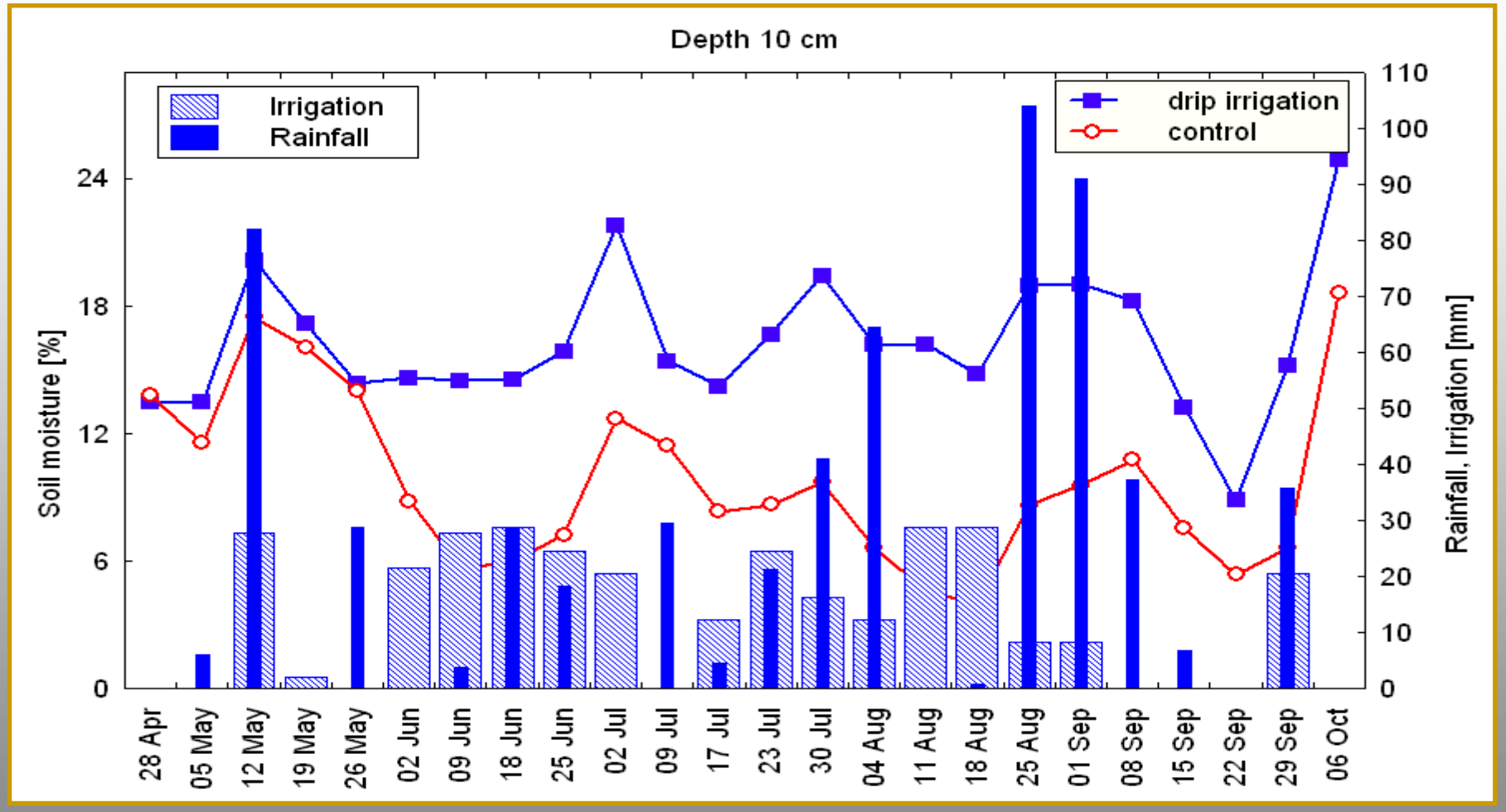
- Time-consuming.
- Destructive measurements.
- Access to laboratory equipment (a balance, an oven).

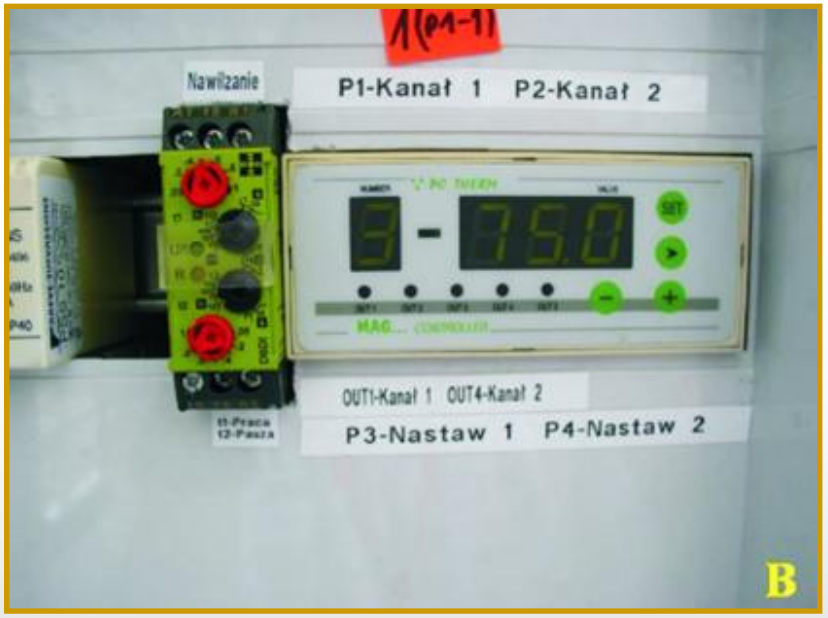
Frequency Domain Reflectometry (capacitance probes)
Time Domain Reflectometry

These sensors detect changes in soil dielectric properties linked to variations in soil water content.




DIVINER


Depth 10 cm
Irrigation
Rainfall
drip irrigation
control
Soil moisture [%]
Rainfall, Irrigation [mm]
0
6
12
18
24
0
10
20
30
40
50
60
70
80
90
100
110
28 Apr
05 May
12 May
19 May
26 May
02 Jun
09 Jun
18 Jun
25 Jun
02 Jul
09 Jul
17 Jul
23 Jul
30 Jul
04 Aug
11 Aug
18 Aug
25 Aug
01 Sep
08 Sep
15 Sep
22 Sep
29 Sep
06 Oct



Irrigation control and management system:

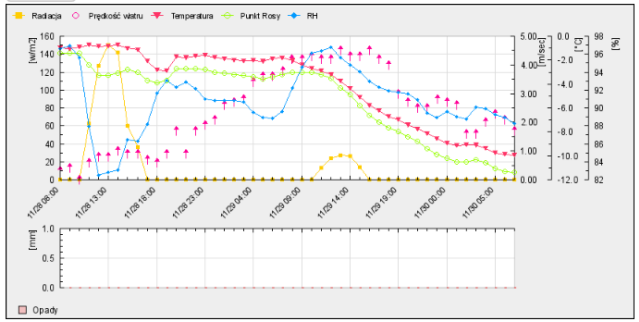
A – capacitance probe
B – controller and programming unit
C – irrigation valves

Data od 2010-11-28 08:00:00 Pokaż 48 Godzin Pokaż

Grupowanie wg
Godzina Dzień
Miesiąc Brak

Część najnowszych danych jest aktualnie w opracowaniu Odświeżanie tego widoku

Sensors



Sensors

Date	Radiacja [W/m²]	Opady [mm]	Prędk wiat [m/sec]		Temperatur [°C]			RH [%]	Punkt Rosy [°C]	
	śre	suma	śre	maks	śre	mini	maks	śre	śre	mini
2010-11-28 08:00:00	0	0.0	0.30	0.70	-0.99	-1.06	-0.95	97	-1.40	-1.50
2010-11-28 09:00:00	0	0.0	0.40	1.00	-1.06	-1.10	-1.03	97	-1.40	-1.60
2010-11-28 10:00:00	0	0.0	0.00	0.20	-0.92	-1.03	-0.76	96	-1.40	-1.60
2010-11-28 11:00:00	63	0.0	0.60	1.00	-0.73	-0.86	-0.56	88	-2.40	-3.40
2010-11-28 12:00:00	127	0.0	0.80	1.10	-0.85	-1.00	-0.75	82	-3.30	-3.60

Advantages:

- High accuracy.
- Measurement in soil profile.
- Can be connected to loggers and/or irrigation controllers.
- Minimal soil disturbance.
- Multi-parametric probes.

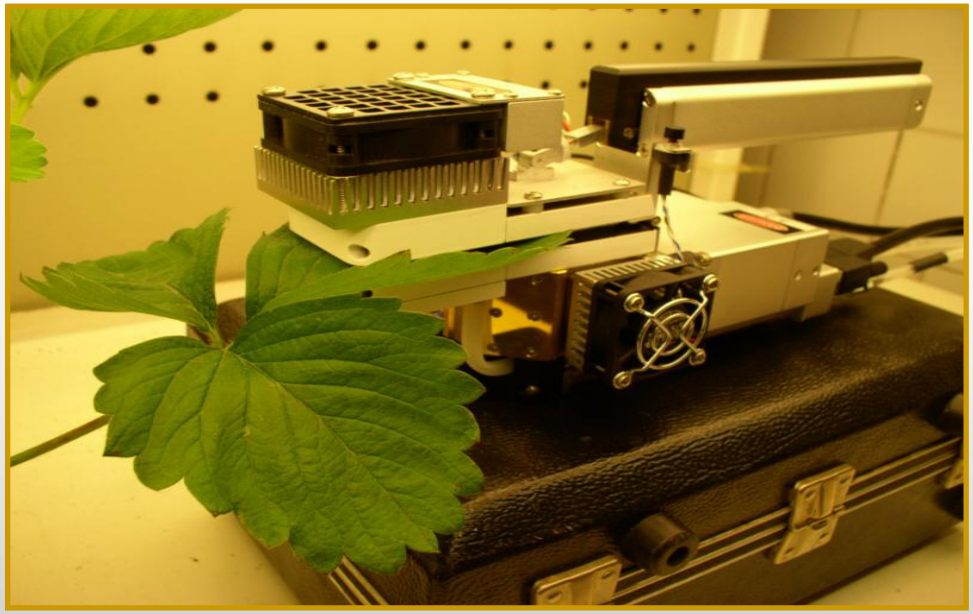
Disadvantages:

- The sensing sphere of influence is relatively small.
- Careful installation is necessary to avoid air gaps to have good contact between the sensor (or tube) and soil.
- Sensitivity to changes in temperature.
- Needs soil-specific calibration.
- Expensive equipment.

Plant based criteria

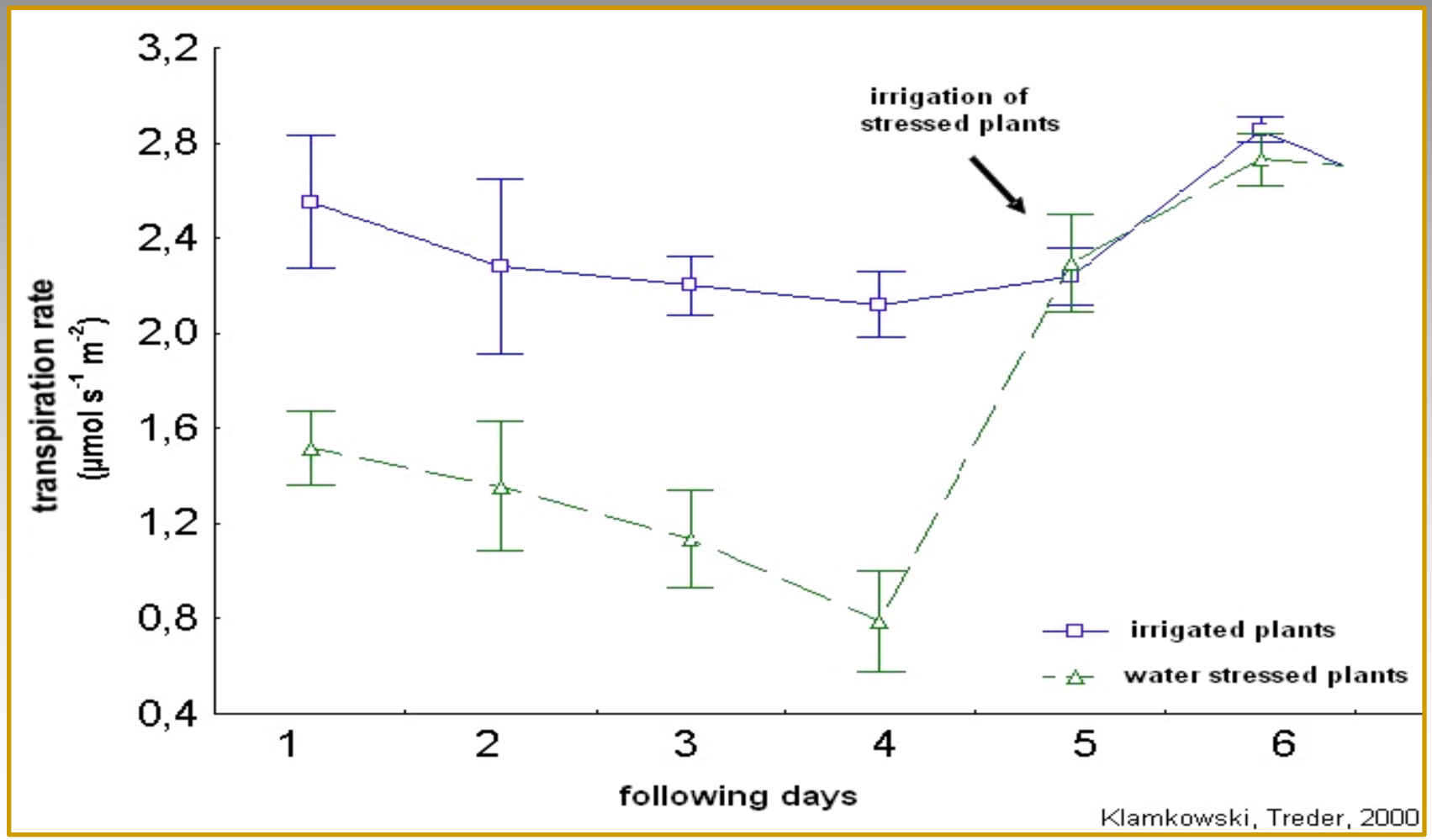
Many physiological parameters could be used as indicators of changes of plant water status:

- Plant water potential.
- Instensity of transpiration.
- Sap flow.
- Temperature of crop canopy.
- Changes in plant organ diameters.



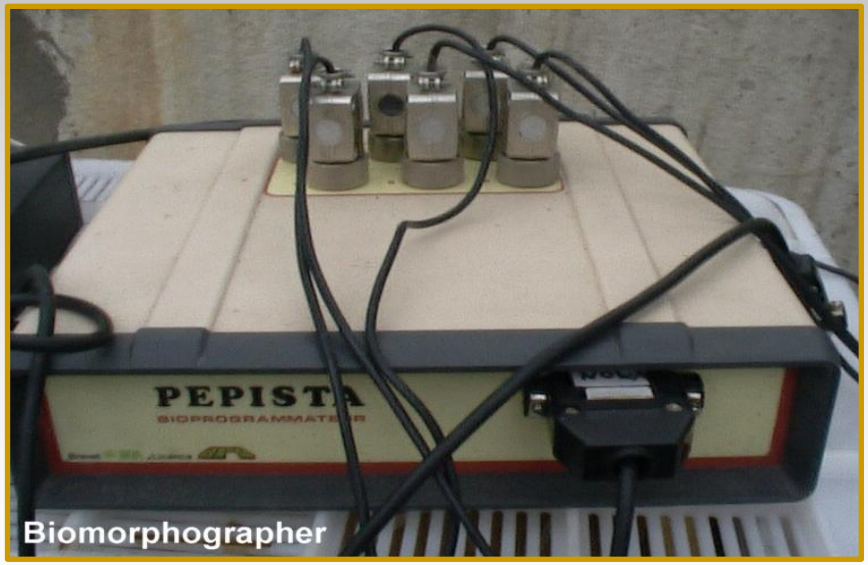

Flow Rate
On
Off
0 --20
Range
0 - 200
Zero
Fill Chamber
Off
Vent Chamber
Max pressure 40 Bar
Chamber Pressure - Bar
Skye
SKPM 1400
Free
Hold

Changes in transpiration rate as affected by irrigation regime (apple trees)



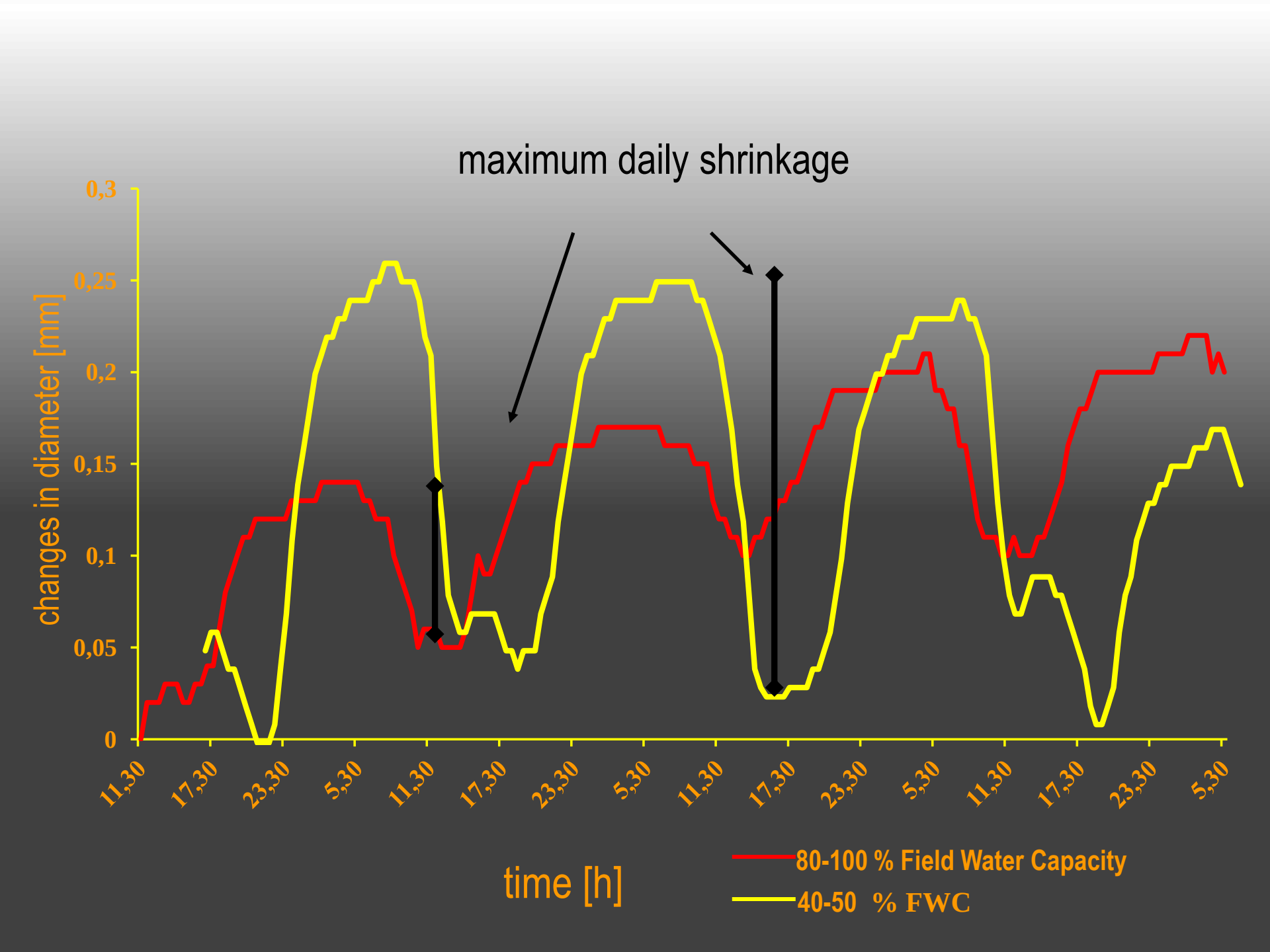
Changes in plant organ diameters

The size of plant organs such as stems, fruits and leaves can change rapidly, both through growth and as a result of changes in water content in response to environmental conditions.

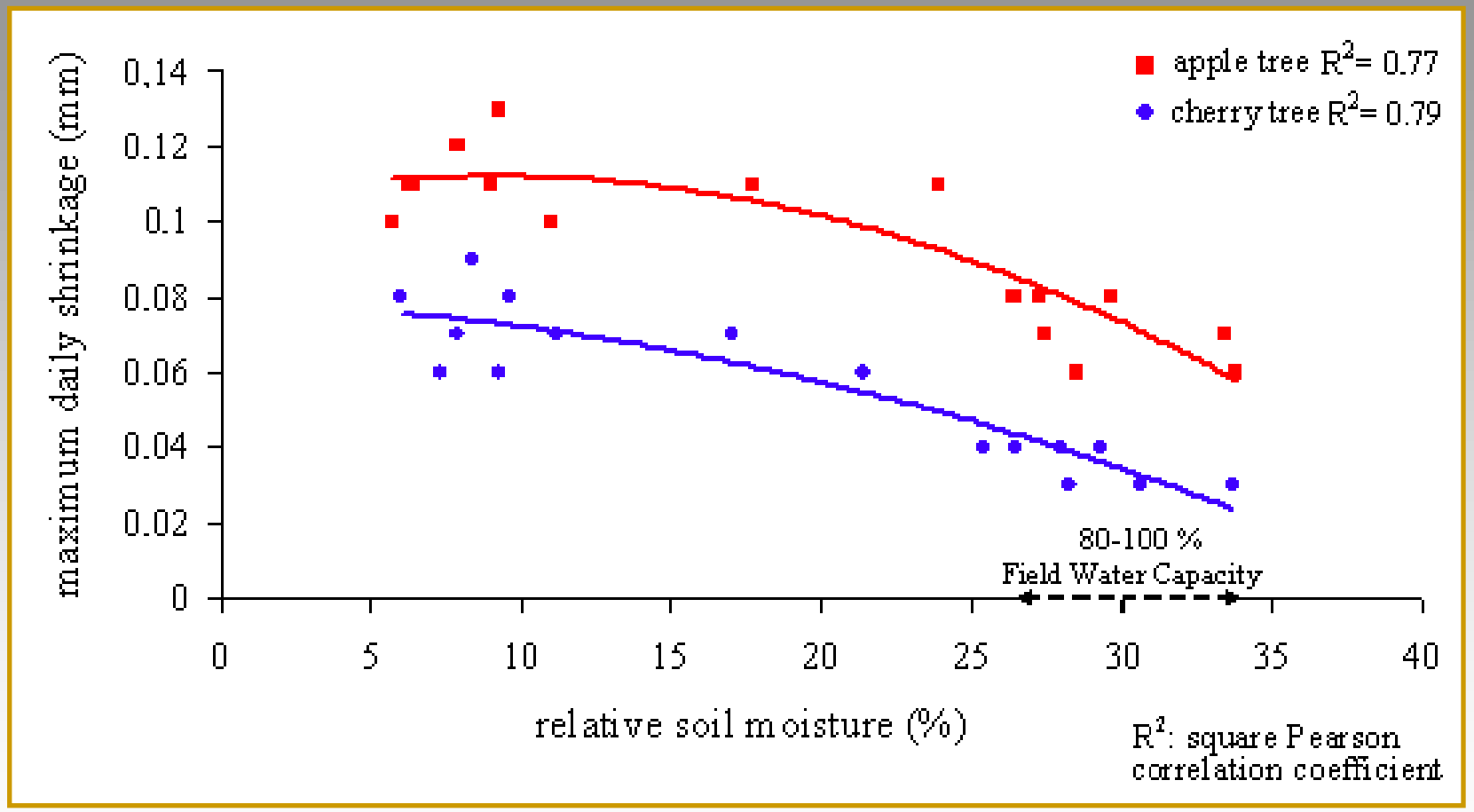


Biomorphographer


Measurement of microchanges in diameter of tree leader


maximum daily shrinkage
changes in diameter [mm]
0,3
0,25
0,2
0,15
0,1
0,05
0
11,30
17,30
23,30
5,30
11,30
17,30
23,30
5,30
11,30
17,30
23,30
5,30
11,30
17,30
23,30
5,30
time [h]
80-100 % Field Water Capacity
40-50 % FWC

Maximum daily shrinkage of cherry (A) and apple (B) tree stems



Combination of different methods enables the most precise assessment of plant water status

Thank you

The sustainable improvement of European berry production, quality and nutrition value in a changing environment: Strawberries, Currants, Blackberries and Raspberries.

Acronym: EUBerry

http://www.euberry.univpm.it/

2011 – 2014