

Precision irrigation in nurseries; toward a more comprehensive approach

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Irrigation in nurseries

- Essential for plant quality
- Irrigation results often in significant water loss
 - Overwatering and leaching
 - Water not reaching the pots
 - Evapotranspiration



Precision irrigation

- **Objectives of the project:**

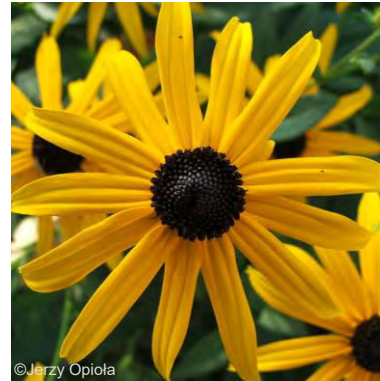
1. Optimize the irrigation management using wireless tensiometers (2019-2020)
2. Establish the best clustering practices (2020-2022)
3. Compare different strategies for the automation of irrigation (2020-2022)

Improve clustering

- **Clustering and irrigation based on reference species**
 - Objective: Cover a wide range of water needs
 - We used previously 10 species
 - 4 new species to increase the range

Improve clustering

- **New reference species**
 - *Sambucus canadensis*
 - *Salix integra* 'Hakuro Nishiki'
 - *Rudbeckia fulgida* 'Goldsturm'
 - *Panicum virgatum* 'Heavy Metal'



Improve clustering



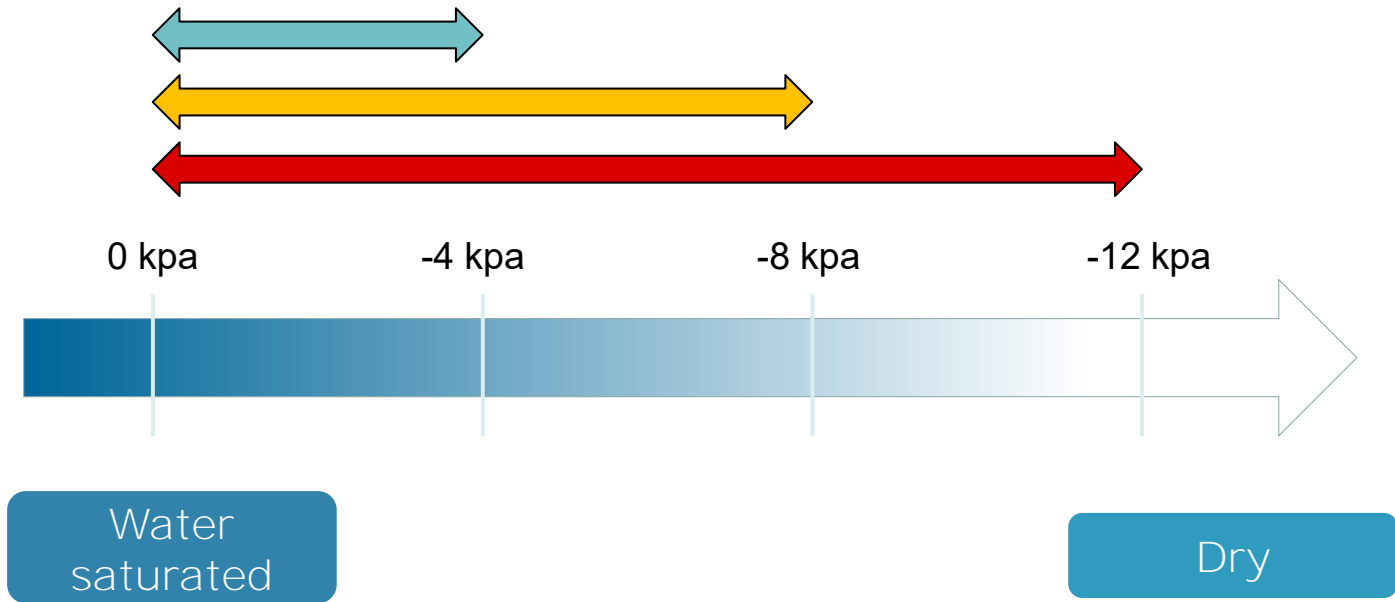
- **Experimental setup**

- Wireless tensiometer (Hortau)
- 2 gallons pots with a bark based soil mix (Agro Mix N7, Fafard)
- Automatic valves connected to the tensiometer hub
- Watermeters
- Micro sprinklers
- Tunnel (no rain)

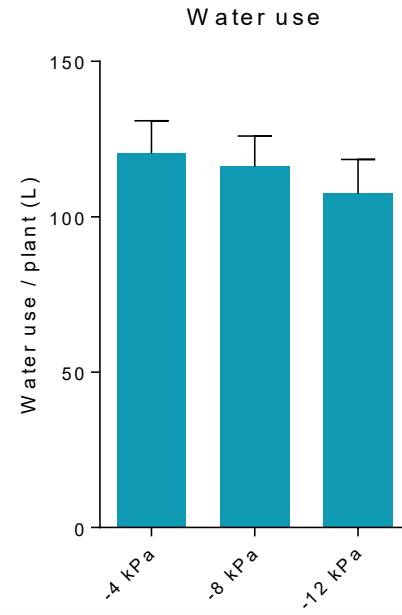
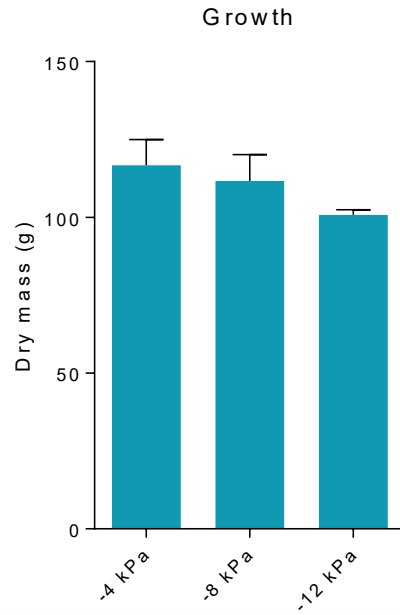
Wireless tensiometer



Irrigation threshold



Rudbeckia fulgida



Rudbeckia fulgida



-8 kPa

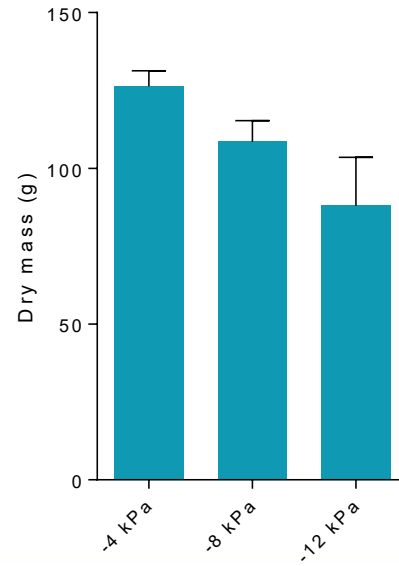


-12 kPa

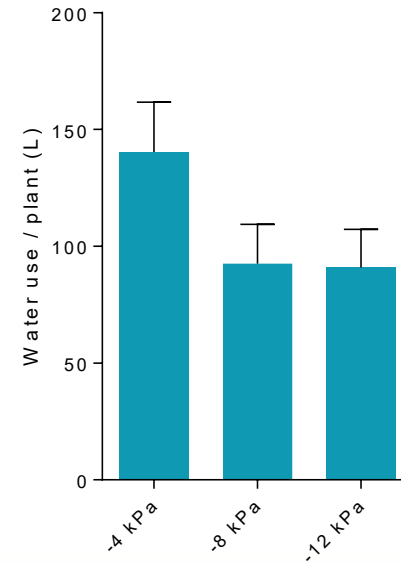
Salix integra



Growth



Water use



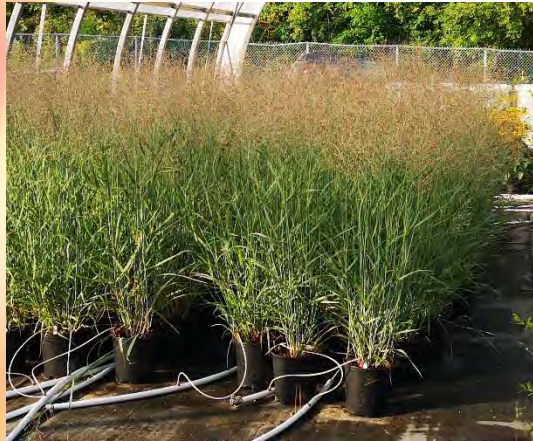
Salix integra



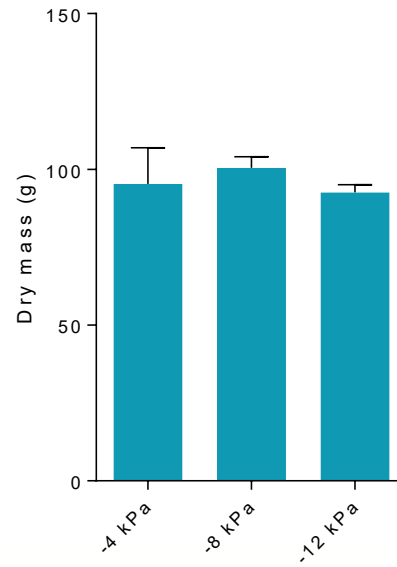
-4 kPa

-12 kPa

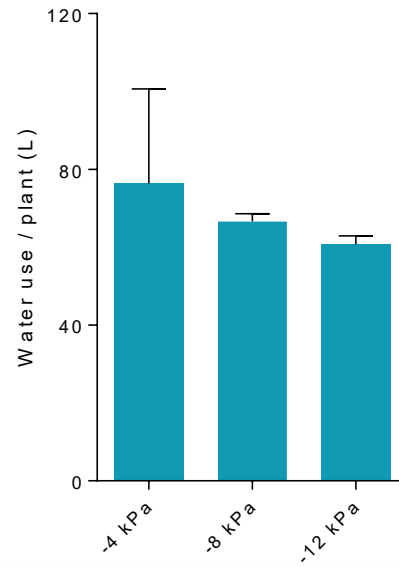
Panicum virgatum



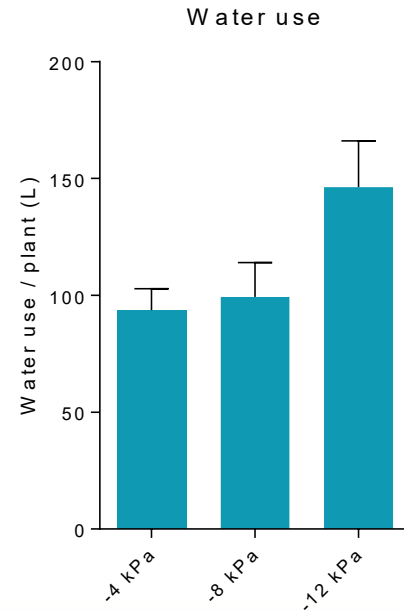
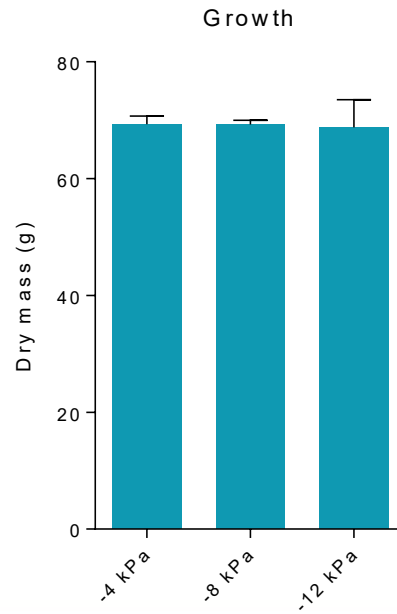
Growth



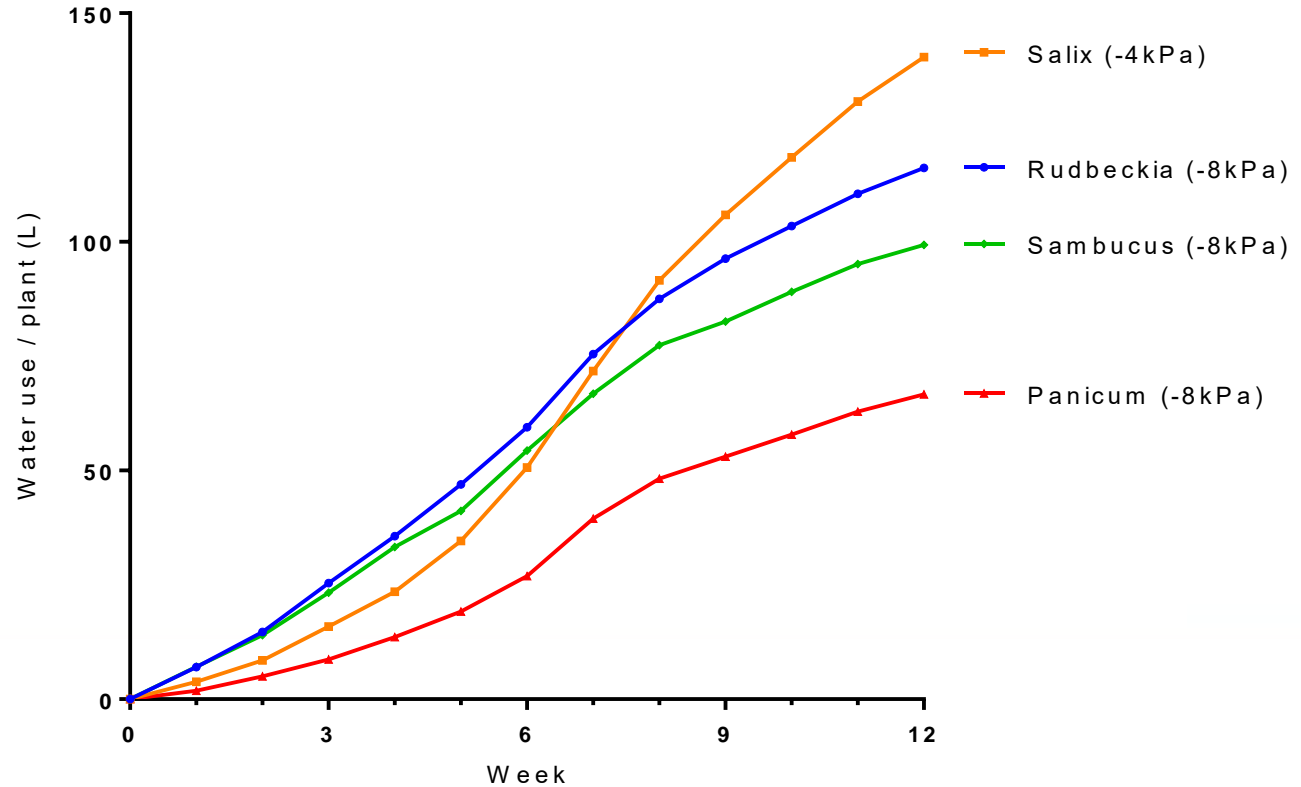
Water use



Sambucus canadensis



Water needs



Improve clustering

- **New reference species to use in clusters**
 - Higher water need : *Salix*
 - Early growth: *Rudbeckia* and *Sambucus*
 - Middle range: *Panicum*



What's to come

- Clustering experiments
 - Best association for irrigation
 - 50 new species in association with the reference species



Automation strategies



Experimental setup:

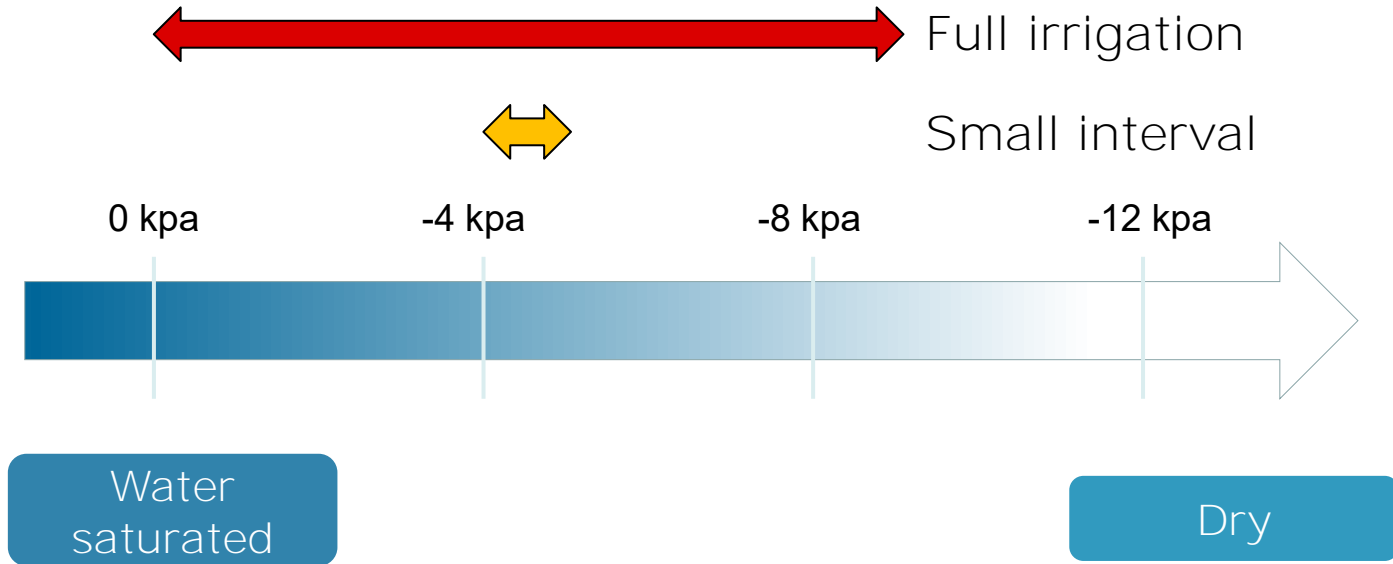
- Wireless tensiometer, automatic valves, weather station (Hortau)
- 2 Species in cluster
- Bark based soil mix (Agro Mix N7)
- Watermeters
- Sprinklers (better model than last year!)

Automation strategies

Comparison of 4 treatments

- Irrigation starts when threshold is reached (**tensiometer**)
 - Full irrigation (0 kPa to -9 kPa)
 - Small interval (-4 kPa to -5 kPa)
- Irrigation based on prediction (**evapotranspiration**)
 - 2 different coefficients (Kc)

Automation strategies



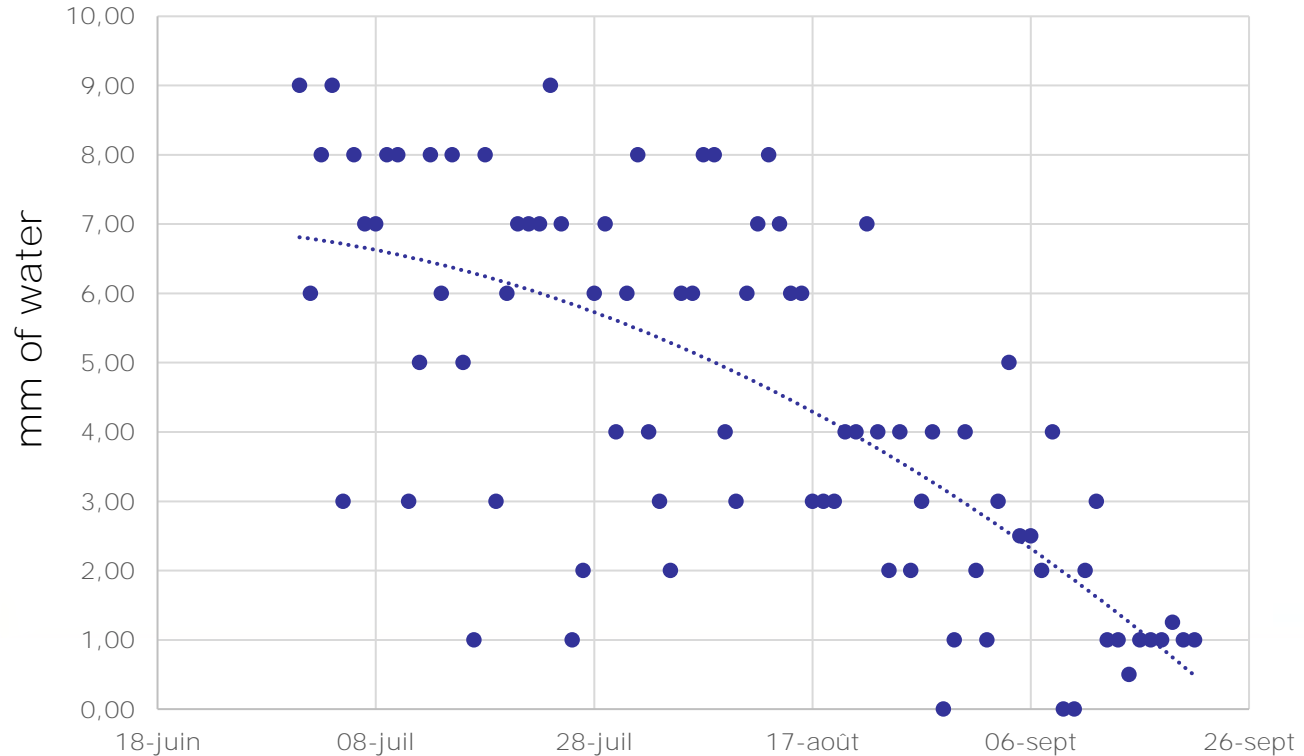
Automation strategies



Evapotranspiration

- Penman–Monteith equation
 - Temperature
 - Wind
 - Solar radiation
 - Relative humidity
- Adjustment for the crop and stage of growth (K_c)
- Irrigation once a day based on estimation of water loss

Daily evapotranspiration (ET_o)



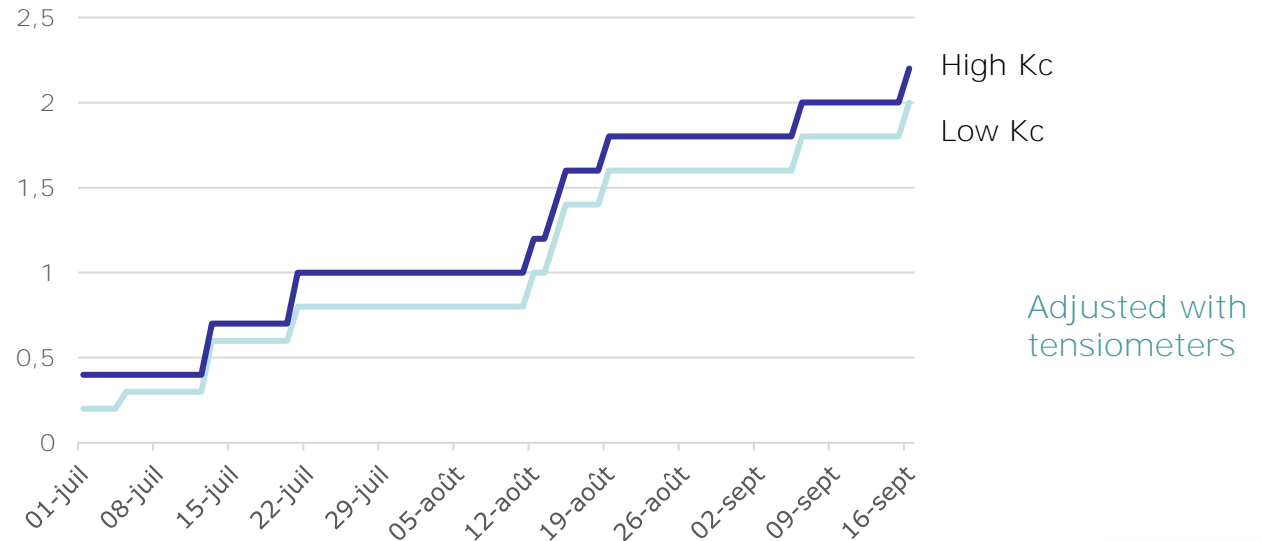
Evapotranspiration



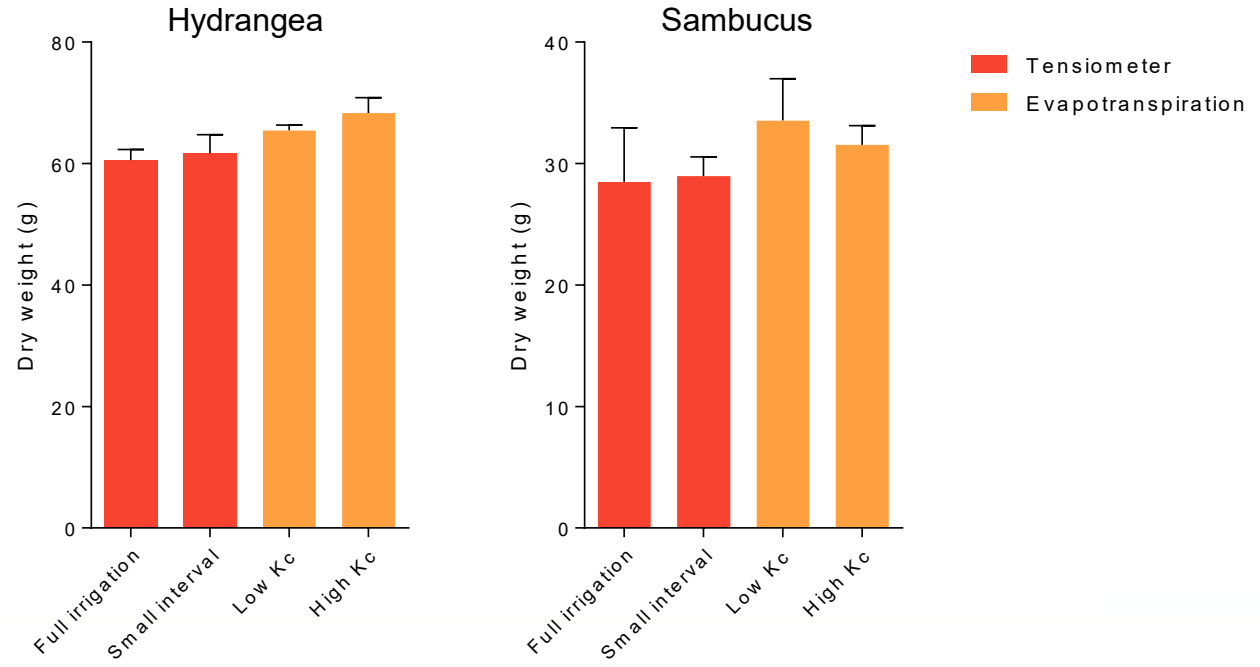
Example:

- $ET_o = 7 \text{ mm}$
 - 7 mm of water lost for the reference
- $K_c = 1.2$
 - Crop coefficient for hydrangea (mid-august)
- $ET = ET_o \times K_c = 7 \times 1.2 = 8.4 \text{ mm}$
 - 8.4 mm of water needed for hydrangea
 - 20 min of irrigation with our sprinkler

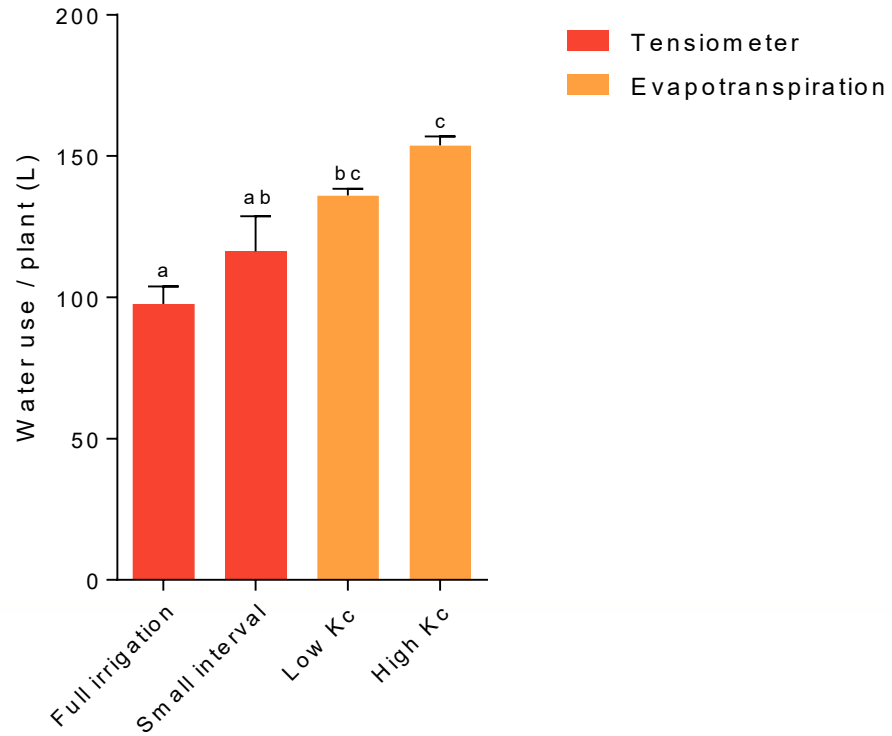
Crop coefficient during the season



Growth



Water use



Takeaways

Automation with **tensiometers**

- Highly efficient
- Choice of the pot with the tensiometer is crucial
 - Avoid the smaller plants
- Full irrigation is better than small amplitude with sprinklers
 - No gain for water use and harder to schedule
 - Not the case with drip irrigation
 - Small amplitude reduce water use

Takeaways

Automation with **Evapotranspiration**

- Less expensive
- Not as efficient as tensiometers but likely to reduce significantly water consumption in most nurseries
- Coefficient must be adjusted often during the season

What's to come

- Automation of irrigation
 - Refine evapotranspiration automation
 - Compare the efficiency of tensiometers and evapotranspiration with other species



Thanks to all our partners



HORTAU

MULTIPLANTS
— IMPLANTÉ DEPUIS 1946 —

