



Precision irrigation in nurseries; toward a more comprehensive approach

Charles Goulet, February 2022



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: Identify the best clustering practices for 25 species of shrubs and perennials
- Treatments based on 8 previously characterized reference species

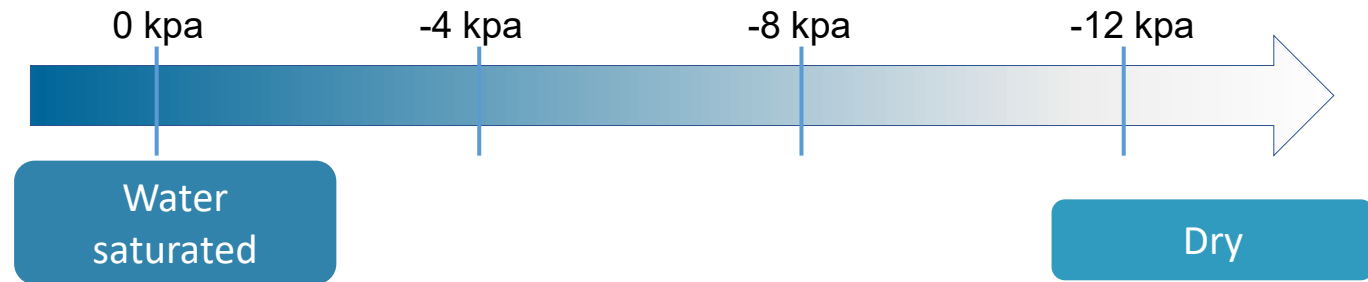




Experimental setup

- 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 tensiometers





Bloc 1



Reference species

Shrubs

Salix integra 'Hakuro Nishiki'

Hydrangea paniculata 'Phantom'

Spirea japonica 'Goldmound'

Thuja occidentalis 'Nigra'

Perennials

Rudbeckia fulgida 'Goldsturm'

Astilbe arendsii 'Diamant'

Hosta 'Golden Tiara'

Hemerocallis 'Stella de oro'

Improve clustering

13 shrubs

Wisteria

Syringa

Spirea

Diervilla

Myrica

Symphoricarpos

Larix

Viburnum

Rosa

Buxus

Alnus

Salix

Improve clustering

12 perennials

Salvia

Elymus

Miscanthus

Amsonia

Cimicifuga

Nepeta

Tradescantia

Penstemon

Polemonium

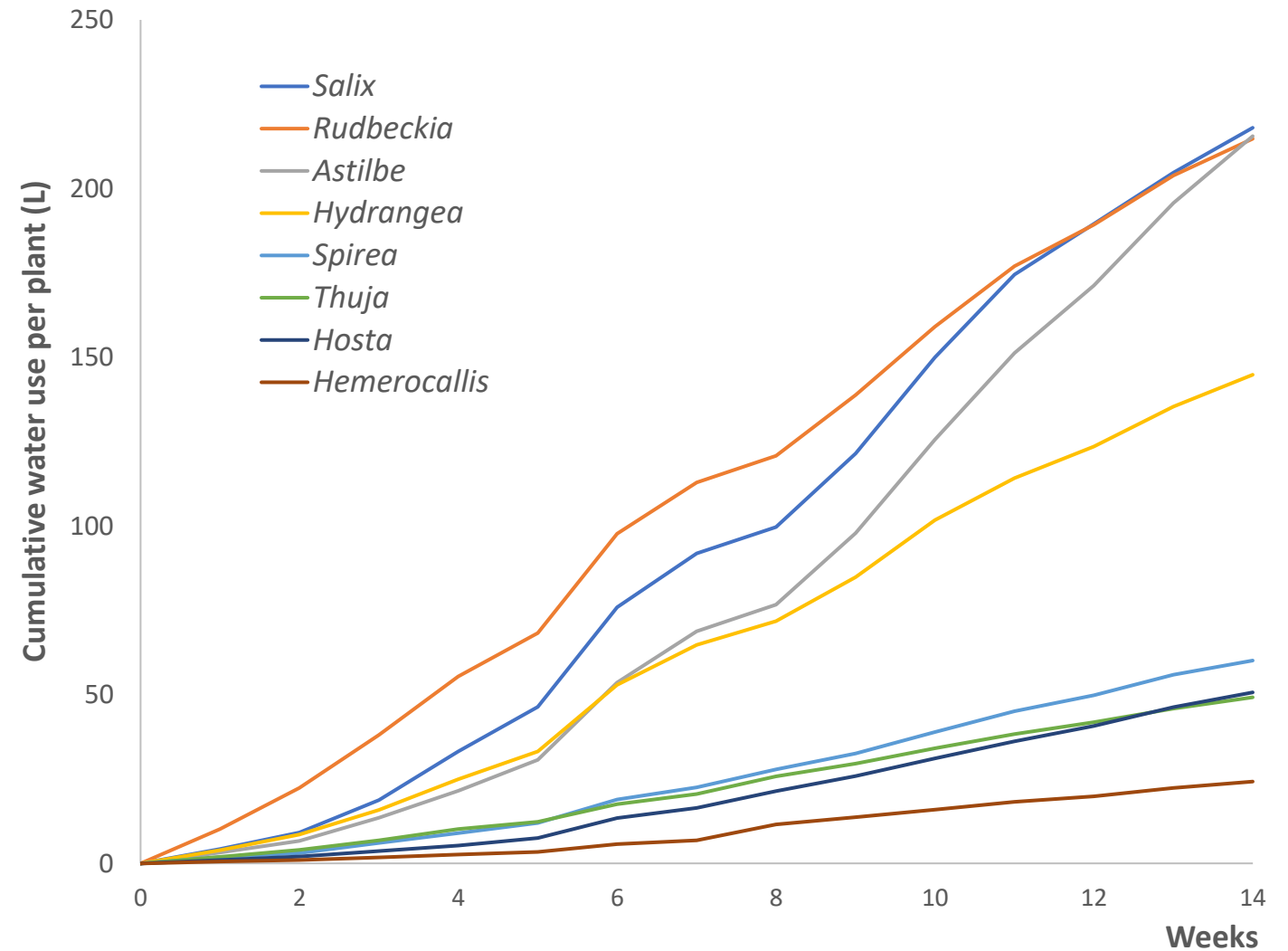
Pulmonaria

Vinca

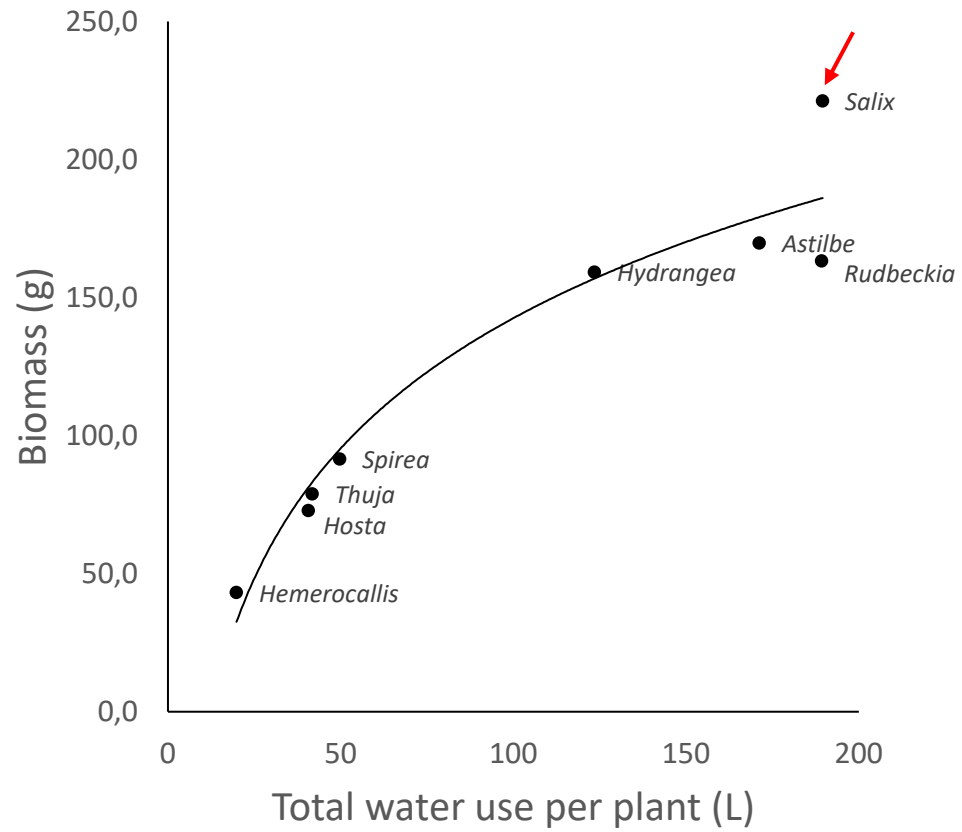
Pachysandra

Reference species

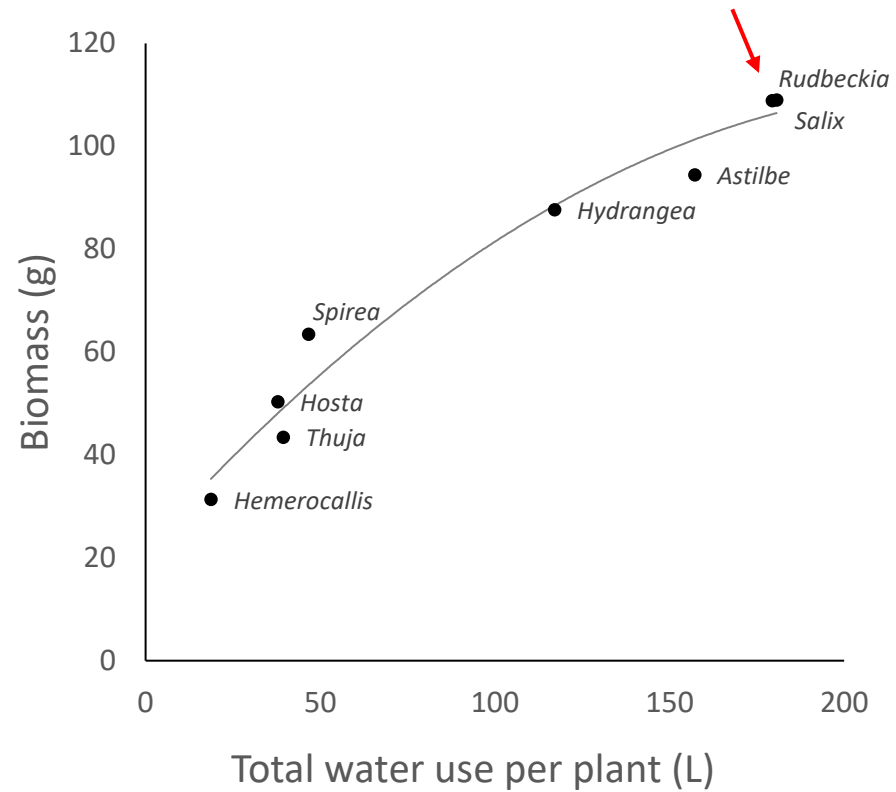
- Different water needs throughout the growing season
- Distinct profiles to cover a wide range of species



Myrica gale

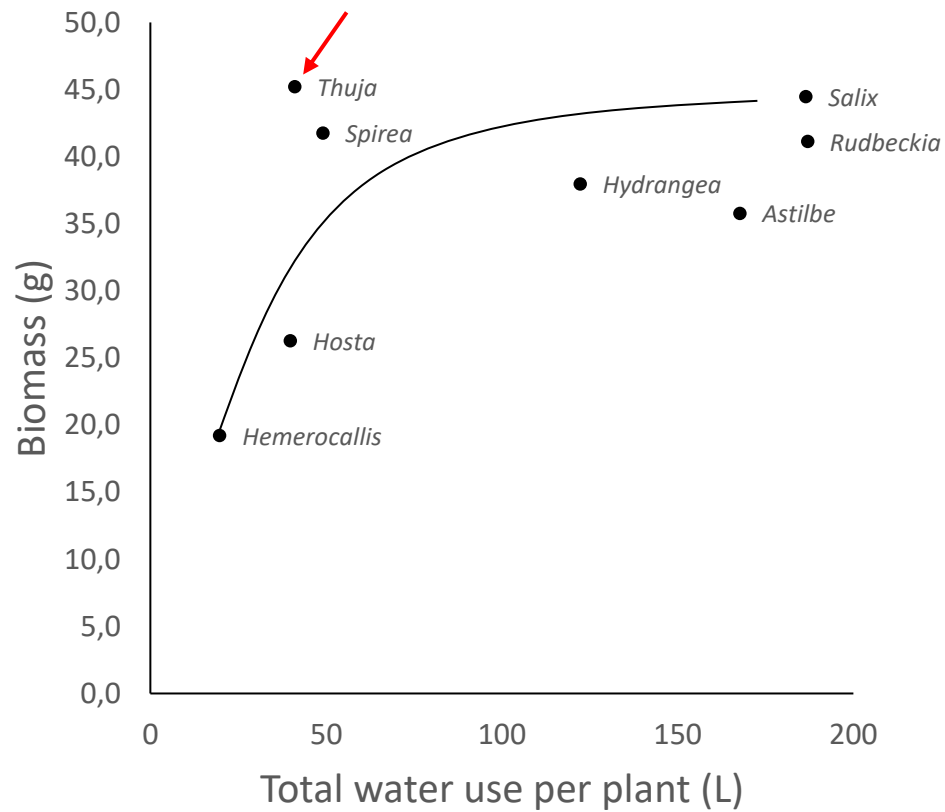


Salvia nemorosa

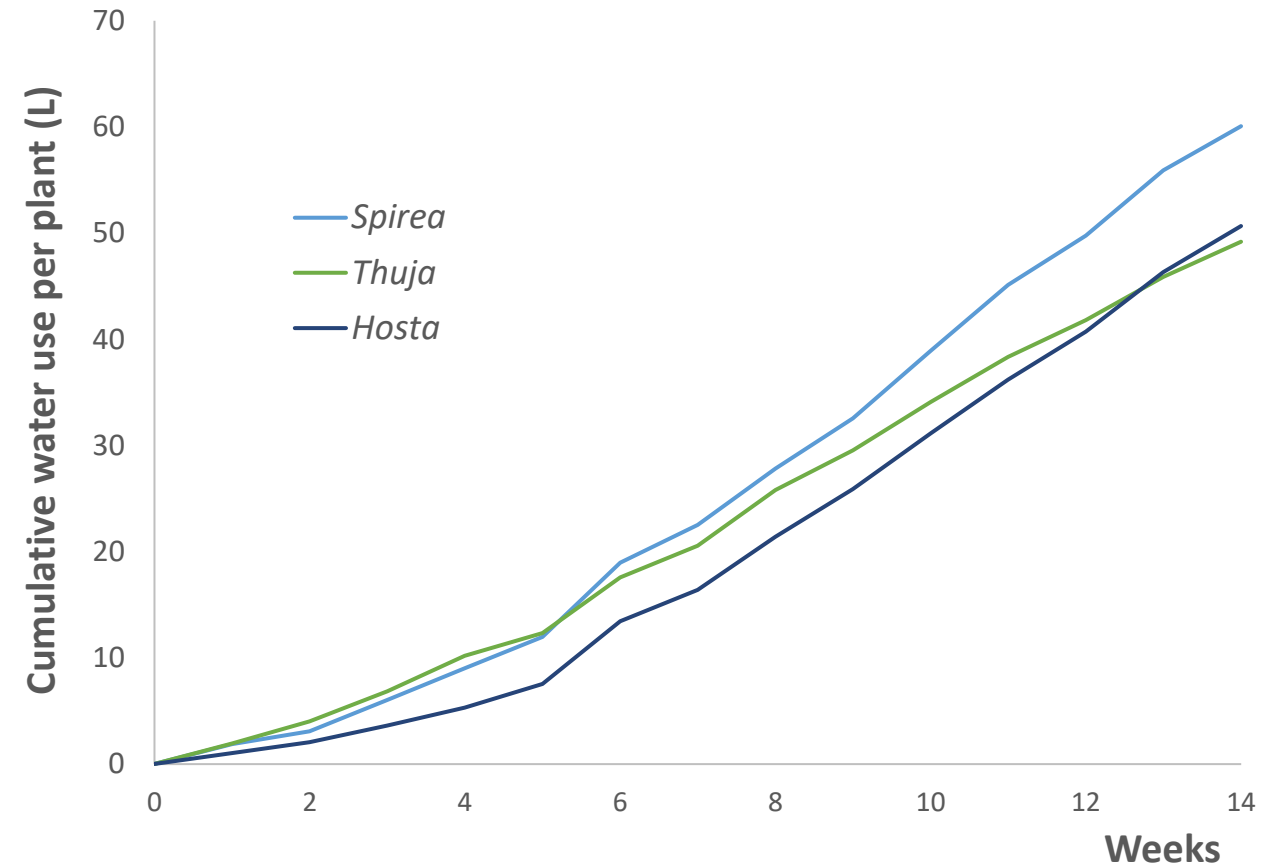


Picture: 15 July 2021

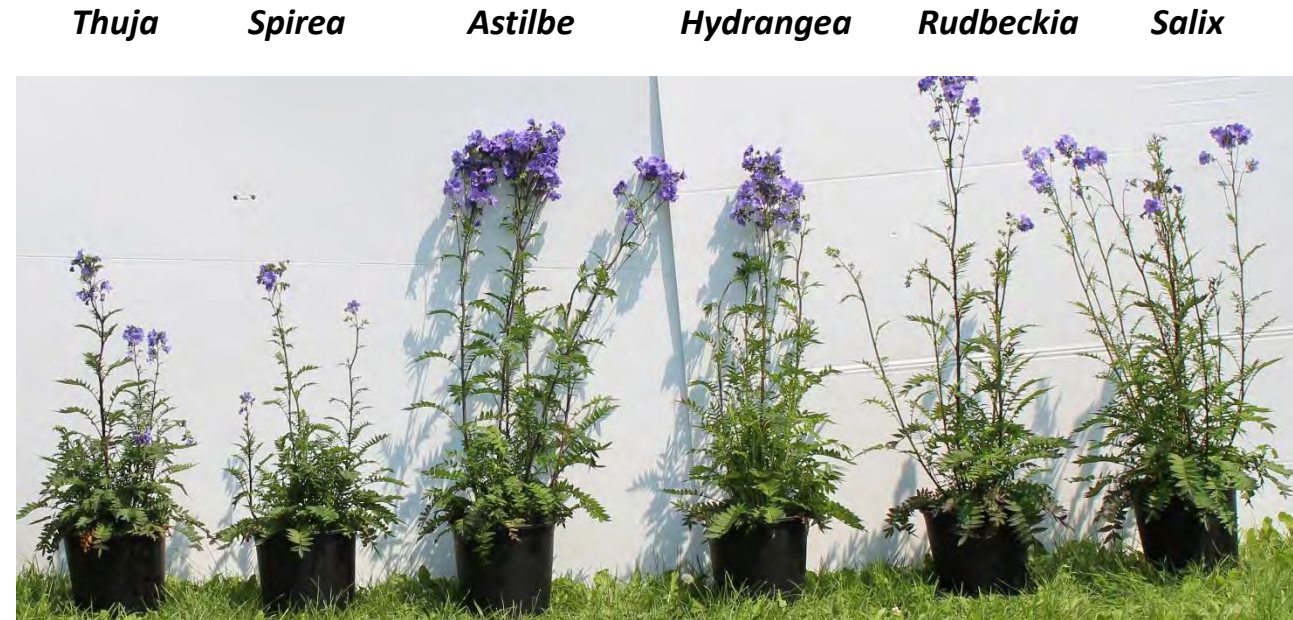
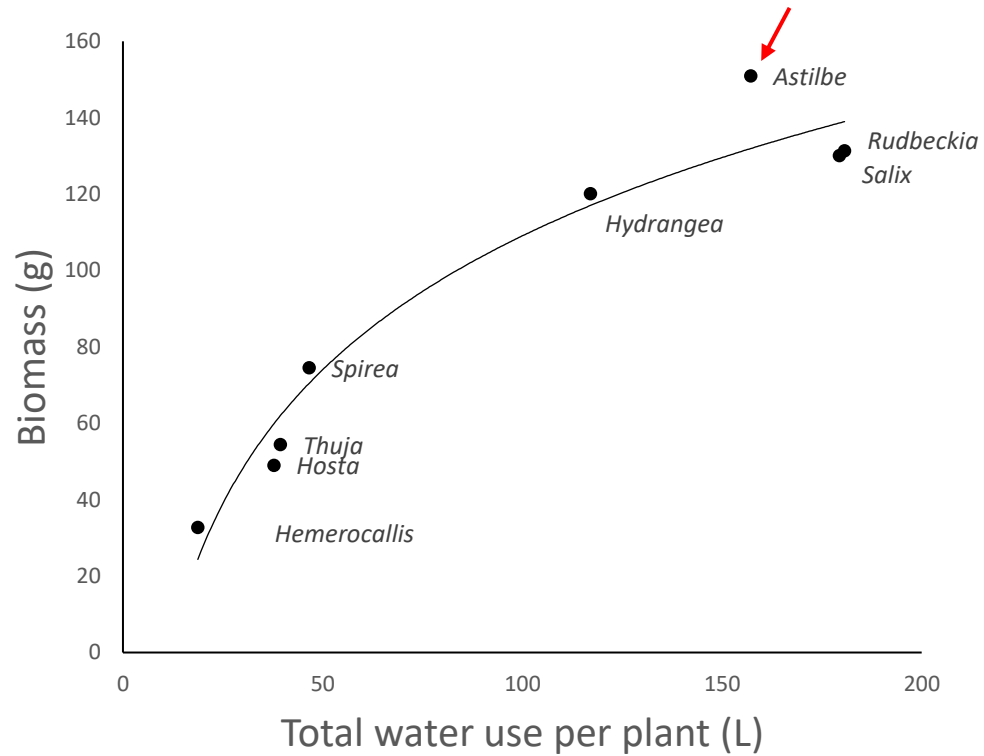
Actaea simplex (Cimicifuga)



Actaea simplex (Cimicifuga)

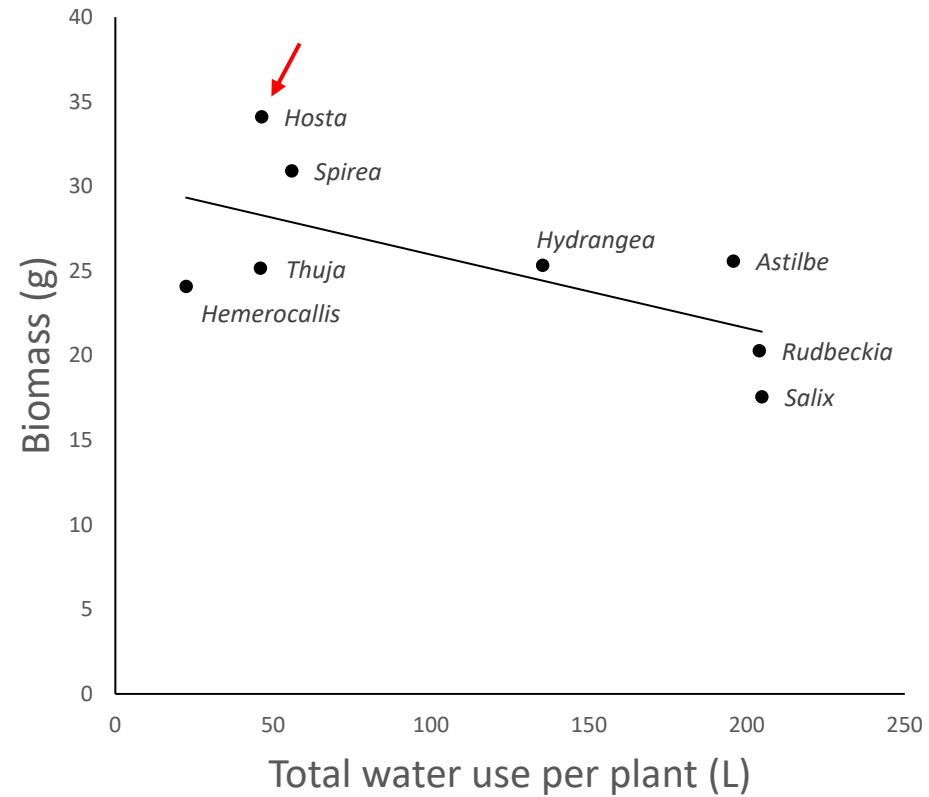


Polemonium yezoense



Picture: 15 July 2021

Pachysandra terminalis



Takeaways

- Optimal clustering practices lead to significant reduction in water use
- Speed of growth is an important factor to consider when choosing the reference species
 - Water use varies during the season between species
 - Variations can arise from the plug quality (vigor, diseases)





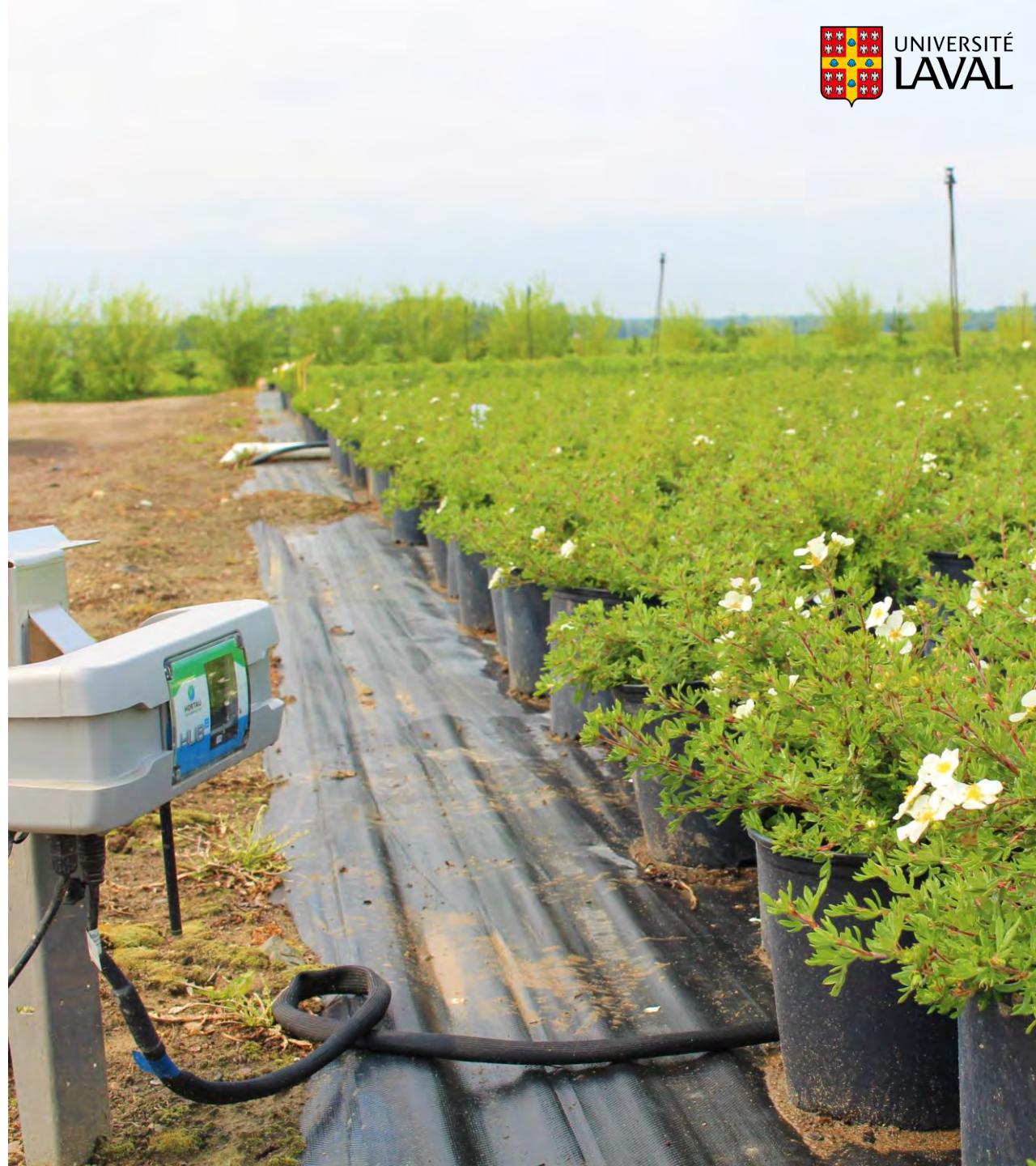
Improve clustering- What's next?

- 25 new species to come...

Automation strategies

Experimental setup

- Wireless tensiometer, automatic valves, watermeters, weather station (Hortau)
- 2 species in cluster
- Bark based soil mix (agro Mix N7)
- Sprinklers





Irrigation treatments

- Fully automated irrigation
 - Wireless tensiometers (-6 kPa)
- Evapotranspiration prediction-based irrigation
 - Weather station
- Replication of grower's irrigation strategy



Evapotranspiration calculation

- Penman-Monteith equation
 - Temperature
 - Wind
 - Solar radiation
 - Relative humidity
- Adjustment for the crop and stage of growth (K_c)
- Daily irrigation based on water loss predictions

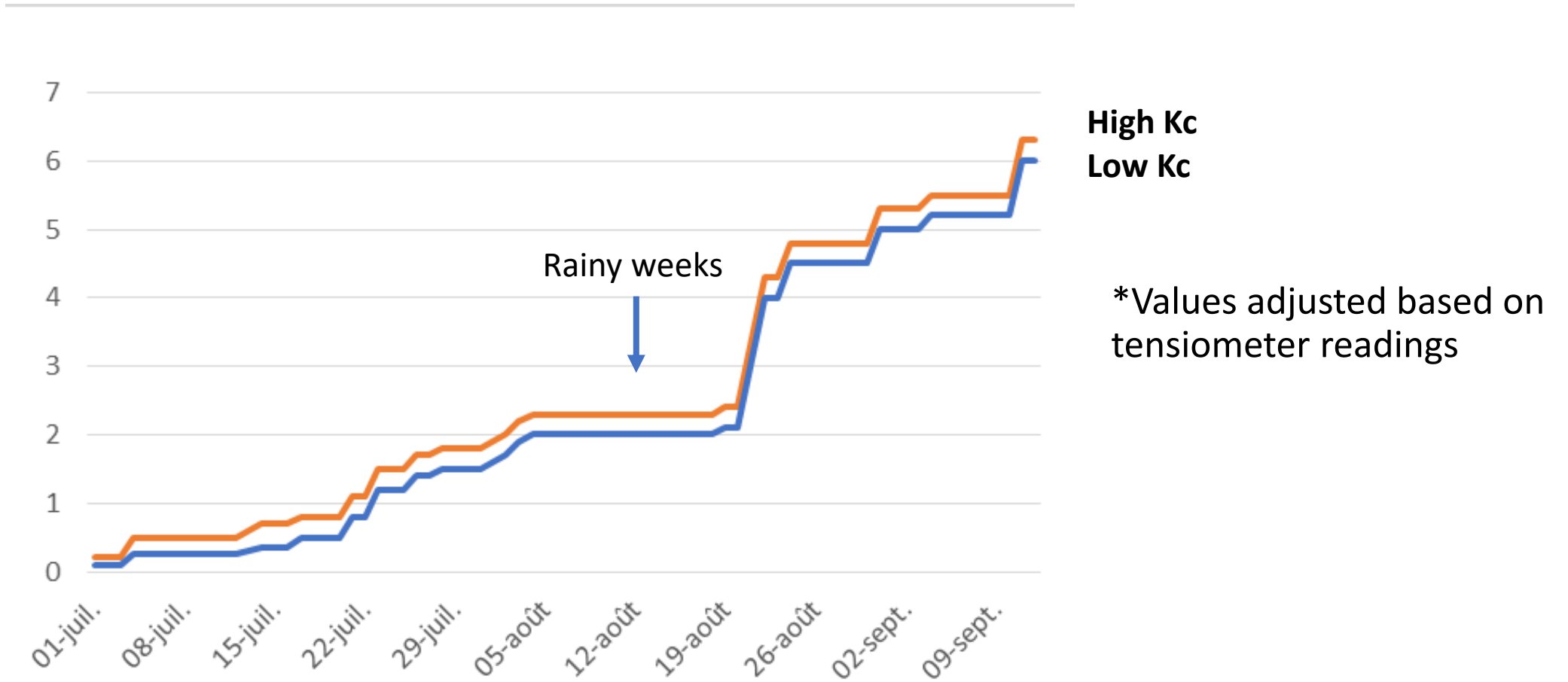


Evapotranspiration calculation

Example:

- $ET_0 = 4 \text{ mm}$
 - 4 mm of water lost for the reference
- $Kc = 2$
 - Crop coefficient for *Spirea* (early august)
- $ET = ET_0 \times Kc = 4 \times 2 = 8 \text{ mm}$
 - 8 mm of water needed for *Spirea*
 - 20 min of irrigation with our sprinkler

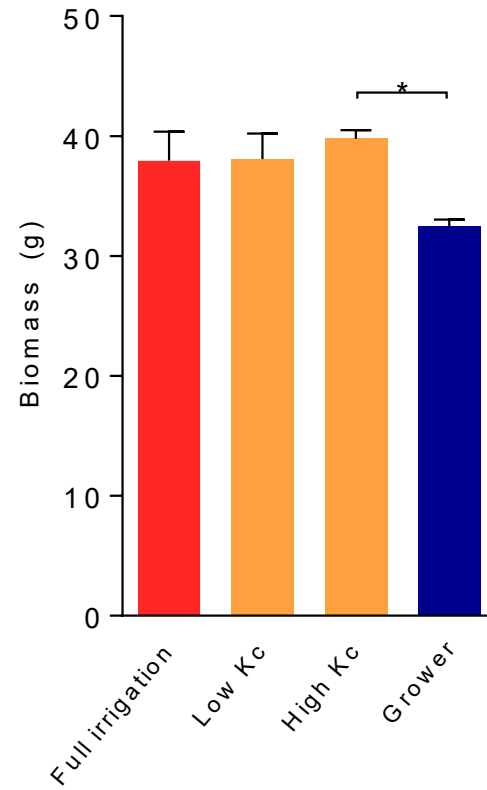
Crop coefficient throughout season



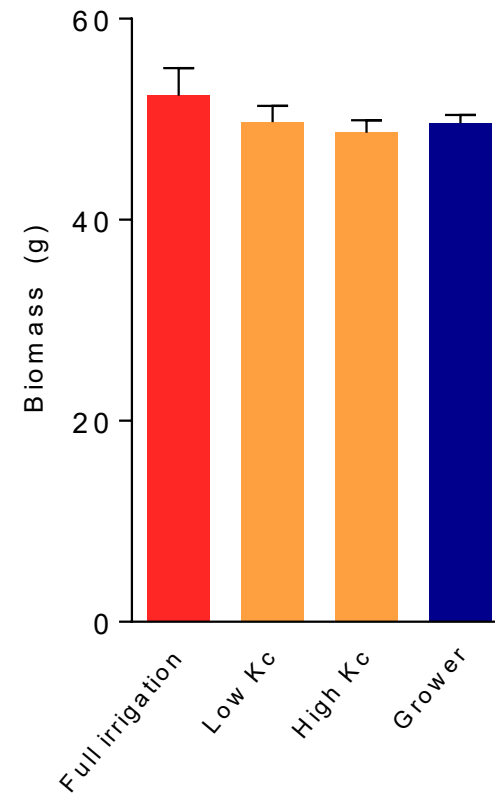
Growth



Spirea japonica



Spirea vanhouttei

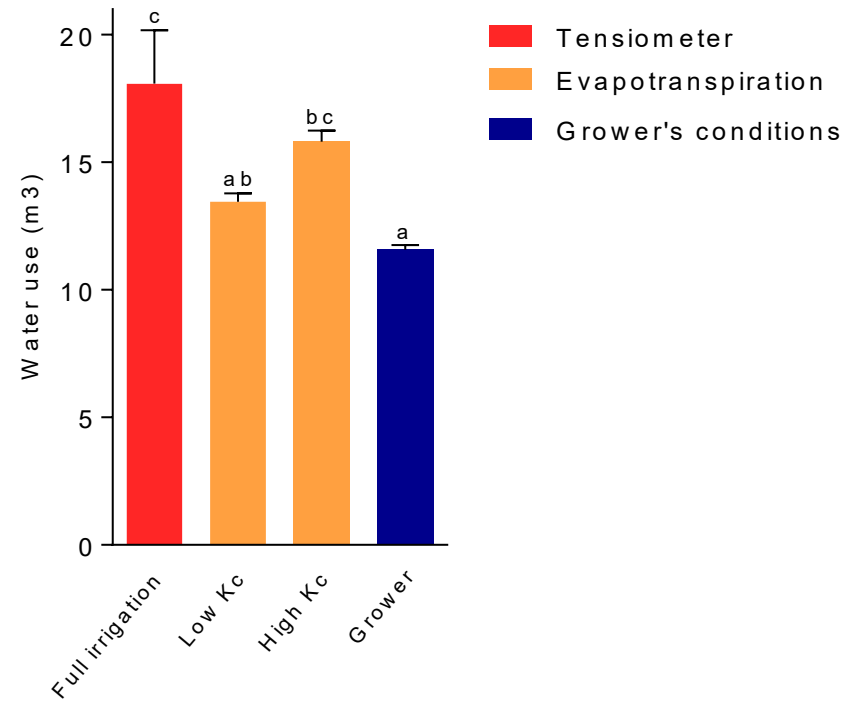


- Tensiometer
- Evapotranspiration
- Replicated grower's conditions

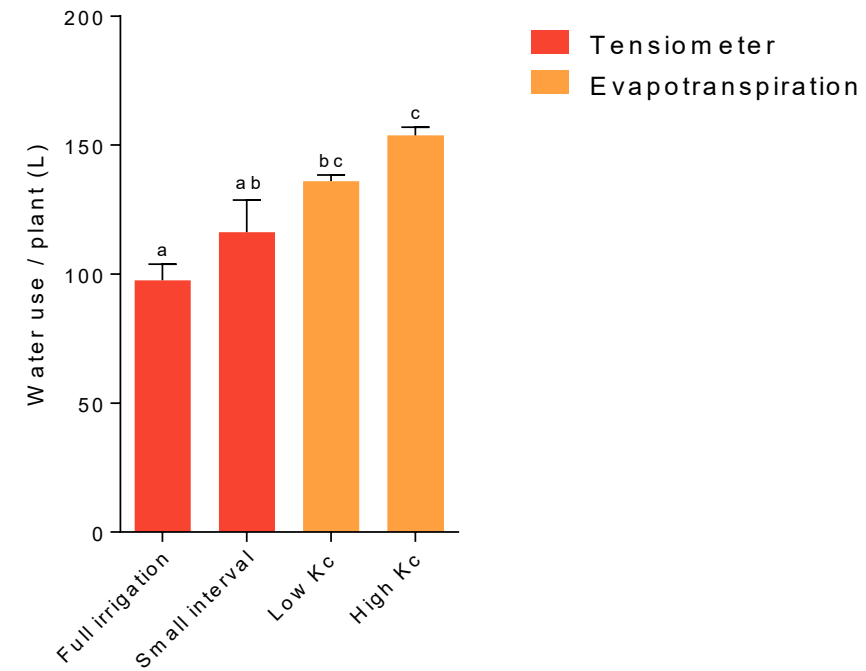
Water use



Season 2021



Season 2020



Takeaways

- Control of irrigation by **tensiometers** again show high efficiency
 - Easy to use and reliable
- **Evapotranspiration** based irrigation can be as efficient for water management
 - Kc must be adjusted rigorously throughout the growing season
 - Necessitate less equipment



What' to come?

- Compare automation strategies with tensiometers
- Refine evapotranspiration prediction



Thanks to all our partners!



Canada 



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— IMPLANTÉ DEPUIS 1946 —

Questions?

