UC Landscape Plant Irrigation Trials

The quest for the best low-water plants

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People want this
Or this

But...
Water Issues in California

- Constantly ↑ population
- Limited storage capacity
- No summer rainfall
- Recurring winter drought
- LARGE agricultural H₂O demand

- $56.6B industry in 2015 - 5th year of drought!

$5.3B
California’s response: MWELO
Model Water Efficient Landscape Ordinance

- Water budgets
- Combined plant water use ≤ 50% of local ET₀
- Uses online database
  *Water Use Classification of Landscape Species*
  - 3500 taxa categorized

Problem?
New cultivars may not match old taxa.
The only university-run ornamental plant trials in California
UC Landscape Plant Irrigation Trials

- 2005- Present
- 2 years in-ground
- Perennials- woody and herbaceous
- $ET_0$-based irrigation
UC Davis Arboretum All-Stars
Grower/Breeder Selections
Full Sun
12/15 Species/Year

50% Shade
4 Species/Year
PURPOSE of UC LPIT

1. Provide research-based water use info for
   – plants already thought lower water users
   – new introductions from growers

2. Demonstrate just how low you can go
   – Recommended rate or range of water
     • HIGH – MODERATE - LOW

⭐ Evaluate for other sustainability traits
METHODS

- Rows & plants: 2 m spacing
- 2 randomized complete blocks
- 4 treatments; 6 reps – 3 treatments; 8 reps
  - Total of 24 plants of each species/cultivar
- No fertilizer, no pesticides

Herbicide between rows only
METHODS

• Fall planting – October
• 1 G pots (exception- bareroot roses)
METHODS

- Drip irrigation rings
  - ½ inch tubing
  - @ pot/soil interface
  - 4 emitters/plant
- 3” chipped wood mulch
- 18 months of irrigation at 100% of $ET_0$ & 25% Available Water deficit
Plant Available Water (PAW)

• The amount of water present in the soil *that plant roots can take up.*

• Some water is held tightly to the soil particles, some drains below the root zone.

• The remainder is *AVAILABLE.*
METHODS

• Treatments begin 2\textsuperscript{nd} April/May

• Real-time $\text{ET}_0$-based irrigation
  – @ 100% AW depletion
  – 80%, 50%, or 20% of $\text{ET}_0$
Evapotranspiration (ET) - *What is it?*

- **Water loss to the air**
  - *by evaporation from the ground* +
  - *transpiration from plants* (like exhaling)

- Affected by wind, sun, humidity, temperature
**Reference ET or \( ET_0 \)**

- Amount used by tall fescue turfgrass (4-6”)
- Varies by region
- Stations collect data
- CIMIS reports it-
  - *California Irrigation Management Information System*

[Link to CIMIS website](http://www.cimis.water.ca.gov)
Irrigation Methods

• 80%, 50%, or 20% of $ET_0$

• Corresponds to WUCOLS LEVELS
  – HIGH
  – MODERATE
  – LOW

• Why do HIGH?
**Average 2\textsuperscript{nd}-Yr Irrigation Frequency**
(full sun, clay-loam soil, 18” deep/ 1m\textsuperscript{2}, \approx 16G)

<table>
<thead>
<tr>
<th>Treatment ET\textsubscript{0} Percentage</th>
<th># Days between irrigation events</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>12 (8-14)</td>
</tr>
<tr>
<td>60</td>
<td>18 (14-21)</td>
</tr>
<tr>
<td>40</td>
<td>30 (23-36)</td>
</tr>
<tr>
<td>20</td>
<td>2X during the period</td>
</tr>
</tbody>
</table>
**Average 2\textsuperscript{nd}-Yr Irrigation Frequency**  
*shade, clay-loam soil, 18” deep/1m\textsuperscript{2}, \approx16G*

<table>
<thead>
<tr>
<th>Treatment ET\textsubscript{0} Percentage</th>
<th># Days between irrigation events</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>1x/month</td>
</tr>
<tr>
<td>60</td>
<td>45 days</td>
</tr>
<tr>
<td>40</td>
<td>2x/ season</td>
</tr>
<tr>
<td>20</td>
<td>1x (maybe)</td>
</tr>
</tbody>
</table>
METHODS

• Monthly measurements
• Monthly quality ratings on scale of 1-5
  – Foliage quality
  – Flowering abundance & length of flowering time
  – Pest/Disease resistance
  – Vigor
  – Overall Appearance – WOW Factor!
Open House Field Days

*Industry Pros & MGs*
## Sample Results- FULL SUN

<table>
<thead>
<tr>
<th>PLANT</th>
<th>Average Annual Quality Rating (1-5)</th>
<th>REC rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>Irrigation Rate</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Aster ‘Purple Dome’</strong></td>
<td>4.1</td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Bulgine ‘Tiny Tangerine’</strong></td>
<td>4.5</td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Rosa ‘Korbin’</strong></td>
<td>3.9</td>
<td>4.2</td>
</tr>
<tr>
<td><strong>Buddleia ‘Blue Heaven’</strong></td>
<td>3.9</td>
<td>4.0</td>
</tr>
<tr>
<td><strong>Cordyline ‘Purple Sensation’</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Escallonia ‘Pink Whisper’</strong></td>
<td>2.3</td>
<td>2.5</td>
</tr>
<tr>
<td><strong>Lomandra ‘Seascape’</strong></td>
<td>3.5</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Mimulus ‘Curious Georgie Boy’</strong></td>
<td>3.0</td>
<td>3.0</td>
</tr>
</tbody>
</table>
## Sample Results- 50% SHADE

<table>
<thead>
<tr>
<th>PLANT</th>
<th>Average Annual Quality Rating (1-5)</th>
<th>REC rate</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Irrigation rate</strong></td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td><em>Helleborus</em> ‘Red Lady’</td>
<td>3.4</td>
<td>3.4</td>
</tr>
<tr>
<td><em>Heuchera maxima</em></td>
<td>4.0</td>
<td>4.1</td>
</tr>
<tr>
<td><em>Ribes viburnifolium</em></td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td><em>Woodwardia fimbriata</em></td>
<td>3.9</td>
<td>3.3</td>
</tr>
<tr>
<td><em>Abelia</em> ‘Sunshine Daydream’</td>
<td>4.5</td>
<td>4.4</td>
</tr>
<tr>
<td><em>Hypericum</em> ‘Red Ignite’</td>
<td>4.1</td>
<td>4.0</td>
</tr>
<tr>
<td><em>Ligustrum sinense</em> ‘Sunshine’</td>
<td>4.9</td>
<td>4.9</td>
</tr>
<tr>
<td><em>Trachelospermum</em> ‘Sebra’</td>
<td>3.7</td>
<td>3.6</td>
</tr>
</tbody>
</table>
# RESULTS - Roses

<table>
<thead>
<tr>
<th>Cultivar</th>
<th>Treatment % of ET&lt;sub&gt;0&lt;/sub&gt;</th>
<th>Recommended Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>80</td>
<td>60</td>
</tr>
<tr>
<td>'Aushouse'</td>
<td>2.9</td>
<td>3.1</td>
</tr>
<tr>
<td>'Gruss an Aachen'</td>
<td>3.8</td>
<td>3.1</td>
</tr>
<tr>
<td>'KORbin'</td>
<td>4.1</td>
<td>4.3</td>
</tr>
<tr>
<td>'KORelamba'</td>
<td>3.8</td>
<td>3.5</td>
</tr>
<tr>
<td>'KORfloci01'</td>
<td>3.3</td>
<td>3.1</td>
</tr>
<tr>
<td>'KORSixkono'</td>
<td>4.2</td>
<td>4.3</td>
</tr>
<tr>
<td>'KORsteimm'</td>
<td>3.5</td>
<td>3.6</td>
</tr>
<tr>
<td>'Meidrifora'</td>
<td>3.9</td>
<td>4.0</td>
</tr>
<tr>
<td>'Meijocos'</td>
<td>4.0</td>
<td>3.9</td>
</tr>
<tr>
<td>'Meigalpio'</td>
<td>4.0</td>
<td>3.8</td>
</tr>
</tbody>
</table>
Auxiliary Trial - CA Native Establishment

- **DRIVERS**
  - Losses in the first year
  - Economic loss for nursery
  - Frustration for landscapers and gardeners
  - Discourages CA Native use
CA Native Establishment

- Paired trials in clay loam and sandy loam
- Spring planting
- Irrigation based on allowed moisture depletion
  - 25%, 50%, 75%, 100%
# CA Native Establishment Results

<table>
<thead>
<tr>
<th>Plant Name</th>
<th>Clay loam</th>
<th>Sandy loam</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>Arctostaphylos</em> ‘Emerald Carpet’</td>
<td>50-100</td>
<td>50-75</td>
</tr>
<tr>
<td><em>Arctostaphylos uva-ursi</em> ‘Point Reyes’</td>
<td>25-50</td>
<td>50</td>
</tr>
<tr>
<td><em>Arctostaphylos uva-ursi</em> ‘Wood’s Compact’</td>
<td>50-75</td>
<td>50</td>
</tr>
<tr>
<td><em>Baccharis pilularis</em> ‘Pigeon Point’</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td><em>Ceanothus</em> ‘Concha’</td>
<td>50</td>
<td>75-100</td>
</tr>
<tr>
<td><em>Ceanothus griseus</em> var. <em>horizontalis</em> ‘Yankee Point’</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td><em>Eriogonum giganteum</em></td>
<td>25</td>
<td></td>
</tr>
<tr>
<td><em>Mimulus</em> ‘Trish’</td>
<td>75</td>
<td>75</td>
</tr>
<tr>
<td><em>Rhamnus californica</em> ‘Mound San Bruno’</td>
<td>25-50</td>
<td>25</td>
</tr>
<tr>
<td><em>Salvia clevelandii</em> ‘Allen Chickering’</td>
<td>75</td>
<td>25</td>
</tr>
</tbody>
</table>
New Fields

• Matched Trials Field in Irvine @SCREC
• Expanded field in both Davis and SCREC
  – Larger spacing for larger plants (3m spacing)
• FUTURE?
  – Larger field/ longer trial period – larger plants?
• BIGGEST OBSTACLE?
  – $$$$$$
American Rose Trials for Sustainability
http://www.americanrosetrialsforsustainability.org/

• Beginning 2018
• New and standard cultivars
• National trial in 9 regions
• We are Mediterranean trial
• 2-year trial followed by UC LPIT protocol
• Winners awarded and marketed as
  — *Local Artists OR Master Roses*
All Trials Results to date:

http://ccuh.ucdavis.edu/Resources/plant-trials
Key messages for your clientele

1. Attractive low-water use plants are available!
2. Establishing on regular water is KEY to success.
   – Begin at pot/soil interface - water BOTH!
   – Gradually increase width of irrigation zone.
3. Irrigation needs to be DEEP to drive roots deep.
4. Once established, infrequent, deep irrigation keeps low-water users happy and healthy.

- PAY ATTENTION TO SOIL TYPE!
- Resist the temptation to over-generalize frequency recommendations!
5. Drip below mulch is the most efficient delivery.

6. At least 3” of mulch is KEY to conserving water.

7. Hydrozoning is KEY to optimizing irrigation.

8. Weather-based irrigation saves water.
Questions?