Carbon and water relations of *Nerium oleander* in simulated residential landscapes

Linda B. Stabler and Chris A. Martin
Department of Plant Biology

These data present a preliminary overview of carbon and water relations of *Nerium oleander* in response to irrigation and pruning treatments.

Methods

- 14 10x10 m plots, each with 6 clones of *N. oleander*
- 2 x 4 Treatment Factorial
  Irrigation volume (high vs. low)
  Pruning frequency (every 6 weeks, 6 months, yearly or unpruned)
- Growth measurements every 3 months for 3 years
  Estimates of leaf surface area and biomass production
- Maximum gas exchange fluxes every 3 months for 2 years
- Mass sap flow April-October 2002

Results

On a leaf area basis, irrigation volume did not affect CO_2 assimilation (A) or transpiration (E) (Fig 1a).

On a leaf area basis, pruning increased A and E relative to unpruned controls (Fig. 1b).

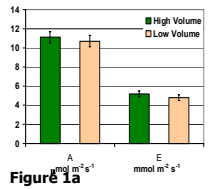

Figure 1a

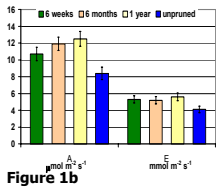

Figure 1b

Figure 1

Maximum fluxes of CO_2 assimilation (A) and transpiration (E) per unit leaf area for two years in response to (a) irrigation and (b) pruning.

Error bars are +/- 1 SE
n = 340 for irrigation
n= 170 for pruning

Results

Estimated whole plant standing leaf surface area (LSA) was affected by interaction of irrigation and pruning (Fig. 2a).

Differences in LSA translated to an interactive effect on whole plant A and E (Fig. 2b and 2c).

Yearly productivity was affected by irrigation and pruning, but not interactively (Fig. 2d).

High irrigation volume increased productivity.
Plants pruned yearly or left unpruned were more productive than those pruned more frequently.

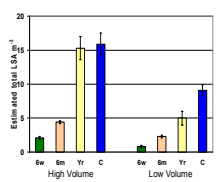

Figure 2a

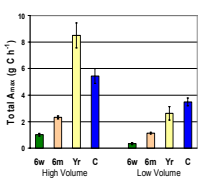

Figure 2b

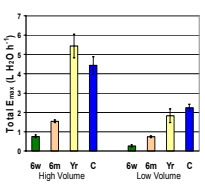

Figure 2c

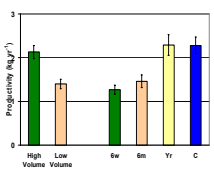

Figure 2d

Figure 2. Estimates of (a) whole plant standing leaf surface area (LSA) after 3 years growth and pruning ,mean whole plant maximum (b) A and (c) E, and (d) yearly productivity. Estimates of whole plant LSA are preliminary and being refined via destructive harvest.

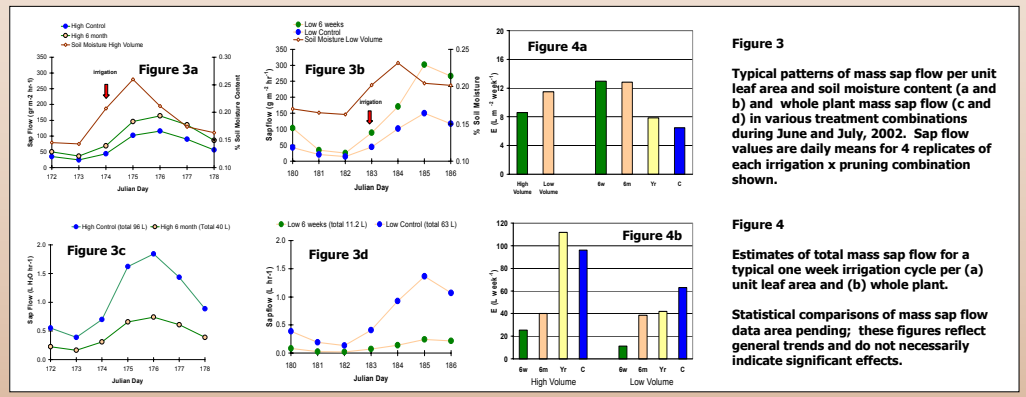

Figure 3

Typical patterns of mass sap flow per unit leaf area and soil moisture content (a and b) and whole plant mass sap flow (c and d) in various treatment combinations during June and July, 2002. Sap flow values are daily means for 4 replicates of each irrigation x pruning combination shown.

Figure 4

Estimates of total mass sap flow for a typical one week irrigation cycle per (a) unit leaf area and (b) whole plant.

Statistical comparisons of mass sap flow data area pending; these figures reflect general trends and do not necessarily indicate significant effects.

Results

On a leaf area basis, smaller plants trended toward higher rates of mass sap flow (Fig. 3a and 3b).

On a whole plant basis, larger plants trended toward higher rates of mass sap flow (Fig. 3c and 3d).

On a leaf area basis, estimates of E based on mass sap flow were somewhat similar to patterns predicted based on maximum gas exchange measurements in response to irrigation and pruning (Fig. 4a and 1b).

On a whole plant basis, estimates of E based on mass sap flow were very similar to those predicted from maximum gas exchange measurements in response to irrigation and pruning (Fig. 4b and 2c).

Conclusions

- Total plant carbon uptake and water loss in oleander is most closely related to total leaf surface area.
- Irrigation volume and pruning frequency most impact carbon and water relations of oleander via effects on total leaf surface area.
- Whole plant transpiration in oleander is likely a function of leaf surface area and soil water content.
- Yearly productivity in oleander is likely an interactive function of treatment effects on leaf surface area and leaf level processes.
- These data suggest that estimates of leaf area might be the best predictor of primary productivity and transpiration in managed urban landscapes.

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