Growth of Two Landscape Shrub Following Severe Pruning: Evidence of a Hysteretic Effect of Former Irrigation and Pruning Practices

Darin K. Mahkee and Chris A. Martin
Department of Applied Biological Sciences, Arizona State University East
7001 East Williams Field Road, Mesa, Arizona, USA 85212

INTRODUCTION

One important characteristic shared by many plants is the ability to regenerate aboveground biomass (such as stems and leaves) that have been lost as a result of a defoliation event, such as herbivory or fire (Herms and Mattson 1999). This regeneration is made possible through the metabolism of stored carbon and nutrient reserves from undamaged parts of the plant, usually from belowground parts such as roots or tubers. However, the size of these stores can vary between plants, even within a species. This variation is often a result of site-specific resource availability. However, several studies have shown that repeated defoliation events can greatly reduce the amount of carbon and nutrient stored within the plant as a result of the continual need to regenerate growth (Avice et al., 1997).

In the southwestern United States, contemporary urban spaces for landscape plantings are extremely limited in size. These urban spaces are often landscaped using design schemes that include excessively close spacing of desert and desert-adapted plants, which are subsequently chronically over irrigated to encourage lush growth and frequently sheared to control their size (Martin and Stabler, 2003). In time, frequently sheared plants are often cut down to the ground, in order to stimulate more attractive new growth, and rejuvenate the plant. Called severe renewal pruning (SRP), this practice is stressful, and the rate growth after SRP might be related to the amount of carbon and nutrients stored within plant root systems. The objective of this research was to determine if former irrigation and pruning practices affect growth rates following SRP of two regionally common landscape shrubs following severe pruning.

MATERIALS AND METHODS

Two shrub taxa, Leucophyllum frutescens var. green cloud, and Nerium oleander ‘Bister Agnes’ were grown from May 1999 until March 2003 in a factorial matrix of two drip irrigation rates (high and low) and four pruning frequencies (every 6 weeks, every 6 months, once yearly and unpruned control) (Stabler, 2005). In April 2003, all shrubs were subjected to SRP. Subsequently, all pruning treatments were stopped, but irrigation treatments were maintained. Every 14 days following SRP, measurements of height, along with canopy spread in 2 diameters (N-S and E-W) were recorded until 196 days after SRP (DAP).

Size measurements were used to calculate plant volume, based on geometric formulas for each plant. L. frutescens was treated as a truncated sphere, and N. oleander was treated as an upright cylinder (Fig. 1). Time trends of volume increases as a measure of growth rate after SRP were then analyzed for a hysteretic effect of former irrigation and pruning practices using JMP 6.0.1 (SAS Institute).

RESULTS

- For Nerium oleander, there were significant differences in the growth response over time for each irrigation/prune treatment (G-G = 0.0993028, approx F = 3.9140, num DF = 3, 7372, den DF = 96.82, P>F=0.0009).
- For Leucophyllum frutescens, there were significant differences in the growth response over time for each irrigation/prune treatment (G-G = 0.0896179, approx F = 2.5674, num DF = 3, 7344, den DF = 96.82, P>F=0.0462).
- For both shrubs, the largest plant volumes at the end of the study period were found in the high rate, 6 month pruning treatments.
- For both shrubs, the smallest plant volumes at the end of the study period were found in the low rate, 6 week pruning treatments.

CONCLUSIONS

- These data indicate that low irrigation rates, frequent pruning can lead to decreased regeneration potential.
- Our preliminary studies have shown that in Nerium oleander, leaf area was significantly reduced at high pruning frequencies. (unpublished data). When exhaust of reserves is coupled with reduced leaf area for light capture, regrowth potential of frequently pruned shrubs is likely severely limited.
- Frequently pruned plants likely have smaller root systems, and may be unable to acquire the resources necessary for continued growth, especially in dry soil where nutrient availability is likely limiting.

REFERENCES


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