Treeshelter Use in Producing Container-Grown and Landscape-Grown Trees

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INTRODUCTION

Treeshelters are now used in the establishment of trees in the landscape (Evans and Potter, 1985; Frearson and Weiss, 1987; Potter, 1988). These treeshelters are cylindrical or square, translucent, polypropylene tubes of varying height (usually 60 to 150 cm) which are placed around seedlings or transplants at planting time. Trials in England have shown that placing these shelters over transplanted or naturally sprouted seedlings of various species improved the seedling survival rate. Treeshelters protected seedlings from herbicidal drift and animal browsing, but their most attractive characteristic was the 60% to 600% increase in plant height (Frearson and Weiss, 1987; Potter, 1988, 1991). Growth rate increases have been attributed to the enhanced growing environment around the plant achieved with the use of the treeshelter. Increases in ambient temperature, relative humidity, and CO_2 concentration have all been suggested as probable causes for increased growth (Frearson and Weiss, 1987; Potter, 1988). The nature of the relationship among these environmental parameters and their potential effect on treeshelter-grown plants is not clear.

Treeshelters are intended for and customarily used in the landscape (Potter, 1991). The use of treeshelters during the production of container-grown plants has not been explored. However, based on work conducted with treeshelters in the landscape, plant growth could be enhanced and plants more suitable for transplantation to the landscape could be produced with the use of treeshelters in the nursery. The objectives of our work were to: (1) determine how three container-grown, landscape species would respond to treeshelters in a nursery, (2) determine the water use characteristics of these trees grown with or without a treeshelter, and (3) compare the growth and survival of seedlings replanted into the landscape, grown with or without a treeshelter and receiving 7 to 14 times less water than in the nursery.

MATERIALS AND METHODS

Nursery Experiment. Three tree species were selected for the study: *Cedrus deodara* (deodar cedar), *Quercus ilex* (holly oak), and *Magnolia grandiflora* (southern magnolia). In February, 1990, 30 young plants of each of the three species grown in 1-gal containers were transplanted into 5-gal containers. A treeshelter (Tubex, St. Paul, Minnesota) was placed over 10 plants of each species. The bottom of the shelter was pushed into the container medium approximately 3 cm. A stake was driven down along side the shelter and the shelter tied to it for support.

Height and trunk caliper (at the top of the pot) were measured for each experimental plant at the beginning of the experiment and on December 12, 1990.

None of the trees were pruned during the experiment. After the first year, some trees had the treeshelter removed from around them and they were allowed to grow another year without a shelter, some plants remained in the shelter, and the control plants were unsheltered.

Water use measurements were taken twice during the growing season (5/1/90 and 6/7/90). Plants were watered heavily and allowed to drain to container

Table 1. Response of *Cedrus deodara*, *Quercus ilex*, and *Magnolia grandiflora* trees to treeshelters. Hgt=Height, Cal=Caliper, SFW=Shoot Fresh Weight, SDW=Shoot Dry Weight, RFW=Root Fresh Weight, and RDW=Root Dry Weight.

Treatment	Hgt (cm)	Cal (mm)	SFW (g)	SDW (g)	RFW (g)	RDW (g)
			Cedrus			
No stake, no shelter - Years 1,2	170 B	34.7	2710	1314	2357	888
No stake, shelter - Year 1	211 A	35.3	2623	1264	227	1862
No stake, shelter - Years 1,2	212 A	29.7	2293	1092	2373	809
	NS	NS	NS	NS	NS	
			Quercus			
No stake, no shelter - Years 1,2	183 C	29.0 A	1600	966	1425	669
No stake, shelter - Year 1	242 B	30.0 A	1906	1175	1295	614
No stake, shelter - Years 1,2	271 A	30.0 A	1763	1040	1266	603
Staked, no shelter	221 BC	18.5 B	-	-	-	-
		NS	NS	NS	NS	
			Magnolia			
No stake, no shelter - Years 1,2	116 B	19.0	1170	536	659	223
No stake, shelter - Year 1	163 A	15.3	640	325	434	148
No stake, shelter - Years 1,2	176 A	19	1043	487	565	203
	NS	NS	NS	NS	NS	

NS - Not Significant.
Values followed by different letters are significantly different at p=0.05 using Scheffe's Mean Separation Procedure.

capacity (1 h). The plant and container were weighed and placed back into the nursery bed. After 24 h the plant and container were re-weighed. The difference in weight was defined as the water used and consisted of water transpired by the plant and water evaporated from the soil surface.

RESULTS AND DISCUSSION

Height increases of trees grown in shelters for one year were 24%, 32%, and 41% greater than unsheltered trees for *Cedrus*, *Quercus*, and *Magnolia*, respectively (Table 1). Only *Quercus* trees growing in shelters had a significant height increase over unsheltered trees during the second year. Treeshelters did not significantly affect the caliper of any one of the three tree species. Staking of *Quercus* trees significantly reduced trunk caliper (Table 1, *Quercus* trees staked with no shelter). *Quercus* trees grown in shelters for one year developed into high-quality trees ready to be transplanted into the landscape. Once the shelter was removed from around *Cedrus* trees, they were incapable of supporting their own weight. Leaves of *Magnolia* trees grown in shelters deteriorated and senesced leaving the main stem with very few leaves.

While it has been shown that the root growth of these tree species is reduced while growing in a shelter during the first year of growth (Burger et al., 1992), the difference disappears during the second year. There were no significant differences in shoot or root fresh or dry weights of trees growing with or without shelters after two years (Table 1). Only *Cedrus* trees grown in shelters and measured on 6/7/90 used significantly less water than those grown without shelters (353 versus 577 ml/24 h). There were no significant differences in water use of *Magnolia* and *Quercus* trees grown with or without shelters on either test date with values ranging from 253 to 337 ml/24 h for *Magnolia* and 340 to 367 ml/24 h for *Quercus*.

MATERIALS AND METHODS

Landscape Experiment

Fifteen seedlings of coast redwood (*Sequoia sempervirens*), seeded on May 5, 1989, were selected at random on May 10, 1990 from seedling flats. They were immediately planted in Falkirk Park (San Rafael, California) in three north-south rows (150 cm between plants). Height and caliper measurements were taken of each tree before treeshelter treatments were imposed. Ten treeshelters were placed over randomly selected seedlings. Beginning 14 days after planting, the seedlings were irrigated as follows: (1) five seedlings in shelters received 1 liter of water every 7 days (SR schedule), (2) another five seedlings in shelters received 1 liter of water every 14 days (S schedule), and (3) the remaining five control, unsheltered trees received 1 liter of water every 7 days. These irrigation schedules were maintained until October 29, 1990, when the first rain occurred.

RESULTS AND DISCUSSION

Redwood seedlings growing in treeshelters and irrigated with 1 liter of water every 14 days (S schedule) were taller than unsheltered trees receiving 1 liter of water every 7 days (Fig. 1). Sheltered trees irrigated with 1 liter of water every 7 days (SR schedule) were 26% to 28% shorter than those in treeshelters with the S schedule. Trees irrigated under the SR schedule were 60% to 63% taller than the unsheltered trees irrigated similarly; however, this height increase was not statis-

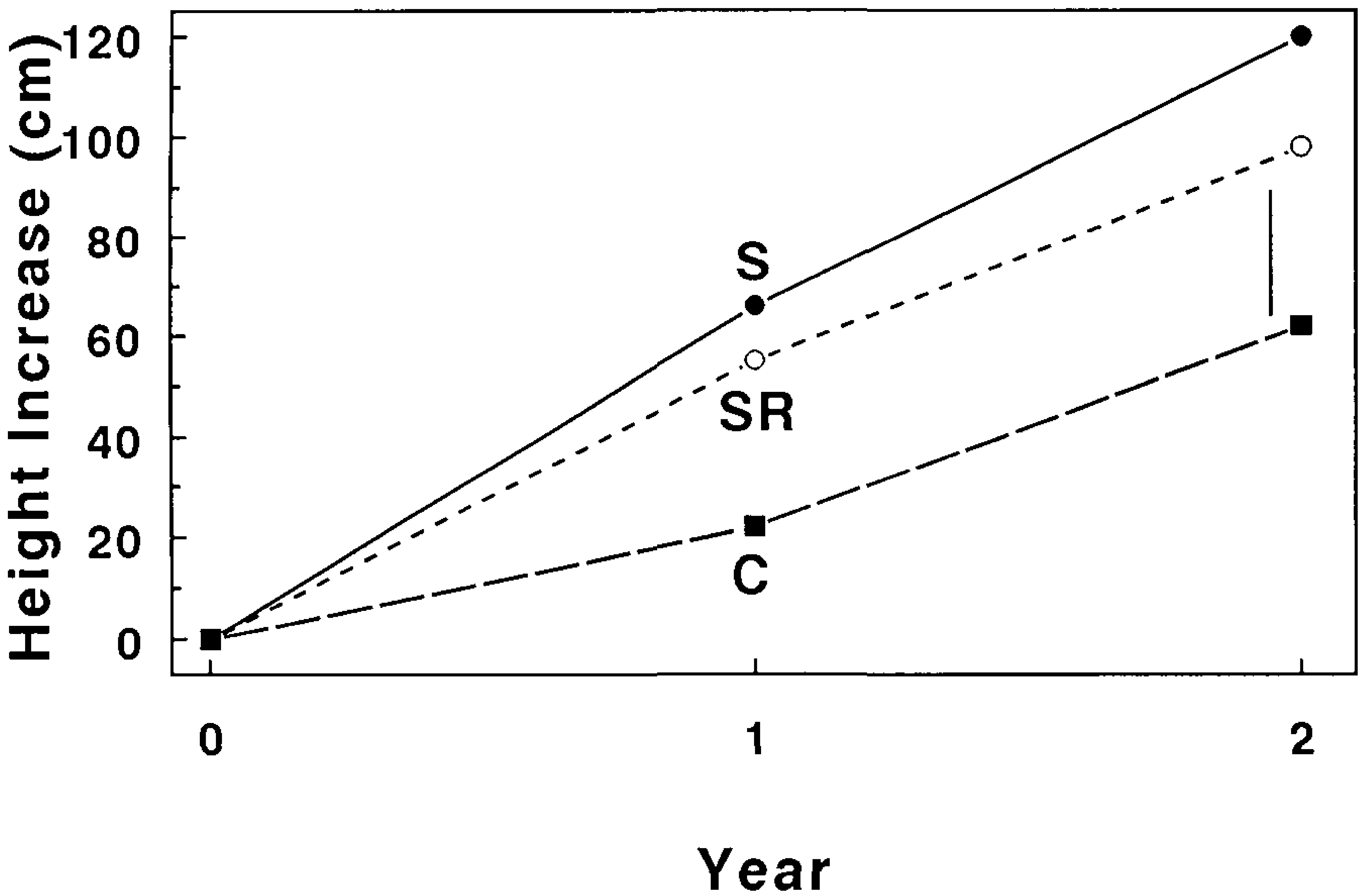

Figure 1. Height increase of redwood trees over a two-year period growing in treeshelters (S and SR treatments) and without shelters (C) under different irrigation regimes. Vertical bar represents 1 Standard Error.

tically significant. Neither treeshelters nor watering schedule had a significant effect on caliper, although in the second growing season, the control trees had about 26% to 31% greater caliper than those in treeshelters.

CONCLUSIONS

The growth responses of container-grown plants in our study indicate that treeshelters have an application in the nursery. The acceleration in tree height is attractive enough to encourage nursery managers to try slow-growing or grafted woody plants in treeshelters. Questions remain related to root development and transplantability of trees grown in shelters in the nursery. These are currently being addressed.

The landscape experiment with one-year-old redwood seedlings suggests that these trees, if planted by standard procedures, successfully establish themselves whether grown in treeshelters or not.

LITERATURE CITED

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