Effects of Copper Hydroxide-Treated Containers and Water-Reservoir Containers on Root and Shoot Growth of Four Tree Species

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Nature of Work: Copper hydroxide-treated containers have been reported to reduce root circling within containers and in some cases have enhanced shoot growth (1,3). Containers with water reservoirs have been reported to increase plant growth by providing an even supply of water to the plants between irrigation cycles (4). The objective of this study was to evaluate the effects of these container modifications on shoot and root growth of four tree species.

In April 1994, 40 plants each of Acer rubrum 'Franksred' Red Sunset™, Franklinia alatamaha, Prunus x 'Snofozam' Snow Fountains(g), and Ulmus parvifolia 'Emer I' Athena™ were potted into 3 gallon, black polyethylene containers with pine bark media. Media was amended with 4 lb. dolomite, 1.5 lb. KNO3, 2.0 lb. 017-0, and 5.0 lb. Esmigran micronutrients per cubic yard. Four treatments included; 1) standard containers, 2) standard containers with an interior coating of copper hydroxide, 3) water reservoir containers and, 4) water reservoir containers with copper interior coating. The copper compound was a latex paint base containing 7.1% Cu(OH)2 (SpinOutTM, Griffin Corp., Valdosta, GA) and was applied with a paint brush. The standard containers' (IEM Plastics, Reidsville, NC) drain holes consisted of six 0.75 inch diameter round holes equally spaced around the bottom edge of the container plus one 0.75 inch diameter hole in the bottom center. Water reservoir containers were made by obtaining standard 3 gallon containers without drain holes and then drilling six 0.75 inch diameter holes on the sides of the container. Four of the holes were centered 1.38 inches above the container bottom and two of the holes were centered 3.5 inches above the container bottom. This configuration is the design of Environmentally Friendly Containers, Pursley/Rigsby Inc., Palmetto, Fla. All plants were grown in full sun on a gravel pad in a randomized complete block design, n=10. Plants received daily waterings for 15 min. at 15 psi with 180 degree pattern emitters (avocado color spray stakes, Rogers Irrig. Products, San Marcos, CA.) providing approximately 0.7 gallons/day/plant. This was sufficient water to provide leaching from all containers. A slow release fertilizer was applied twice during the growing season.

Stem diameter (1 inch above the media surface) and plant height were measured in May, 1994 (following planting) and again in November, 1994 (after leaf fall). On the latter date, root systems were visually rated based on the percent of the rootball surface covered by roots or root tips and to the degree of root circling; 1) < 20% of the rootball covered with roots, with no root circling; 2) 2040% of the root ball covered with slight root circling; 3) 40-60% root coverage with moderate root circling; 4) 60-80% root coverage with moderate to extensive root circling and 5) 80-100% root coverage with extensive root

circling. Plant height was measured from the media surface to the highest bud on the plant with the exception of Prunus x Snow Fountains, a weeping form, in which case the weeping shoot which would extend the highest was measured.

Results and Discussion: Copper hydroxide-treated containers significantly reduced or eliminated circling roots on the perimeter of the rootballs for all taxa (Table 1.). Shoot growth was not effected by the copper hydroxide for any taxa. Copper hydroxide had a slight positive effect on stem diameter growth of Prunus x Snow Fountains and a slight negative effect for Franklinia alatamaha. For Ulmus parvifolia Athena, copper hydroxide increased stem diameter growth slightly for plants in water reservoir containers but decreased stem diameter growth slightly for those in conventional containers.

Water reservoir containers, alone, had no significant effect on shoot growth, stem diameter growth, or root circling (root index). However, the water reservoir containers did stimulate root circling for Prunus x Snow Fountains, but only in containers without copper hydroxide. Most of this root circling was observed in the water reservoir portion of the container - a surprising result as many Prunus spp. are intolerant of wet conditions (2). Reports of positive effects of water reservoir containers on growth of some species may depend on container size, species, and environment. At our site the rainfall for the growing season months of 1994 was: 6.3", 6.9", 7.8", 5.9", and 4.7" for June, July, August September, and October, respectively. This considerable rainfall may have contributed to the negligible beneficial effect of containers with water reservoirs on plant growth in our study. Also, in a 3 gallon container, as used here, a one inch reservoir in the bottom of the container (assuming a 50% pore space) would only hold approximately 0.13 gallons when saturated. Larger reservoirs may be needed to buffer transient water deficits or significantly improve irrigation efficiency with daily waterings.

Significance to the Industry: Copper coated containers virtually eliminated root circling on these species with no substantial undesirable side effects. No apparent benefits were observed from containers with water reservoirs under our conditions.

Literature Cited

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Table 1. Shoot and root growth of four tree species as influenced by copper hydroxide-coated containers and water-reservoir containers.

Copper	Water reservoir	*Acer rubrum* Red Sunset			*Prunus* Snow Fountains			*Franklinia alatamaha*			*Ulmus parvifolia* Athena		
		Shoot Growth (mm)	Stem Growth (mm)	Root Index	Shoot Growth (mm)	Stem Growth (mm)	Root Index	Shoot Growth (mm)	Stem Growth (mm)	Root Index	Shoot Growth (mm)	Stem Growth (mm)	Root Index
Yes	No	397	7.0	1.2	701	12.6	1.1	487	7.1	1.0	451	6.2	1.0
No	Yes	512	7.6	3.4	1015	12.0	4.1	509	7.9	2.9	383	6.3	2.2
Yes	Yes	451	8.4	1.1	953	12.3	1.0	570	7.5	1.0	516	7.3	1.0
No	No	493	8.5	3.5	888	11.3	3.6	548	9.5	2.8	611	7.7	2.8
Statistical Analysis													
Copper		NS	NS	**	NS	*	**	NS	*	**	NS	NS	**
Water Res.		NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
Cu X WR		NS	NS	NS	NS	NS	*	NS	NS	NS	NS	*	NS

*,**, and NS indicate significance at 5%, 1% or not significant, respectively.