Weed Suppression for Container-grown Willow Oak Using Copper-treated Fabric Disks

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SUMMARY. A commercially available copper-treated disk was evaluated for its effect on weed suppression for container-grown willow oak (*Quercus phellos* L.). No weeds grew in containers where disks were used. All trees grown without disks or preemergent herbicide were dead within 6 months. Top dry weights were greater for trees grown with disks or preemergence herbicide, but root dry weights were not different.

Weed control is one of the most challenging aspects of plant production in containers. Weed control is important because weeds compete with nursery crops for nutrients, space and water. Fretz (1972) and Wilburn and Rauch (1972) reported significant reduction in the growth of container-grown plants due to competition with several broad-leaved weed species, and Walker and Williams (1985) reported similar results due to competition with several grass species. Neely (1984) reported that in the landscape, grasses could reduce tree growth by 50% due to competition for nitrogen that could be partially compensated for by the addition of nitrogen fertilizer.

Conventional weed control in container production usually involves costly and labor-intense hand weeding, preemergence herbicide use, or both. Though preemergence herbicides save labor, growers often limit their use due to concerns over applicator exposure, calibration accuracy, nontarget injury and off-site movement. Several application methods developed in recent years may reduce these concerns. These new herbicide application methods, including slow-release herbicide formulations, herbicide-treated paper, herbicide-treated mulch, herbicide-impregnated cloth and string, herbicides applied with pruning shears, and herbicide collars or disks, were reviewed by Derr (1994).

An alternative to hand weeding and herbicide application is the use of physical barriers on the substrate surface to block weed growth. Smith, et al. (1998) used pellitized and crumbled recycled waste paper products which provided weed control equal to the preemergence herbicide oxyfluorfen + oryzalin (Rout, The Scotts Company, Marysville, Ohio). Appleton and Derr (1990) used disks made from black polyethylene, fiberglass, jute, paper or peat / paper, polypropylene fabrics, and photodegradable plastic. They reported that weed control with most of the disks used was inferior to preemergence herbicide control due to degradation of disk material. Only two disks provided control consistently better than the control or two preemergence herbicides: a disk made from a polypropylene fabric-preemergence herbicide (trifluralin) combination (Biobarrier, Reemay, Old Hickory, Tenn.), and a collar made of two layers of polypropylene with the preemergence herbicides oxyfluorfen and pendimethalin (OH2, The Scotts Company, Marysville, Ohio) placed between the fabric layers (Appleton, 1996; Derr, 1994).

A container disk is generally a circle with a single radial cut that allows insertion around plant stems. The diameter of the disk must match or slightly exceed that of the container to block light that might stimulate weed seed germination around the perimeter of the disk (Appleton and Derr, 1990). The disk must be made of heavy material to resist becoming wind blown, or the edge of the disk must nest into the container lip to anchor it in place (Appleton, 1998). Materials used must, as above, exclude light to prevent weed seed germination, and must be resistant to UV light degradation for their anticipated period of use (Appleton and Derr, 1990).

The Tex-R Geodisc (Texel USA, Henderson, N.C.) is a needlepunched, nonwoven polypropylene disk coated on one side with 6 $g \cdot m^{-2}$ (0.02 oz / ft^2) copper from SpinOut (Griffin Corporation, Valdosta, Ga.), a product used by the nursery industry to regulate root growth on the rootball surface of container-grown plants (Struve and Rhodus, 1990). Tex-R Geodiscs have been shown to significantly suppress liverwort (*Marchantia polymorpha* L.) growth on the substrate surface of container-grown dwarf Alberta spruce (*Picea glauca* var. *albertiana* Sarg.)

Table 1. Weed dry weight relative to weed control treatment.

Weed control treatment	Weed dry wt (g)[z]
Control	396.1 b[y]
Geodisc	0.0 a
Snapshot	156.2 a

[z]28.35 g = 1.0 oz.
[y]Mean separation within column by Duncan's multiple range test at $P \leq 0.05$.

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Table 2. Willow oak top and root dry weights relative to weed control treatment.

Weed control treatment	Top dry wt (g)[z]	Root dry wt (g)
Control	19.0 b[y]	45.1 a[x]
Geodisc	92.1 a	99.7 a
Snapshot	62.6 a	83.0 a

[z]28.35 g = 1.0 oz.
[y]Mean separation within column by Duncan's multiple range test, $P \leq 0.05$
[x]Mean separation within column by Duncan's multiple range test, $P \leq 0.05$

(Svenson, 1998). They also suppressed weed growth equal to or better than granular or sprayed preemergence herbicides (products not listed) when used on the substrate surface of container-grown azaleas (*Rhododendron* sp.) and winterberry (*Ilex verticillata* Gray) (Mervosh, 1999). The objective of this study was to compare the effectiveness of the Tex-R Geodisc vs. a standard preemergence herbicide in suppressing weed growth for container-grown willow oak.

Materials and methods

Thirty uniform willow oak seedlings were potted in 11.3-L (3-gal) plastic containers on 20 Apr. 1998 in a (v:v) 4 pine bark : 1 sand substrate. The 1-year-old trees had been grown from seed the previous year in a Cellugro unit (ACF Environmental, Richmond, Va.). One week after planting, one of three treatments was applied to each tree: Tex-R Geodiscs, isoxaben + trifluralin preemergence herbicide (Snapshot 2.5 TG, DowElanco, Indianapolis, Ind.) and a no disk–no herbicide unweeded control.

Geodiscs were fitted around tree trunks on the substrate surface, and into groves in the container lip to prevent wind dislodging. Snapshot was broadcast with a shaker-type applicator at the rate of 167 kg·ha^{-1} (150 lb / acre). All containers were topdressed with 57 g (2 oz) of a 15N–3.9P–14.5K slow release fertilizer plus micronutrients (Osmocote Plus, The Scotts Co., Marysville, Ohio), and placed on a gravel-covered nursery bed that received daily overhead irrigation.

No weed seed were introduced into this study. All weed growth was the result of weed seed that was either a contaminant of the substrate, or was introduced via wind, irrigation or birds. The experimental design was a randomized complete block on a 0.4-m^2 (3-ft^2) spacing with 10 replications per treatment. Trees and weeds were harvested on 20 Oct. 1998. Plants were dried for top and root dry weights for the willow oak, and a total dry weight (roots plus shoots) for weeds (all weed species pooled for one weed weight per container). Data were subjected to analysis of variance and means compared using Duncan's multiple range test.

Fig. 1. After 6 months, dead willow oak in the unweeded control (center) versus live trees with the Geodisc (foreground) and Snapshot preemergence herbicide (background) treatments.

Results and discussion

No weeds grew in container substrate covered with Geodiscs, and no Geodisc dislodging due to wind occurred in this study. The predominant weed in the unweeded control and the preemergence herbicide treatments was large crabgrass [*Digitaria sanguinalis* (L.) Scop]. Total weed dry weight was greatest in the unweeded control (Table 1). Greater weed control might have been achieved in the herbicide treatment had the herbicide been reapplied during the study. By the end of the study all trees in the unweeded control treatments were dead (Fig. 1), presumably due to competition for water and / or nutrients, or due to allelopathy (Neely, 1984). Top dry weights were greater for trees grown with disks or preemergence herbicide, but root dry weights were not different (Table 2). Irrigation or fertilization rates other than those used in this study might alter these results (Svenson, 1998).

No degradation of the Geodisc polypropylene fabric was observed during the 6 months of the study, nor in a previous year of observation. Multiple-year use on the same container would be beneficial for plants that take several years to produce, or that by being slow growing or upright, leave the substrate surface exposed (unshaded by the plant) for a long period of time. Confirmation of multiple-year use is needed, as is a determination of whether there could be any adverse growth effects from use of Geodiscs. As Smith et al. (1998) suggested for recycled waste paper products, the Geodisc might also be appropriate for use on large containers where increased container spacing results in a greater risk of nontarget herbicide loss, or in environmentally sensitive areas near surface water bodies.

Commercial growers and other researchers have observed problems with Geodisc dislodging due to wind. While dislodging did not occur in this study, the authors have experienced the problem in the past, and have recently been shown a new way in which the manufacturer is overcoming this problem (personal communication).

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